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President of the Institution of Water Engineers, 1913-14.

The Surveyor

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Minutes of Proceedings.

The L.G.B: A Year's Work.

The forty-first annual report of the Local Government Board, which has recently been issued, is a very interesting document throughout. It covers far too wide a field, however, for us to deal with the whole of it, and we shall therefore confine our comments to that section of it which is devoted to public health matters. In regard to the housing of the working classes, it is very satisfactory to note that the board has abundant evidence of the increasing interest with which local authorities in general regard this important subject, and it is a matter of considerable satisfaction that this increasing interest, whether it be due to a better appreciation of the necessity of dealing with unsatisfactory housing conditions or to pressure from the board or to the force of public opinion, is resulting in increased activity in the direction of applying and enforcing the various remedial powers conferred upon the local authorities by the Housing of the Working Classes Acts and the Public Health Acts. These results must be attributed largely to the additional powers and facilities conferred by the Act of 1909, and to the more systematic inspection of the various districts in regard to housing conditions which is in process of being carried out under section 17 of that Act and the regulations prescribed thereunder. The activity of local authorities is not confined to any one aspect of the housing question, but extends to dealings with unhealthy areas, to the repair or closing of insanitary houses, and to the provision of additional accommodation for persons of the working classes.

The report shows that considerable progress has been made in regard to town planning matters, authority having been given during the period covered by the report for the preparation of fourteen schemes. Reference is made to the Town Planning Conference held at West Bromwich in July, 1911, under the auspices of the Institution of Municipal and County Engineers, and it is pointed out that one of the most striking features of the conference was the careful investigation by many of the delegates of some of the more general problems connected with town planning, such, for example, as the width and construction of streets. The report goes on to say that the great variation in the opinions expressed on many important points of a practical nature would seem to show that the time had not yet arrived at which it would be prudent to attempt to lay down a complete code of general provisions for insertion in town planning schemes submitted for approval. The opinion is expressed that the question of prescribing such general provisions under section 55 of the Act of 1909 must be deferred further until experience has been gained in reference to the desires and aspirations of local authorities on the various subjects which may be dealt with in schemes. In the meantime the board have offered to render any assistance in their power in regard to the provisions to be included in schemes, and many conferences have taken place with their officials on this subject.

One of the most important matters which the board has in hand at the present time is the compilation of the return ordered by the House of Commons in 1910 as regards each water undertaking and the supply of water to each district in England and Wales. This made substantial progress during the year. On March 31st, 1912, 2,824 returns had been received from local authorities, companies, and private proprietors, and only a small number were outstanding. The forms for the return are necessarily somewhat complicated, and difficulty has been experienced in getting them filled up correctly. The time and trouble involved in filling up the forms should not be grudged by water authorities, in view of the importance and value of the return when completed. The report deals with many other matters of interest, and affords clear evidence of the magnitude of the work of the board and the zeal with which its various duties are discharged.

* * *

New South Wales Hardwoods: Prof. Warren's Experiments.

A paper of much interest to engineers concerned with structural work was read before the Society of Arts recently by Prof. W. H. Warren, M.INST. C.E., who described the methods which he uses in carrying out tests on the timbers of New South Wales, and presented very valuable data relating to these timbers as materials for bridgework and in structural engineering generally. The fact that the average life of the timber bridges of the Public Works Department of New South Wales is—with, of course, the exception of the floors—twenty-five years is of much significance; and, as Prof. Warren pointed out, this average life would be increased if more attention were paid to the proper seasons for felling the trees and to the seasoning of the timber before use, as well as to the significance of locality of growth upon the probable value of a given species. Prof. Warren has seen sound timbers taken from bridges which had been in use from forty to sixty years; and if we assign to each of the factors—season of felling, locality of growth, and seasoning—an influence separately worth only 10 per cent on the life of the bridge, we get as a result a probable average life of about

thirty-three years—a figure which might be further increased by an application of accumulated experience as to the best means of making joints and the ways in which decay may be delayed after the bridge is built. The considerations embodied in the last sentence above are adduced by way of comment, but will probably be endorsed by most engineers who are experienced in work with timber, and will no doubt have a visible result in the average life of recently built bridges in Australia. A valuable feature of the tests made on the New South Wales hardwoods is the series in which compression tests were repeated with specimens containing different proportions of moisture, the loss of strength with increase of moisture content being in many cases considerable, and, what is perhaps of equal importance, being much less with some timbers than with others. For instance, in a series of compression tests, which gave results ranging from about 10,000 lb. to 7,400 lb. per square inch with 15 per cent of moisture, the loss of strength at 35 per cent of moisture was as much as 2,500 lb. per square inch for Woolybutt, more than 2,000 lb. for South Coast turpentine, 2,750 lb. for North Coast turpentine, and 2,800 lb. for brush box; while for grey box the loss was only 800 lb. per square inch, for blue gum 1,150 lb., and for Colonial teak 550 lb. Another important series of tests was that carried out on columns or struts of various lengths. The series included tests with pieces of square section with ratios of length to diameter in several classes about 2·7 to 3·2, 8 to 10, 16 to 20, and 20 to 24, and it was found that a straight line formula could be established for a number of important woods through a practically useful range of ratios of length to diameter.

* * *

Transverse, Impact, and Sand-blast Tests.

Prof. Warren has carried out bending tests on specimens of ample size, the span, in the case of the series shown with his paper being 11 ft., and the section about square, ranging from 9 to 10 in. An important feature of these tests is that the load is applied at two points equidistant from the centre of the span. The results illustrate the importance of time in seasoning. In the case of grey ironbark, for instance, 1,072 days' seasoning gave a beam with a modulus of rupture of 14,300 lb. per square inch, and a seasoning of 559 days only 11,000 lb., and similar results were obtained with blue gum. As regards the results with tallow-wood and blackbutt no such difference was found; possibly a shorter seasoning brings these timbers nearly to full strength. In these tables a small diagram shows, in each case, the position of the annual rings in the beam as tested. The impact tests which Prof. Warren described are carried out in a very ingenious manner, and have an important bearing upon the value of the timbers for floors of bridges and of buildings. The specimens tested were short beams about 2 in. square in section on a span of 2 ft.

To municipal engineers the most interesting part of the paper is probably that in which sand-blast tests are described. These tests, in which a stream of sand is directed into the specimen by means of a steam-jet, give some idea of the wearing qualities of different woods used for town paving, the manner in which wear takes place being recorded as well as the loss of weight under a test of given duration with a known quantity of sand. The proportionate amounts by volume of the wood removed, reduced to a definite standard, are as follows, for four kinds of wood:—Spotted gum, 22·4; blackbutt, 28·9; tallow-wood, 30·6; and jarrah, 33·2. Though, of course, only summaries of his fuller records of the important work which he has carried out in this branch of experimental engineering at Sydney University, the contents of this paper are sufficient to enable the engineer and architect to select suitable timbers for various purposes, not only by the name of the species, but also with regard to the district in which the trees are grown; and, altogether, the paper forms a valuable contribution to the literature on the subject.

* * *

Underground Pumping and Highway Subsidence.

The sinking of land as the result of mining or of pumping on a large scale has often led to the necessity for the diversion of highways, or to considerable expenditure in keeping them up to the proper levels, and the legal points arising in such cases have, from time to time, received attention in our pages. The engineering features of such subsidences are often of considerable interest. The sinking sometimes occurs gradually, as the abandoned workings underground cave in a little at a time, or with the continuous removal of rock salt by pumping which carries off the salt-saturated water and establishes a current of water capable of taking up more salt in solution, and so gradually removing solid rock salt which was supporting the strata above it. In other cases the strata bridge the hollows for a time and then cave in suddenly in a way which occasions much inconvenience to the inhabitants of the neighbourhood, and sometimes exposes them to considerable dangers. In a recent illustrated article in *The Engineer* there is a description of sudden sinkings of this character in the Northwich district, where a deep crater has been formed at the site of an old mine shaft which the inhabitants tried in vain to close by measures which seem to have been by no means well-conceived. In this neighbourhood a road called Dunkirk-lane, which in 1878 was a much frequented highway, has been submerged, and all attempts to maintain it have been abandoned. The Warrington-road has had to be diverted in two places, at one of which the site is said to have sunk 30 ft. in the past sixty years, the surface having been maintained by tipping cinders.

Subsidence may occur as the result of pumping even in places where salt is not removed, possibly by the gradual removal of earthy matter, or, more generally, by a lowering of the water-levels in strata which had previously been in equilibrium with the water pressure as one of the balancing forces. The pumping from the Severn Tunnel had the effect, some years ago, of giving to some of the fields on the right bank of the river a mottled appearance, due to small subsidences which were resisted by the patches of turf between the hollows, making the fields look like a bog from which the water had recently been drained. A farmer in the neighbourhood had stipulated that if his water supply failed after the pumping started he should be provided with a piped supply, and this had to be done, for the water dealt with was found to include that in neighbouring strata, and not only that water percolating through the bed of the Severn. Apart from the more striking instances of subsidence due to the lowering of water levels, there are many examples of injury on a small scale being done to highways by lack of attention to the probable effects of lowering either visible or underground water levels affecting the road either directly or through adjacent and underlying strata.

* * *

Bacteria—and other Organisms.

Although the description applied to modern principles of sewage treatment is now "biological," at one time the word "bacterial" was generally adopted under the impression that the greater part, if not the whole, of the work of purification was performed by those microscopic organisms known as "bacteria." Later investigations in various quarters demonstrated that other, higher, forms of life also played an important *rôle* in this process. Worms of various kinds, some extremely small in size, insects of numerous kinds, infusoria and other organisms were found in large numbers, especially in slate beds and filters, and one of the most noticeable forms of insect life associated with sewage filters even by the layman was a peculiar form of

fly, often found in immense swarms on sewage works. Many have doubtless wondered whether and to what extent these insects have any influence upon the processes of purification which take place in the filters and beds, and some specially interesting observations upon this point are given in the last annual report (April 1st, 1911, to March 31st, 1912), prepared by Mr. H. D. Bell, the manager of the sewage disposal works at Stratford-on-Avon. It was noticed that, on restarting the *high-level* percolating filters after they had been given a considerable rest, the percentage of purification fell to below 88 per cent, and there was a very large reduction in the numbers of Poduridæ Aquatica, or Podura (the scientific name of the flies referred to above), and as the winter approached ponding recurred. On the *low-level* filters, which had practically no rest during the dry, hot weather, no pondage took place, high nitrates were maintained, and vast numbers of Podura were present in the material of which the filters were formed. "During the subsequent winter months the *high-level* filters were given alternate working and resting periods, and several bucketsful of the Podura were distributed over the surface, with the result that the nitrates in these filters have become normal, the Podura more numerous, and the pondage stopped on all except one of these filters, and the latter is daily becoming more normal." Research work was carried out during the year in the form of qualitative experiments with a view to discovering what gases were evolved by the Podura in their life processes, but the results obtained up to the time when the report was prepared were not sufficiently definite to justify any exact conclusions. We gather from the words used in this report that, although the insects in question are referred to as flies, it is not in its fly form, but in the larval stage of its life—the well-known very small bluish-coloured maggot—that its work in the filters is performed, and Mr. Bell apparently assumes that this work includes disintegration of the colloidal growths on the surface of the filtering material. Definite information on these points would be very useful. It would also be interesting to have a fully-detailed life history of this fly, and to know its origin in the case of new sewage filters, also whether it is the cause or the effect of the processes which take place in the work of decomposition of organic matters in a sewage filter. Investigations of this kind are extremely valuable, but are so seldom attempted in this country that we hope Mr. Bell will continue the research work he has so ably commenced, and we look forward with interest to the publication of further results of his observations in his next report.

* * *

The Action of Acids on Concrete.

The development of reinforced concrete practice and the variety of purposes for which that material can be adapted have given a new significance to the study of the action of different acids and other substances on concrete. This subject was dealt with at the last meeting of the Concrete Institute in an able paper by Mr. W. Laurence Gadd, F.I.C., M.C.I., in the course of which there appeared some valuable tables showing the comparative strengths of concrete when immersed in water in the usual way and when subjected to the action of certain other substances, such as beer or milk, with which concrete may be brought into contact in actual practice. Mr. Gadd's experiments demonstrated the probability that the whole of the series of higher fatty acids is detrimental to concrete. As regards the mineral acids, the most usual case in which these are brought into contact with concrete is through the atmosphere of towns in which sulphurous gases become oxidized to form sulphuric acid which acts on the buildings. There can be no doubt as to the detrimental effect of such an action, although it is not so marked as in the case of certain stones. This may be due to the fact that the surface pores of concrete become closed with a deposit of calcium sulphate, which affords protection from further action of the acid.

Mr. Gadd disposed very effectively of the proposal, which has gained some ground in America of late, to incorporate a certain small amount of oil or fat with concrete so as to render it dustless and waterproof. He pointed out that the natural instinct of the concrete worker has always led him to avoid oil or grease as far as possible, and he has been right. Whether we accept the crystallisation theory or the colloidal theory of the setting of cement, the presence of oily matters must interfere with the process of setting, even assuming that the oil has no chemical action with the constituents of the cement. Furthermore, oil does not readily mix with water, and has a tendency to collect in globules, which, however small, are a source of weakness to the concrete. The conclusions which Mr. Gadd drew from the theoretical and experimental data before him were that the addition of oil or fat of any kind to concrete results in a weakening of the strength; that animal and vegetable oils have a direct action on green concrete, and in time will bring about its destruction; that indurated concrete is less liable to be attacked by oils and fats; and that oil-mixed concrete is not rendered more waterproof.

* * *

The Newtownards Surveyor's Salary.

The second thoughts of the Newtownards (co. Down) Urban District councillors with respect to the vacant surveyorship were obviously an improvement on the first. In their advertisement they fixed the salary at £100 a year, and in response they received applications from twenty-five candidates. Their estimate of these applications is to be conjectured from the fact that they held a special meeting at which they rescinded the resolution fixing the salary at £100 a year, and followed this up by appointing Mr. J. L. Peacock, "at present in the service of the council," surveyor, at a salary of £150 per annum. It is probable that the twenty-five candidates who sent in their applications on the strength of the advertisement are disposed to nourish a grievance at the treatment they have received, and it must be allowed that the council's procedure is somewhat unusual, if not arguably irregular. There is, however, something gained from the professional point of view by the fact that the principle of a higher financial status for the council's surveyor has been finally and, it is to be trusted, permanently admitted, and the councillors sternly resisted the pleadings of a deputation of ratepayers in favour of appointing an officer at the inadequate salary originally offered. This, at all events, is something attempted, something done.

* * *

Planning of Workmen's Houses.

In another column will be found a letter from Miss Margaret Tabor commenting on the paper on Working Class Housing read lately before the Institution of Municipal Engineers by Mr. S. Palmer, P.A.S.I., and reproduced in our issue of the 20th ult. Miss Tabor's experience is such that any opinion which she expresses on this subject is well worthy of attention, and while she agrees with Mr. Palmer on the desirability of getting the working classes to dispense with "that bogey the sitting-room, which is hardly ever used except for knick-knacks," she does not approve of his way of surmounting the difficulty. Miss Tabor's suggestions are, in our opinion, on the right lines, and, as stated above, are based on a large experience of the habits of working-class tenants. We further agree with her plea for the retention of the bedroom fireplace, both on account of its practical utility in case of sickness and as a means of securing ventilation. The practical and economical planning of working-class dwellings is a subject of such importance that we shall be glad to receive the opinions of our readers on Miss Tabor's suggestions.

Sludge Disposal at Bradford.

DESCRIPTION OF NEW WORKS.

One of the largest schemes for the treatment of sewage, and one which entails an expenditure of £1,250,000, is now being carried out by the Corporation of Bradford. The original works at Frizinghall having proved to be inadequate, an estate at Esholt, covering an area of 1,856 acres, situated to the N.E. of the city, and about 6 miles distant from the centre of the town, was purchased in 1906.

The area of the City of Bradford is 22,844 acres, and the population 288 500. Of this an area of 14,578 acres and population of 259,750 is in the watershed of the river Aire, and drains naturally to the new scheme herein described; the remaining area of the city, 8,266 acres in extent, with a population of 28,750, is in the watershed of the river Calder, and is served by modern and efficient works already completed which need not be further considered here.

The Esholt scheme as a whole received the sanction of the Local Government Board in April, 1909, the first contract was let in July, 1909, and the first section of the works has recently been opened by the Lord Mayor of Bradford (Alderman J. B. Moorhouse, J.P.).

The plant for dealing with the sludge has been removed from the old works at Frizinghall, and housed in new and commodious buildings at Esholt, and since it has been found necessary to retain for the time being the old precipitation tanks at Frizinghall for the collection of the sludge, a temporary 8-in. steel pipe line some 5 miles long has been laid down to deliver sludge to the new works. The main, which follows the towpath of the Bradford and Leeds and Liverpool Canals, has been laid in such a manner that it has sometimes a falling gradient and sometimes a rising gradient, while a great length of it is level. The total fall from the inlet to the outlet end is 70 ft. In order to get sufficient velocity to discharge 500 tons of thick sludge containing only 80 per cent of water, compressed air is fed into the main with the sludge, the "Pohle" air lift worked upside down. It is found that the pressure on the inlet end varies from 30 lb. to 40 lb. per square inch. The sludge is fed into the main by compressed air operated sludge rams.

The new buildings, which cover 1¼ acres, are faced with a coarse sandstone obtained from the quarries of Messrs. B. Whitaker & Sons, of Horsforth, near Leeds. The design is in keeping with the nature of the stone, being massive and rugged in appearance and the mouldings simple but bold. The basements and earthworks around the buildings were carried out by Messrs. H. Arnold & Sons, Doncaster, and the superstructure by Messrs. W. Farnish & Sons, Bradford.

The boiler house, measuring 80½ ft. by 68½ ft., contains three Stirling boilers, each having 4,096 sq. ft. heating surface, and fitted with chain grate stokers made by the Underfeed Stoker Company, Limited. The main flue is 7½ ft. by 5 ft., and leads to a chimney 200 ft. high by 8 ft. 6 in. inside diameter at the top. The boilers and pumps were supplied by Messrs. G. & J. Weir, Limited, and feed the water from a feed-water heater supplied by Messrs. Royles, Limited, heated by exhaust steam from the engines.

The engine house, measuring 120 ft. by 40 ft., contains two non-condensing steam engine air compressors having steam cylinders 12 in. and 19 in. diameter, and air cylinders 11 in. and 17 in. diameter, supplied by Messrs. Robey & Co., Limited, Lincoln, and capable of compressing 700 cub. ft. of free air per minute to a pressure of 100 lb. A transformer station at the termination of a pole line from the Bradford Corporation's electricity system supplies power for lighting and other purposes.

The water tower, measuring 18 ft. by 18 ft., contains a ferro-concrete water tank holding 17,000 gallons of water, and in the basement a borehole, 266 ft. in depth, has been sunk, from which the water is forced into the tank by means of an air lift.

The press house, measuring 237 ft. by 92 ft., contains 128 sludge presses, 64 of which have been made by Messrs. Manlove, Alliott & Co., Limited, of Nottingham, 36 by Messrs. John Wilson & Son (Johnstone), Limited, of Johnstone, N.B., and 28 are now being made by Messrs. Knowles & Co., of Bradford, to complete the installation of 128.

The grease house, measuring 237 ft. by 50 ft., con-

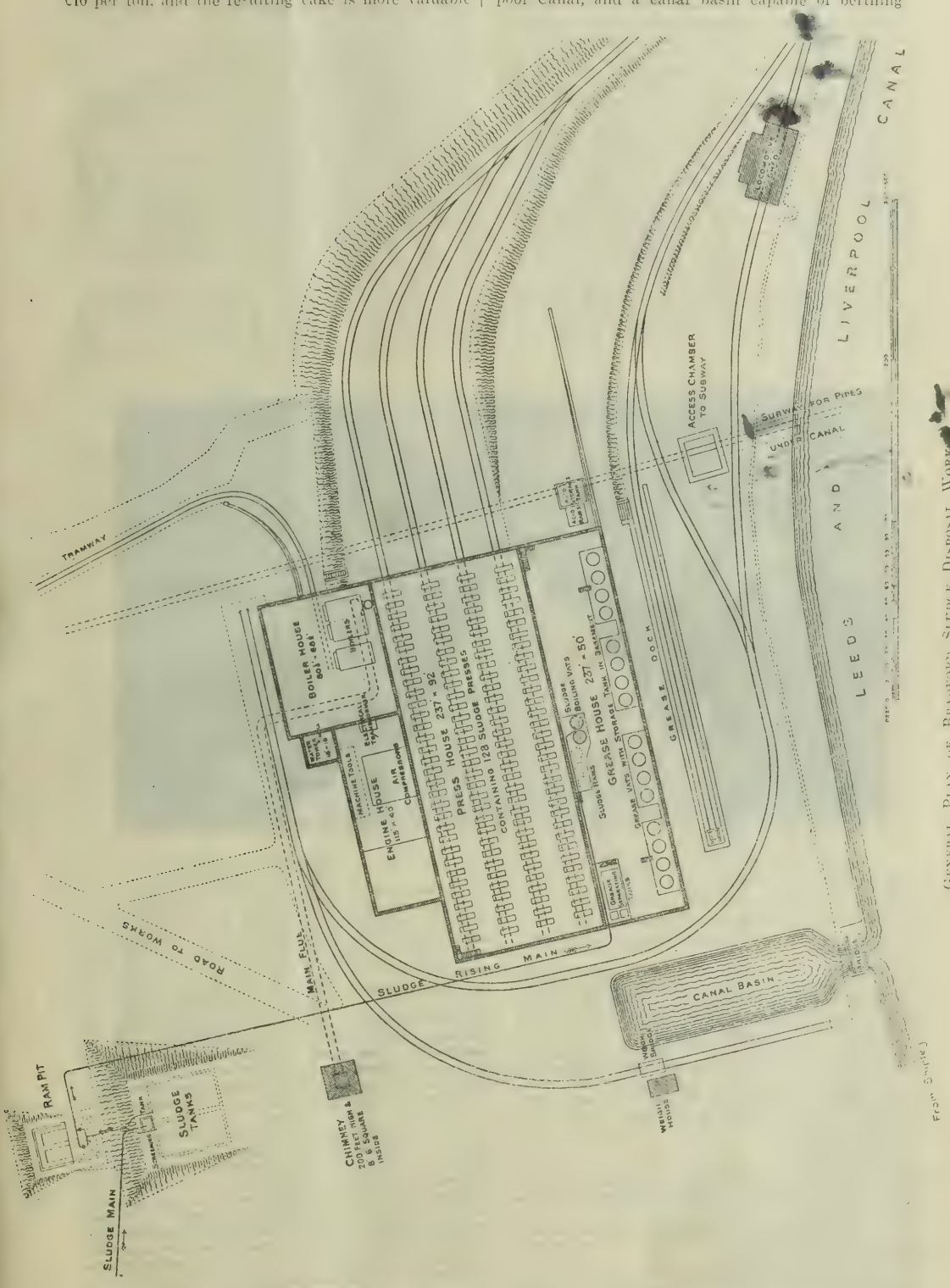
Bradford Sludge Disposal Works.

tains 16 grease vats, each capable of purifying 6 tons of grease, with a grease storage tank under capable of holding 1,000 tons, also grease separators, sludge boiling vats and rams.

The ferro-concrete floors and staircases were executed by Messrs. The Chain Concrete Company, Limited, and the steel roofs by Messrs. Clayton & Co., of Leeds. The contractors for the cast-iron pipes were Messrs. Knowles & Co., of Bradford, and for the steel tubing, Messrs. Taylor & Parsons, Bradford, the quantity used in the buildings being about 1¼ miles.

The sewage of Bradford presents unique features on account of its strength, character and concentrated condition, for which the trade refuse discharged into the sewers is responsible, and on account of this peculiar character the sludge disposal works present novel features, being designed for the recovery of grease from the sludge. The method adopted by Mr. Garfield, the engineer of the scheme, is as follows: The sludge on its arrival at the receiving tanks is lifted to the boiling-up vats by means of compressed air. Here it is heated by live steam and passed into three steel vessels placed underneath, and from which it is forced by compressed air to the sludge filter presses. Each press contains 17 chambers 3 ft. sq. The object of heating the sludge is to facilitate the filter pressing, and to render liquid the grease contained in the sludge. The grease and water coming away from the filter presses are separated in tanks, from which the water is pumped back again into the sewage and the grease into the purification vats. From these vats the

grease is run into barrels, pumped into tank wagons on the adjoining railroad, or discharged into the storage vats, whichever may be necessary. It has been found that the 100 filter presses now in operation produce from 12 to 15 tons of grease per twenty-four hours. The material is valued at from £8 to £10 per ton, and the resulting cake is more valuable than that usually produced, consequent upon the fact that it contains no lime and only 28 to 30 per cent of moisture, and is sold at the price of 3s. per ton at the works, where it is loaded direct from the filter presses into the railway wagons below. The works are in direct communication with the Midland Railway Company's system by a branch railway and sidings, altogether measuring 1¼ miles. On the branch line a 50-ton weighbridge has been placed to weigh the inwards and outwards traffic, which amounts to about 100 tons per day. The works have been placed conveniently near the Leeds and Liverpool Canal, and a canal basin capable of berthing four boats has been constructed. Adjacent to this a second weighbridge has been put capable of weighing 20 tons. The works are also served by a new roadway, so that excellent facilities are afforded for the receipt and despatch of goods and material at a low rate. The makers of the weighbridges were



GENERAL PLAN OF BRADFORD SLUDGE DISPOSAL WORKS.

From Engineer.

Messrs. Samuel Denison & Son, Limited, of Hunslet, Leeds.

Two main sewers will eventually convey the sewage of Bradford to Esholt. The larger sewer will be 10 ft. diameter, with a gradient of 1 in 2,000, and is capable of discharging 180,000,000 gallons of sewage. This sewer will be in tunnel for 4,807 yds., and the contract is in the hands of Messrs. Pethick, Dix & Co., Westminster. The smaller sewer has been completed, the contractors being Messrs. H. Arnold & Sons, of Doncaster. This sewer intercepts the sewage of Eccleshill & Idle, and conveys it to the works by gravitation, the cross section being egg-shaped in form, 3 ft. 6 in. by 2 ft. 4 in., 1 mile in length (one-third of which is in tunnel), with a gradient of 1 in 630, and capable of discharging 12,000,000 gallons of sewage. Into this sewer will be pumped the low-lying area of Greengates, where a pumping station with two 6-in. centrifugal pumps of the "Stereophagus" type is now being erected. These pumps will be electrically driven and automatically controlled, and have been designed to pass unscreened sewage. They are capable of raising 2,000,000 gallons of sewage and trade effluent through a 12-in. rising main to a height of 100 ft. Tanks have been provided at the works temporarily to treat the sewage of these districts and of the district of Yeadon by chemical precipitation, the effluent being finally purified by land filtration.

METHODS OF ROAD SURFACING.

SIR GEORGE GIBB AND THE CARPETING PRINCIPLE.

The remarks of a correspondent, under the heading "Automobilism," in the issue of the *Times* of the 24th ult., is the subject of a letter which Sir George Gibb, chairman of the Road Board, has addressed to that journal.

Sir George commences by observing that it is always pleasant to receive praise, but sometimes embarrassing. "Your correspondent," he says, "refers in complimentary terms to the 'scientific work of the Road Board,' but he connects this with references to a particular method of road surfacing which, I fear, may cause misunderstanding.

"The Road Board can claim no credit for the methods used in constructing the road crust on the Victoria Embankment which your correspondent mentions as 'having been taken in hand on Road Board methods.' The road in question was, I think, completed before the board was constituted, but, in any case, we had no connection of any kind with the work or the methods employed.

"Neither have the board indicated any preference for the method which your correspondent describes as 'putting down a solid floor and covering with a bitumen carpet.' Acting on the advice of our Advisory Engineering Committee, we have encouraged the responsible highway authorities, to whom it is our duty to make advances, to use many different forms of bituminous treatment in road-crust construction—painting or spraying surfaces with tar, grouting with pitch or other bituminous material, coating stone or slag with tar before laying down or carpeting with bitumen, drawn from various sources of supply, mixed with sand or other materials. But we have not given precedence to one method over another, and have no present intention of doing so. The choice must depend on the circumstances of each case. Moreover, the carpeting method has not yet been tried, to any material extent, on rural main roads, which form the bulk of the mileage of important roads in the country.

"I do not wish by this letter to depreciate the carpeting method; my sole object is to remove any impression that may exist that the board or their Advisory Engineering Committee are prepared, at the present time, to advocate the general adoption of that method. The arguments in favour of it may prove to be sound, but they have yet to be tested by practical road engineers in the actual execution of work to a much larger extent than has hitherto been done in this country."

INTERIOR OF PRESS HOUSE, BRADFORD SLUDGE DISPOSAL WORKS.

The contract now in hand is the main outfall sewer. Other works to be constructed are as follows:—

A high-level aqueduct and roadway to convey the sewage across the Aire Valley 733 yds. long and 80 ft. maximum height.

Precipitation tanks in two series, covering 13¼ acres, and having a capacity of 19,500,000 gallons.

Detritus tanks of a capacity of 1,000,000 gallons, and storm-water tanks covering an area of 7 acres and of a capacity of 11,500,000 gallons.

An area of bacterial filters, 60 acres in extent, are included in the scheme, but at present these are in abeyance pending experiments on the land.

Main effluent channels to the eastward and westward of the estate, measuring 3¼ miles, and varying in size from 10 ft. by 4 ft. to 3 ft. by 1 ft. 6 in., are to be carried out.

An area of land 200 acres in extent is to be laid out for intermittent downward filtration, and a further 200 acres of land is available for surface irrigation.

New works are also contemplated for the manufacture of sulphuric acid, and also for the drying and disintegration of sludge cake.

The engineer of the scheme is Mr. Joseph Garfield, ASSOC.M.INST.C.E. For the 10-ft. diameter sewer and Aire Valley crossing the engineers are Mr. James Watson, M.INST.C.E., and Mr. Joseph Garfield, ASSOC.M.INST.C.E., acting jointly, while the resident engineer is Mr. Howard Wontner-Smith, ASSOC.M. INST.C.E.

Land Transfer.—A paper on "The Land Transfer 'Scandal,'" read at a meeting of the Law Society by Mr. J. S. Rubinstein, is now available to those interested in the form of a booklet of handy size. The printers are Spottiswoode & Co., Limited.

Fine Grade Filters, Their Use and Limits.*

By W. H. MAKEPEACE, Sewage Engineer to the County Borough of Stoke-on-Trent.

It is generally admitted that authorities, particularly in Staffordshire and adjoining districts (with one or two exceptions), have adopted fine grade material as their agent in completing the purification of their sewage, and no doubt they have, in a large number of cases, been well advised, particularly as this county happens to have very large industrial centres situated on the banks of very small streams. This being the case, a very high standard of purity has to be aimed at, and I certainly think that the maximum amount of efficiency can be better obtained in the minimum amount of space by the use of this material.

Fine grade filters, as officially recognised by the Royal Commission and the Local Government Board, consist of material which will pass through a ½-in. sieve, but no mention appears to have been made as to whether a square or round mesh is meant, although generally the square one is used.

As the result of fifteen years' experience in the design, construction and management of these beds, I venture to say that if the necessary and proper attention is given to the preliminary treatment of the sewage prior to its being passed on them, and with the co-operation of a reliable distributor, this type of bed is far superior to any other.

With reference to the preliminary treatment of sewage, I certainly think, in spite of the great advances that have been made in this direction, there is considerable room for improvement, and as this develops it would appear to be reasonably certain that the fine grade bed would become even more popular.

One of the chief conditions which must be enforced if fine grade beds are to remain popular is the question of distribution. In the department under my control we have various methods of distribution adopted on this type of bed, and, as the result of my observations, I have come to the conclusion that a distributor which is capable of discharging the sewage in a thin film form in such a manner as to avoid ploughing into the surface of the bed, and arranged so as to not have a flushing action through the interstices of the filter, is far superior in practical results to the jet action which you get from a revolving arm. At the present time I am having erected a series of jets which are arranged to discharge automatically at fixed intervals in an expanding and contracting form, the idea being to get the same result with a fixed jet as we obtain at present with a rectangular distributor of the "Hartley" type.

The total area of fine grade filter beds belonging to the Sewage Department of Stoke-on-Trent is 17 acres; the sizes of the material vary considerably even with this definition. At the Hanley works the top layer consists of 1 ft. of ½-in. to ⅝-in. cubes, with ½-in. underneath. At the Longton works there is a similar layer

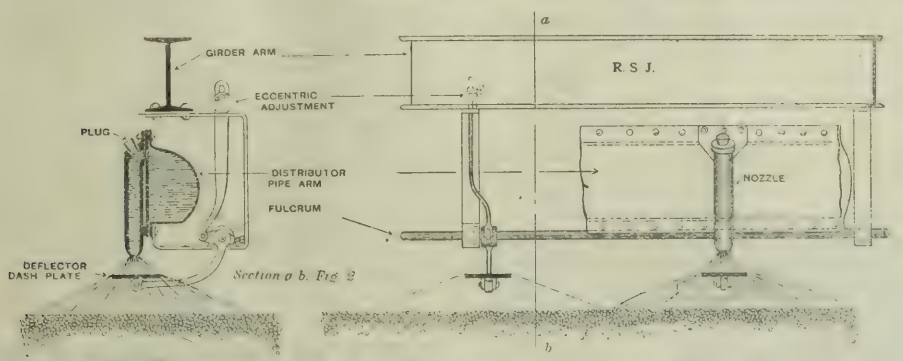


FIG. 1. FIG. 2. FIG. 3.

(Details of jet spray adopted on rectangular beds of fine grade media.)

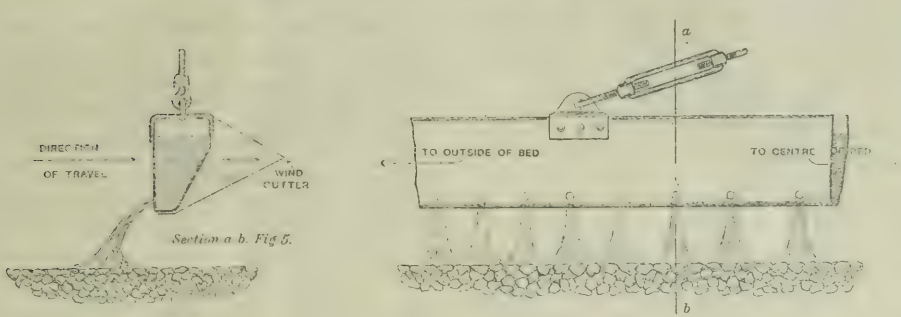


FIG. 4. FIG. 5.

(Details of jet spray adopted on circular beds of coarse clinker media.)

16 in. thick of ⅜-in. to $\frac{1}{16}$-in., with ⅝-in. underneath. At Tunstall the upper layer is 1 ft. thick of ⅝-in. to ⅜-in., with ⅝-in. underneath. At Burslem, in the filters that have been renovated, the upper layer consists of ⅝-in. to $\frac{3}{16}$-in. cubes 1 ft. thick, with ½-in. underneath. At Fenton the upper layer is ⅝-in. to $\frac{3}{16}$-in., 1 ft. thick, with ⅝-in. underneath.

The whole of the distributors are designed to discharge at the rate of 200 gallons per square yard per day, and with the exception of Longton and Tunstall that rate is still maintained. At Longton, owing to the very fine material on the surface, which contains a considerable amount of dust, the rate of flow, in order to avoid prolonged pooling, has had to be decreased to 130 gallons. At Tunstall, owing to the upper layers being practically the same size as the layer underneath, the distributing action of the jets from a distributor having four arms was such as to upset at the 200-gallon rate the character of the effluent, and the rate has been reduced in order to obtain the quality of effluent which we consider is necessary in our district.

From hourly records taken at the Hanley works, where there are 9 acres, it would no doubt be interesting for you to know that, during the past twelve

* Paper read at the recent annual meeting of the Association of Managers of Sewage Disposal Works.

months, after an average of eight years' work, the analyses of the combined effluent are as follows:—

Handley Effluent as Discharged into River Trent.
Average samples taken consisting of hourly collections throughout one month.

Opacity in inches	32·50
Chlorides as Cl.	10·56
3-minute oxygen absorption, N 80, KMn04, at 62 degrees F.	0·21
4-hours oxygen absorption, N/80, KMn 04, at 62 degrees F.	0·44
Nitrate as nitric nitrogen	2·94
Nitrites as nitrous nitrogen...	0·0104
Total solids	92·80
In solution	90·88
In suspension	1·92
Free ammonia	0·07
Albuminoid ammonia	0·03

The number of hours each bed has worked during the twelve months is given below. The object aimed at is to endeavour to give each bed its equal share of work; therefore it will be understood that where the figures are below the average of a half-year—namely, 4,380 hours—the cause is generally due to the bed requiring a longer period of rest. The number of hours in the year is taken as 8,760.

No. 1 bed	2,332 hours
„ 2 „	6,044 „
„ 3 „	6,450 „
„ 4 „	3,619 „
„ 5 „	5,861 „
„ 6 „	5,326 „
„ 7 „	7,000 „
„ 8 „	5,089 „
„ 9 „	7,653 „

With reference to the question of pooling in fine grade beds, it has been generally understood that any surface pooling is detrimental to the effluent almost immediately. I have found from experience that this is not the case, as in many instances I have noticed that, where beds have pooled for as long as a month on the surface, the effluent does not show any signs of serious deterioration, and I attribute this to the fact that lateral distribution is carried on through the lower parts of the filter to a greater extent than if no pooling took place. Several methods to cure temporary pooling have been tried, and the most successful one at present met with is to place just under the surface of the bed a few rows of agricultural pipes within the area affected. This, on many occasions, has proved sufficient to cure this area.

In order to keep the surface of the beds from becoming consolidated a special rake carried on the distributor has been designed to rake over the beds, which makes it possible to rake 1 acre in area in six hours with only one man.

After eight years' working it has not been found necessary to renew the surfaces of the beds, and a little humus is being discharged from the bed.

At the Burslem works, where the filter material was not graded uniformly or placed in the bed in separate layers, the results from the bacteria beds, although composed largely of fine media, were very unsatisfactory, and the comparison in the effluent from the beds which have been altered, are worth noting:—

	Original Beds.	Renovated Beds. Average for six months. Apr. 1 to Sep. 30, 1912.
Opacity in inches ...	1·50 ...	25·24
Chloride as Cl. ...	13·20 ...	10·82
Three minutes' oxygen, N 80, KMn 04, at 62 degrees F. ...	·84 ...	·21
Four hours' oxygen absorption N 80, KMn 04, at 62 degrees F.	·70 ...	·47
Nitrate as nitric N. ...	? ...	1·90
Nitrite as nitrous N.	? ..	·0173
Free ammonia	2·630 ...	·04
Albuminoid ammonia	0·243 ...	·02
Total solids	101·70 ...	98·50
Solids in suspension	8·49 ...	1·50
Solids in solution ...	93·39 ...	97·03
Incubator tests, oxygen absorbed in three minutes after four days at 26 degrees C.	1·00 ..	·19

At Burslem the method of distribution is by rotary arms.

The extent to which fine grade filters can be used successfully depends, in my opinion, on three things—

(1) The character of the sewage, which must lend itself to successful tank treatment.

(2) Construction of the beds, in uniform layers and size, with a top layer perfectly free from dust.

(3) Distribution of the sewage, which should provide for intermittent discharges, which will allow the sewage distributed to percolate into the filters before it received any other discharge.

From observations and research I have come to the conclusion that a fine grade filter need not have a greater depth than 4 ft., providing that the upper layer does not consist of particles greater than ¼ in., and not less than 12 in. in thickness, and I would much prefer to have the additional area of the beds, which a system of fine grade filters will permit one to have, than a coarse grade filter, which would require greater depth to get the same results.

I am strongly of opinion that even distribution of sewage over a bacteria bed largely controls the life of it; the more perfect this is the longer the life, assuming that good tank treatment has been given; and as the costs of renovating beds must be considerably less in the case of fine grade filters, compared with a coarse one, I prefer as a distributor a machine that will give a sufficient dose with a maximum interval rather than a small one at a minimum interval, in order to get the volume on where fine grade filters are used. The construction of fine grade filters requires very careful consideration, and a good substantial floor with adequate underdrainage is always necessary; the material must be laid in regular layers and sizes, and practically free from dust, and be as hard and cubical as possible. There is no necessity for fine built walls; in fact, I would much prefer to spend the money often used in this way for additional filtration area.

I am of opinion that in practice the Local Government Board's minimum requirements are a great improvement on their old conditions, but I still consider they are high enough.

DEATH OF THE BOROUGH SURVEYOR OF DUBLIN.

We regret to announce the death of Mr. John G. O'Sullivan, Assoc.M.Inst.C.E., M.I.C.E.I., borough surveyor and city engineer of Dublin, which occurred early on Christmas Day at his residence, 7 Breffni-terrace, Sandycove, after a week's illness. Mr. O'Sullivan's connection with the Dublin Corporation extended over a period of nearly twenty years. He took up the duties of deputy borough surveyor in 1900, and on the resignation of Sir Spencer Harty about two years and a-half ago succeeded to the position of borough surveyor and city engineer. An important municipal undertaking with which he was closely identified was the clearing of the Cook-street area, an extensive slum district, and the building thereon of improved artisans' dwellings. The plans for the new Roundwood reservoir were prepared under his direction, and he had almost completed the installation of an electricity plant for the working of the main drainage pumping station. In the field of administration he displayed conspicuous ability, having introduced important reforms in the working of his department, by means of which increased efficiency was obtained and expenses curtailed. One who knew him intimately said of him, "He was one of the successes of Dublin; a man of enormous working powers, one who never spared himself, and who was successful in all his work."

The funeral took place on Friday last at Glasnevin Cemetery, and was attended by practically every member of the Dublin Corporation, a large number of city officials, and the representatives of every profession. As indicating the universal respect in which Mr. O'Sullivan was held it may be stated that the names of those present take up more than a column of the *Freeman's Journal*, while a very large number of telegrams of sympathy were received.

Surveyors' Institution Employment Register: Colonial Appointments. The secretary of the Surveyors' Institution from time to time has been asked to recommend practical land surveyors with a good knowledge of the use of surveying instruments for appointments abroad. Members with the necessary qualifications, and desirous of such appointments, are invited to send in their names to the secretary, Great George-street, S.W., stating their age, qualifications, and salary required. A special file of such names will be kept for reference.

Institution of Water Engineers.

WINTER GENERAL MEETING IN LONDON.

(Conclusion.)

In our issues of the 20th and 27th ult. we reproduced papers on "Some Recent Examples of the Pollution of Public Water Supplies" and "Advances in the Science of Water Purification," by Dr. John C. Thresh and Dr. Adolph Kemna respectively. These two contributions were submitted for consideration at the recent winter meeting of the Institution of Water Engineers, held in London, and were discussed together.

Dr. KEMNA, before giving a *résumé* of his paper, said: What I have to say is the outcome of a practical experience of over twenty-five years. I have said to the engineer repeatedly that he is not scientific enough, and I remember in this room having been taken to task by that able and fluent speaker Mr. Jones. He represented me on the basis of my own paper as a genius coming to spread light on the dark minds of the engineers. The present paper deals with another side of the question—with our friend Science. To the scientist I say "Be practical; you are not always practical." The result of my behaviour is that I shall have both sides down on me; but it is in that unanimity of reprobation I revel, because I feel sure I am right. It is all of service. We are the best of friends, and both the engineer and the scientist have the same aim, and the only things to be considered are the prolongation of human life and the prevention of human-borne disease. It is important that that aim should always be borne in mind, and that all the rest is only a means to an end. So many milligrammes of organic matter, and so many microbes (which are generally harmless) do not signify, so long as they do not reflect upon the statistics of health. That is the great point which it is necessary to remember, because a great deal of harm is done by the issuing of reports and by the useless expenditure of sometimes large sums of money on the reports and analyses of scientists, which were really of no interest, and when vital statistics would have proved that the water supply was above suspicion.

Dr. THRESH also prefaced his paper by some remarks. He said: I am very pleased to follow Dr. Kemna, because I have contended all along that a man who simply makes a chemical or bacteriological examination of water, and takes no other interest in it, knows nothing about the subject. If he does not trace the source of the contamination and make investigations, there is very little good to be got from multiplying bacteriological analyses. I think that collaboration between the bacteriologist and the engineer has shown that in many cases they have been able to find out what perhaps unaided by each other they would have been unable to discover.

Mr. W. T. BURGESS (London) said he did not know that he had very much to say. The cases which Dr. Thresh had referred to were very interesting, but every chemist and bacteriologist who had matters brought before him for investigation was familiar with cases of the character referred to in the paper. One thing he would like to emphasise was the point mentioned by Dr. Thresh of raw sewage being turned into a river, which lower down was utilised for waterworks purposes, and which the author had referred to as a disgrace to our boasted civilisation. He would like to call the attention of the meeting to the fact that in the eighth report of the Royal Commission on Sewage, published a little time ago, one of the recommendations of the commission contemplated the possibility of such discharges into rivers, if the discharge was relatively small to the volume of the river. That was to say, if the quantity was something like 1 to 500, sewage might be discharged in a crude state, or possibly with simple straining. He thought that report ought to be in the hands of every water engineer, and particularly in the hands of those who had to deal with supplies taken from rivers, because he for one did not feel at all happy about the recommendations of that commission. The point that Dr. Thresh had mentioned about Thanet sand softening water and resulting in it containing carbonate of soda instead of carbonate of lime was quite an interesting matter. He remembered Dr. Thresh dealing with this matter some time ago, and being asked about the possibility of using Thanet sand for water softening purposes, and his reply was that it would only soften a few times its volume of water. He followed this up and made experiments with Thanet sand, and he found one sample was capable of softening 27 times its volume of Thames water. That did not, of course, come anywhere near to the capabilities of the new material "Permutit," which at one running softened over 100 times its volume of water, but still, at any rate, it dealt with a quarter of that quantity, which was something in excess of the figure Dr. Thresh found from his experience. Other samples of Thanet sand which he had tried yielded comparatively poor results. There were also physical difficulties about getting the water through the Thanet sand.

Mr. A. B. E. BLACKBURN (Sunderland) said he thought that what really came out of the papers was that they saw that bacteriology had its limits. There were bacteriologists who dogmatised as the result simply of their bacteriological examinations, and who labelled waters doubtful or bad if they contained B. coli in 100 c.c. or 1 c.c.; but the authors of the papers had shown them that that was a bad thing, and that they could not do this. He thought the medical profession were realising this, because at the meeting of the British Medical Association in Liverpool in July of this year there was a very important resolution passed, after three splendid papers, given by Dr. Housman, Dr. Savage, and Dr. Wright. He thought that resolution should be quoted there for the benefit of the members. It was: "That this conjoint meeting of the sections on State Medicine and Bacteriology unanimously desire to strongly urge that no opinion as to the quality of water for dietetic purposes should be arrived at on bacteriological evidence without a local and topographical inspection of the sources of supply made by a competent observer." He thought that was very important for them as engineers, because they did want to know what the significance of this B. coli really was. Dr. Wright in the paper he gave emphasised the necessity of the significance of B. coli and coliform organisms in water supplies being put on a true basis. He said: "Until we can be authoritatively informed that a particular water supply is contaminated with organisms of human origin, indicating thereby the possibility of infection from a recognised or unrecognised case of enteric fever, we may be excused in affirming that the presence of B. coli and its varieties in a water supply is not of great significance after all." He would like to know from Dr. Thresh what his opinion was with regard to the significance of lactose fermenting organisms which did not comply with the recognised tests in one or two respects, and whether they were necessarily of excremental origin. Bacteriologists assumed that they were, and based their belief on the fact that 70 per cent of the lactose fermenting organisms were not B. coli in all respects. Did Dr. Thresh agree that about 30 per cent of them in sewage were typical, and if so, could he tell him in what reports on the examination of sewage this was brought out? With regard to softening by "Permutit," as engineers they would like to know how the costs worked out. With it they had to use common salt, and common salt was much more expensive than lime. He would also be glad to know whether that institution would be able to have the benefit of the results of the trial by the water company which Dr. Thresh had mentioned laid before it at an early date. From what he had gathered himself, it cost about 1½ times as much as softening by lime. That was in one particular case, and in another case he heard it cost 1½d. per 1,000 parts of water of 17 to 20 deg. of hardness.

Dr. HUNTER remarked that the papers were very valuable contributions, and they were greatly indebted to the readers. The question which had been put as to the cost of this precipitation was well worth bearing in mind. He recollected that some ten or twelve years ago Sir William Crookes and Sir James Dewar recommended the London water companies to do something in that line, but they found upon going into the matter that the cost of getting rid of the slime was absolutely prohibitive. The question, therefore, as to cost was a very important one.

Mr. J. DEWHURST (Chelmsford) said that while Dr.

Kemna was speaking he was struck with the thought that it was quite as necessary for the engineer in charge of underground supplies to be always on the alert as it was for the engineer who took his supplies from rivers. The papers in their respective ways clearly showed the importance of every waterworks engineer looking after the sources of his supply continually, and in following up any indication that his water was either intermittently or permanently polluted. With regard to the case of the tank under the engine-house floor to which Dr. Thresh had referred, he (Mr. Dewhurst) might be wrong, but he thought it rather bad practice on the part of an engineer to put an intermittent tank underneath any engine house. Surely it was far better to put it outside and safeguard number one? Ball hydrants they all knew should be dispensed with. In investigating as to intermittent pollution he had been rather interested in the question because he had carried out some experiments in certain cases, and he could assure the members that apart from the worry the water was giving them it was very interesting to carry on such work. They found their preconceived theories as to the course of service supplies in their underground courses altogether upset in many cases. He had made boreholes within 10 ft. of his springs and had had an enormous amount of fluorescin put in, and kept it there for a fortnight and had not got the slightest trace of it. That was on the site of the spring from which every authority in the district said the water came. In tracing out any sources of pollution it was to his mind very important that they should get the exact results that they got from their experiments as they found in the pollution. What he meant was that if they found that their pollution came within a given time after a heavy rainfall they wanted to continue their experiments until they could reproduce the exact condition. When they had done that they were pretty near the mark. It might be said that if one's supplies were open to this pollution they surely ought to abandon it and get a more secure supply. That, however, was not always possible, especially in small districts or in districts where one could not obtain very much water. There were financial reasons to be considered if it was the case of a water company, and if they were a district council there was the question of the rateable value. He thought it was of the utmost importance that every engineer, especially those in charge of comparatively small works, should devote considerable attention to eliminating every possible source of pollution, and if it was found on analysis that there was any change in the water it ought to be taken in hand before it got too far. The difficulty was that, as regarded some of these surface supplies, when they were commenced the district was only partially populated, and the surroundings might be all right, but the very fact of a waterworks being there caused the district to grow, and it might be that building operations were carried on on what was practically the gathering ground. In such a case it would not be possible to abandon the works for financial reasons, but the fact remained that they might put down their works, and that very fact brought about what might be a cause of pollution. One could only come to the conclusion that it was extremely important for engineers to look after their sources of supply.

Mr. H. C. ADAMS (Westminster) said that Dr. Thresh had brought forward a collection of most interesting cases of pollution. They served to emphasise the facility with which water could become polluted, and they also showed what a simple matter this pollution was, but unfortunately the simplicity was not apparent until the cause was discovered, and much time was generally expended in finding out the cause. There was one point that was of some importance to which he would like to refer. They did occasionally hear of pollution from the sanitary appliances at the pumping station or in the vicinity of the waterworks. He admitted they were extremely rare, but they did occur. The sanitary appliances when they were put in were, of course, tested and proved to be perfect, but they knew from experience that deterioration took place, pipes broke, joints gave way and other things happened, and he thought it was most necessary wherever there were any arrangements of that sort in a position to cause pollution that they should be tested periodically and proved perfectly tight. He fully endorsed Dr Thresh's condemnation of ball hydrants. Unfortunately, a short time ago he was in the position of carrying out some extensions of mains in a town where the whole of the hydrants were ball hydrants, and he was faced with the fact that the fire appliances in use throughout the district were fitted with ball hydrants, and much as he would like to have had nothing to do with them he was forced to perpetuate them in the three or four extra hydrants he had to put down. If it had been possible to remove the whole of the ball hydrants from the district he thought it would have been a great advantage. The matter of softening water, which had been referred to, by "Permutit" was one of very great interest especially at the present time, and he was very glad to see that Dr. Thresh had spoken so emphatically upon the softening of water for human consumption. There was, however, another side to the question, and that was its use for trade purposes. Of course they all admitted that the health of the individual was the paramount consideration, but he submitted that the material welfare of the community came a very close second. If the water, treated or untreated, was unsuitable for trade purposes, or if the manufacturer had to treat it subsequently at expense to himself, the probability was that it would drive trade out of the district and that works would be closed down. There was, of course, the immediate loss of rateable value from the closing down of works, and there was the additional loss from the population which moved off, and there was the loss in wages to those that were left behind. It might be said that the quantity of water used for trade purposes was very small, and except in the great industrial cities that was so, but the consequences from a trade point of view of the use of that small quantity was so great that he felt quite justified in bringing forward the trade use of water as an important item. Recently his firm were engaged in advising upon the softening of the water for a public water supply, and they considered the merits and demerits of all types of softeners and particularly that of "Permutit," which was in this country a new and to a large extent at present an untried process, and an engineer, in advising its adoption, incurred a very great responsibility. They made every possible investigation into its use abroad; they collected facts for and against it, and analysed them to the best of their advantage. They also considered it from an economical point of view, and he might say that eventually they thought that the balance was in favour of "Permutit," and they recommended the adoption of that system. The scheme would in due course come before the Local Government Board, and they were interested in knowing what action they would take. As to the question of expense, it depended to a very great extent upon the hardness of the water and the relative proportion of temporary and permanent hardness. The lime process alone was cheaper in many cases, and much cheaper than "Permutit." There was a critical limit where the "Permutit" on the one hand and the lime soda on the other were about equal, and above that limit he thought it would be found that "Permutit" would be cheaper. The water they were concerned with was just above that critical limit. Of course, the outstanding feature of the "Permutit" system was that the carbonate of lime was converted into carbonate of soda instead of being deposited, as in the lime soda process, as mud. Of course, it was a great advantage that they got rid of the mud, but the great point they had to consider was the effect of the bi-carbonate of soda in the effluent. The health view had been disposed of. As regarded trade uses it was alleged and strongly supported by a large number of people that this water with bi-carbonate of soda in it often caused serious corrosion in boilers. He could only say that they could not find any definite proof that the bi-carbonate of soda was the cause of corrosion. They knew that corrosion did occur—in fact at the present moment they were investigating cases of corrosion from softened water, and the water was softened by the lime and soda process in that particular case. Presumably, it would turn out to be due to something which the analysis would reveal, and that the water would be corrosive with any other treatment.

Mr. L. C. WALKER (Reading) said he was particularly interested in Dr. Thresh's paper where he said there was not the slightest doubt that the chloride of lime process constituted the greatest advance which had been made in water purification during recent years. His (Mr. Walker's) particular interest in that paragraph arose from the fact that he had adopted the chloride of lime process in the Candy filter at Reading. He had had over two years' experience of it, and during the whole of that time he had not been able to find, or rather the bacteriologists had not been able to find, the B. coli in 100 c.c.

They were so satisfied with the chloride of lime process that they wished to instal plant capable of dealing with 1,000,000 gallons per day. As Dr. Kemna said the B. coli was somewhat more robust than the typhosis, it was safe to assume that if it destroyed the typhosis it must also destroy the B. coli, and he was quite satisfied that they were not likely to get the typhosis. With reference to Dr. Thresh and ball hydrants, he thought they would all agree that ball hydrants ought not to exist upon any up-to-date distributive system, but he was sorry he could not agree with the last speaker, who said he was obliged to perpetuate ball hydrants because he found they already existed. At Reading they had a large number of ball hydrants, but he was gradually displacing them with screw-down hydrants, and he did not think that it was any detriment to have the two types of hydrants, because the screw-down hydrant could be obtained with a bayonet point the same as the ball hydrant, and the standpipe which fitted the ball hydrant could be made use of to fit the screw-down hydrant, so he did not see why they need go on perpetuating ball hydrants.

Mr. H. C. HEAD (Winchester) said he was particularly interested in Dr. Thresh's paper where he referred to contamination through a leaky gas water tank. He read that with considerable surprise, as some years ago he remembered a series of experiments being made with waste and drainage water from some gasworks, and it was found to be surprisingly free from bacteria. He did not know whether Dr. Thresh had made particular inquiry as to this, but after reading the case carefully it occurred to him (the speaker) that the large number of B. coli in the case of the gas-holder tank were due to efforts to stop the leakage. Where there was a small leakage in a gas tank, it was a very common practice to put oatmeal in to draw into the crack. But oatmeal was not universally employed, especially where the leak was a large one, and a large quantity of oatmeal would be required, and he knew as a matter of fact that horse dung was frequently substituted, and if the water was largely diluted in that way it might account for the very large number of bacteria that Dr. Thresh found. In case 10 it might be of some interest to engineers to know that carbide of calcium was a very effective way of getting rid of rabbits. He saw it used a short time ago in a warren for the stinking out of rabbits, and the rabbits never came back again.

Prof. H. ROBINSON (London) said he desired to express his appreciation of the two papers, which he considered were of very great value to engineers. He had always emphasised the advantage of the assistance which they obtained from the bacteriologist and the chemist. Dr. Thresh had given them some instances in his paper, and he (Prof. Robinson) had given some cases years ago, and he wished again to express the opinion that the engineer who carried on his work without consulting the chemist or the bacteriologist was guilty of a great mistake. If he were to commence giving them illustrations to point his moral he would weary them, so he would only give them one which occurred this year. A proposed water supply was designed in a certain district—he would not refer to the place, because it would cause a great scandal; but the work was actually going to be carried out. One of the leading inhabitants thought he would like to have his opinion about it, and he went down and examined into the matter. He found that all the details had been worked out; trial holes were sunk; the position of the underground water had apparently been settled, and all the geological points cleared up apparently, and without any consultation either with a chemist or bacteriologist. The very first thing he did was to have samples of the water taken, and with the assistance of analysts he discovered some flaw in the quality which enabled him to trace the origin of the mischief and alter the scheme entirely. If he were to give them particulars of the many cases he knew of, he was afraid they would have to go without lunch, and therefore he would prefer to sit down without saying any more. He might perhaps just refer to ozone. He had had to use that in connection with the purification of water, and anyone who cared to have information about ozone and its application for water purification could write to him, and he would be glad to send copies of his reports on the question.

Mr. F. W. HODSON (Loughborough) said they were all obliged to Dr. Thresh for the manner in which he put it year after year, and to Dr. Kemna for the stand they made against the mere sample and the numbers of bacteria. They had had to-day from Dr. Thresh a good many cases, and he could add one or two on similar lines. They knew that the analysis was all inferential—the old chemical analysis was inferential. Twenty-five years ago his father said that the chemical analysis was not worth the paper it was written on as a single example, because if a weak tea was sent to the analyst that would be the most polluted water, because it contained such a lot of organic matter. Dr. Thresh had pointed out that B. coli came from all sorts of sources. Was there any reason to treat B. coli when it was known that it could only possibly come from a rabbit, or a pigeon, or roadside waste in some of those cases which Dr. Thresh had pointed out that day?

Mr. H. PRESTON (Grantham) said that Dr. Thresh had mentioned cases of worms getting into water. Two instances which had come under his notice indicated the cause of origin, both of which were traced to the same source. It always occurred early in the morning, when the water was first drawn from the tap. They were from taps in yards, the taps being covered up by an ordinary cast-iron standard, and when the worms were examined they were found to be the larvæ of the gnat. They found that the larvæ were among the loose bricks down at the bottom of the standard, and they crept up the standard, and, finding the washer between the tap worn away, they crept down into the standard nozzle, and were washed out the first time of drawing in the morning. By removing the loose bricks and replacing it with cement the trouble was totally removed. He would like to thank Dr. Kemna for referring so particularly to the Breslau case, because they had noted that when the floods came to the district of his wells it stopped the flow of water to those wells. He had repeatedly noticed that when the water had been getting low in the springs and the rains came, the water immediately fell very much lower for some time, of course, in consequence of the area being flooded, and he thought that the presence of the iron and manganese must have been due to oozing by the lower strata of water. He had mentioned that in his address, and pointed out that it was from some other origin. Unfortunately he (the speaker) did not catch Dr. Kemna's explanation, but he took it that it was due to some alteration of some of the chemical substances in the strata from which the water came, and if Dr. Kemna would be kind enough to refer to the point again in his reply he would feel much obliged.

Mr. F. H. BRUNT (Rochdale) said there was one point he would like to refer to in regard to the purification of water by chloride of lime. Some years ago he was acquainted with works where there were two reservoirs; one was an impounding reservoir, with about 50,000,000 gallons capacity, and below that there was a service reservoir of about 100,000,000 gallons. At the beginning of a drought the body of a woman was found in the smaller reservoir, which had been in the water about a week when it was discovered, as it was in an advanced state of decomposition when removed. There had to be an inquest, but fortunately the matter was not made very public. On the advice of the chemist a quantity of chloride of lime was placed in the upper reservoir—about 1½ parts per 1,000,000 gallons were used—with a view of preventing any epidemic which might arise from the presence of the body in the water.

Mr. W. PATTERSON said there were many points of the greatest interest in Dr. Kemna's paper which he would like to touch upon, because while the author was present he would like to get his opinion on several matters. Dr. Kemna remarked in one place that ordinary filtration was an efficient safeguard against waterborne disease, but how did he reconcile that with his other statement that it was not to be assumed that the distribution of untreated river water should be considered as a normal proceeding? By untreated water he took it to be water untreated with some material like chlorine. Then he took it that the author did not mean them to take his remarks regarding the criticism by inventors of each other's system. At all events he did not think they should take the remarks seriously, because there were many engaged in this question of water purification who did not shut their eyes to the undoubted efficiency of slow sand filtration. Every mechanical filter maker must admit that the results obtained by slow sand filtration could not be obtained by a rapid mechanical filter unless it was helped by some other system. He would be glad if Dr. Kemna would modify his remarks as to that.

because he did not think that makers of mechanical filters regarded sand filtration as being the worst possible filter in existence. Then Dr. Kemna said: "That the B. coli is quite harmless and not pathogenic is obvious from the fact that it is constantly present in the intestine and that we are still alive." He did not see how the author was justified in making that assertion because he understood, although it was outside his province, that there were typhoid carriers which had got these typhoid germs in them, and they lived a long time and had quite an anxiety to communicate wherever they went. There was a case of dangerous germs in the intestines, most deadly germs, and still they went on alive and kicking. Then Dr. Kemna said: "The application of chloride of lime is simplicity itself; a solution of the required quantities is made and regularly run into the water, and the plant can be started in a few hours." But directly afterwards he referred to a case where the application proved disastrous, and said: "It would be extremely interesting to know details of the way in which the chloride was applied, as this would probably explain the reason why the system failed in these cases and not in others." Well, he would be almost inclined to consider the probability was that the trouble arose from want of care in applying the chloride, by adding it in the form that Dr. Kemna seemed to endorse—*i.e.*, mixing it in casks and letting it run in. He considered it was absolutely essential that the water should be metered, and that the reagent should be added in a very weak solution. If they mixed it up in a tub and let it dribble into the water it might be all right if it was under the supervision of Dr. Kemna, but not in places where it was applied in a haphazard way. He was of opinion that the trouble which had been experienced and which had set back this chlorine treatment and given it a bad odour was simply owing to the fact that people were inclined to use it to excess. The author said: "With most waters mere decantation after the addition of the sulphate of alumina is efficient in from twelve to twenty-four hours:" but he would very much like to know if he had ever had experience of a water which precipitated clear and was in a fit condition to go into the mains after twelve or even at twenty-four hours' sedimentation. His experience was that there was always an infinitely minute trace of suspended matter that they could not get rid of unless the water was subsequently filtered. Dr. Kemna had described his experiments, and he would like that information to be supplemented. The author said: "A deep-well water of a brown colour like strong sherry was shaken up with precipitated alumina (not the sulphate) and then filtered. The effluent was beautifully clear and devoid of all colour." He took it that this was the second part of the experiment, and that the first part of the experiment was described later. He went on to say: "But the pure white alumina had become black, all the colouring matter had been abstracted from the water and deposited on the alumina. The latter had been prepared for some time, and the bottle showed two layers, the upper of a creamy character and the lower, where the substance had gone through a molecular condensation, of a more granulated character. The creamy stuff above absorbed the colour from the well water so the sediment showed a black layer at the top, and another, pure white, below. This experiment showed that the decolourising effect is not solely a chemical reaction, but that it is dependent also on the physical condition of the reagent." He took it that the action of alumina was twofold. The primary reaction was that of the mollient. Mechanical entanglement did not enter into that—it was chemical affinity that this mollient had for the colouring matter. The secondary reaction was mere precipitation. The alumina in combination with lime formed a gelatinous precipitate which carried suspended matter down with it, but that should not be confused with the primary effect of the alumina. From the fact that the alumina was shaken up in the river and settled into a pure white precipitate below Dr. Kemna assumed that the coloured precipitate above that was due to the granular construction of the alumina not having the same effect as the fine precipitate, but he (the speaker) suggested that the explanation was this: That as there were two layers they were justified in assuming there was a considerable precipitate in the bottom of the vessel. A large percentage of that precipitate would fall to the bottom almost at once and appear white in colour. The alumina, as a rather finer precipitate, would have time to act as a mollient and abstract the colour from the water, and in that way the fine precipitate falling later would have the colouring matter with it, not because of its mechanical entanglement, but because of the fact that it had had time to get into intimate contact with the colouring matter and exert its chemical affinity. Further on the author mentioned a very important matter and said: "It is, however, important to ensure a uniform distribution of the reagent through the whole mass of the water." Everyone knew that was a matter of supreme importance, and it explained what the author afterwards mentioned about the barge which was drawn across the river. The action was undoubtedly due to the reagent being well distributed throughout the whole body of the water, and being brought into intimate contact, and its chemical attraction at the time of exerting its force. Dr. Kemna suggested that the reason for certain phenomena in connection with precipitation might be explained by the action of cream. It was rather difficult to argue on that from one case to the other. In the one case they dealt with a precipitate, and in the other case they dealt with the very opposite—something which floated—and it might not be safe to deduce the action of one from the other. Unfortunately, he was not present when the paper was read, and it might be that the author made some alterations in it, but if not he would like to draw attention to the references to the researches of Dr. Houston. Dr. Houston did not recommend the treating only of part of the water with excess lime and mixing it with the untreated water. That would certainly be a half measure which Dr. Kemna referred to. Dr. Houston suggested treating about three-quarters of the volume of water with excess lime, producing sterilisation, and treating the other quarter by some other system—*i.e.*, chlorine, ozone or storage—and mixing the two together so that the resultant water was absolutely sterile. Dr. Kemna's paper was undoubtedly cram full of matter of supreme interest, and he felt very much indebted to him for it. There was one point in Dr. Thresh's paper where he referred to "Permutit." He wanted to get at the truth of the matter, and would like an authoritative statement from the author. He understood that it was necessary to remove the carbonic acid before the "Permutit" process could have any effect on the water at all, and he believed this was attempted to be removed by passing the water through chalk or something else of that sort. He would like to know if that was the case, because it certainly complicated matters. Had this "Permutit" any effect upon bacteria? Did it kill bacteria, or did it sterilise the water, or was it necessary to add some other sterilising agent? The softening of water had a great sterilising effect, and he would like to know if "Permutit" had any tendency in that direction. He would also like to refer to the point of Dr. Thresh as to the change from carbonate of lime to sodium carbonate. Personally, he could not see how any system that had been evolved could approach Dr. Clark's invention. It was old now and out of date, but he was perfectly convinced that had they been using "Permutit" for these things and someone had come forward with a system like Dr. Clark's where lime could be used it would have been hailed as a very great advance in the science of water purification. It almost seemed a step backwards to treat water containing lime and change that into sodium carbonate. Those engaged in the purification of water were continually busy correcting the very tendency which this process brought about. They had a water with 20 grains of sodium carbonate put into a boiler, and on evaporation they at once got an immense sedimentation. The inventors said the sodium in the boiler was not a detrimental if concentrated to a certain degree; that it was all right after 8 per cent and all right up to 12 per cent. Everyone knew it had a detrimental effect at the early stages, and it was very doubtful if it was immune between 8 per cent and 12 per cent concentration. In any case they made the boiler into an alkali producer, and they had concentrated soda solution which was very harmful. One gentleman referred to the effect upon industries, and that was a matter of supreme importance. In dye works, for instance, if this plant was put down the water would require to be carefully measured and neutralised with acetic acid or something before it could be used for dying purposes. He quite agreed with the speaker who said it was a matter requiring the very greatest caution before it was adopted.

Mr. C. H. Roberts (Aberdeen) sent the following communication, which was read by the secretary: "I was struck with the author's remarks in the latter part of his paper to the effect that, in his opinion, the sciences of water purification should be advanced rather by the improvement of existing methods than by the introduction of new processes. The author

is evidently a firm believer in slow sand filtration, and he deserves, I think, the thanks of this institution for laying stress on the great efficiency of the process when scientifically carried out. As he has pointed out, there are many inventors in the field with patented processes who are constantly on the watch to depreciate the advantages of a dangerous rival, and as no one is particularly interested to defend the unpatented process, it is sometimes discredited without sufficient reason. If, for instance, an obsolete or improperly worked set of slow sand filters is replaced by some patent process, the fact of the replacement is made much of, but the reasons for the inefficiency or replacement of the sand filters are not referred to. I have frequently heard of agents stating to members of water authorities that the reason why engineers so often recommend slow sand filters is because they cost more to construct, and that for this reason they are, by personal interest, obviously prejudiced in their favour. A very important point in favour of slow sand filters, when compared with some other processes of purification, is that they act very efficiently in reducing the prevalence of what are usually understood to be water-borne diseases; but they also lower the general death-rate. This has been noted by the expert connected with the Massachusetts Board of Health. A very interesting question is, How are the more recently introduced patent processes going to affect the general robustness of the human constitution and the general death-rate? Will the resisting force of the human system degenerate if all drinking water is sterilised? The author speaks rather disparagingly as to the purifying effect of storage of water, and states that there are better and more efficient means of accomplishing that end. It appears to me that to be able to eliminate over 99 per cent of pathogenic bacteria in a river-water by storing it only for a week is a very efficient means of purification, and if the treatment is followed by filtration, even at a rapid rate, a water can be turned out with a degree of safety which can hardly be surpassed. With regard to Dr. Houston's lime process, this has been proposed for sterilising a soft water in Scotland, the excess of CaO being expected to carbonate itself by contact with air before the water is delivered to the consumer. The case referred to by the author where an epidemic of typhoid was suddenly arrested ten days after starting the application of chloride is very interesting. I presume Dr. Kemna, in this connection, refers only to primary cases. I have always understood that an epidemic generally takes a considerable time before it disappears, secondary cases coming in for many weeks after the cause of the outbreak has been discovered and removed.

Mr. S. C. Chapman (Torquay) said that the previous day, in turning over some old "Proceedings" of the Institute of Civil Engineers, he came across some remarks of Mr. James Mansergh, referring to the question of the elimination of all bacteria from drinking water. He said they were accustomed to be told that it was necessary to remove all bacteria from a drinking water supply, and added: "Were we right in so doing is a question upon which I am bound to say I have always had a slight misgiving. We have learned without any doubt whatever that the micro-organism is ubiquitous, universal, and all-pervading. We are accustomed to talk of the majority of these as being simply harmless. May it not be wise to assume that they are actually beneficent? Further, in removing from the water we drink in London 98 per cent of those found in the river, in order to catch the one stray typhosus or bacillus, neither of which has ever been found in the raw water, may we not be doing greater harm than good?

Mr. W. H. Humphreys (York) said that Dr. Thresh had asked for the experience of engineers in discovering bacteria, or any fault in water supplies, and what steps they had taken to correct them. He had had a case which might interest them. It was the case of a service reservoir of a capacity of over 2,000,000 gallons. It was uncovered, and was used for supplying the town from late Saturday night till early Monday morning. In York they had their own chemist, and tests were made daily of the water supplied to different parts of the town. The chemist went anywhere he liked, to any tap in any part of the town, and took his samples, and these were tested daily. He was puzzled for a long time as to the cause of the rise in the number of bacteria in the Monday samples, but after considerable investigation he found it was caused by the bird droppings at the service reservoir. This just showed how wonderfully keen the biological test was in discovering a small matter like that. As a result, they had put that reservoir out of use entirely, because they had not the funds to cover it, and they could do very well without it. He would also like to refer to the recent report of the Royal Commission on Sewage. It was an important report, which affected waterworks drawing water from river sources. He did not think it would affect his own particular case, but the matter might be considered by their institution, either by the council or by a special committee appointed, and a report made to the members. Of course, they all knew they got many of these Blue-books. He himself had tons of them, with all sorts of recommendations, which were never carried out and never intended to be carried out, and probably the particular recommendations he had referred to might never be carried out; but, in any case, it would do no harm for the institute to investigate the matter, and he recommended that this should be done. One thing in Dr. Kemna's paper which struck him as very true, but which may be very much overlooked, was the efficiency of the sand filter. It was a good old friend of theirs, and one they should not despise; and, speaking as a user of mechanical filters and of slow sand filters for twelve years, he pinned his faith to the slow sand filter. The mechanical filter had its uses, and very important uses, but if there was the slightest danger of the contamination of the water, he would never put his trust in mechanical filters. In his case he combined the two, and one was a great friend of the other, as it reduced the work done by the slow sand filters, and did very important work; but he would never think of using one of these mechanical filters unless he had a slow sand filter as an absolute certainty to stand by. He had found that the West Riding of Yorkshire Rivers Board had done an immense amount of good in regard to the purification of the rivers, and if the institute did anything in the matter they might make recommendations to the Rivers Boards. Dr. Kemna had urged the co-operation of the engineer and the chemist, and he (the speaker) was rather surprised more waterworks did not employ their own chemist. In York they did not find it very expensive, but it was extremely useful and very desirable. Where the water supply was drawn from river sources it was very essential that they should be continually on the watch. He got reports from every mechanical filter and filter-bed, and on the water in the town, so that he knew exactly what was happening always. The cost, as he had said, was not very serious, and it was better than sending occasional samples for analysis.

Dr. Kemna, in reply, said that, as to the general ground of the paper, there had been in the discussion tedious unanimity. There had been no objection at all. He came there harnessed and ready to fight any scientist who put his head out of the water—(laughter)—and he had found everybody satisfied, so that he was in the ridiculous position of a knight-errant who could find nobody to fight. The objection which Mr. Roberts, of Aberdeen, raised was quite correct. There had been a mistake in the proof copies of the paper, and this had now been set right. All the rest of the criticisms were really observations on details. The Breslau affair was a very interesting one, and as he told them, there were two theories as to the occurrence. One they might call the surface theory, which was to say that the flood water washing down on dry strata absorbed the sulphate of iron, and the sulphate of iron reacted on the carbonate of lime and also the manganese. Then there was also the underground explanation—*i.e.*, that the layer of clay separating the tertiary from the quaternary strata had been broken down, so that the water under artesian pressure had been tapped. Such a breaking down might happen as the result of the Messina earthquake or some other earthquake, but he thought it was certainly not the case at Breslau. He had referred to the transformation of the carbonate of lime into sulphate of lime, which proved that sulphuric acid had come in from above. Another fact was that the tertiary strata had a good deal of chlorine in it, and there was not the proportionate amount of chlorine in the water which came from the wells. The theory was advanced, and it had the advantage of showing that nobody could be made responsible for the placing of the wells in that soil. He thought there was not the slightest doubt that there was no injection of underground water, but that it was the washing of the flood water which did the harm. As to the question put regarding the experiment with the precipitate

alumina, there was not the slightest doubt that in this case it was not real chemical combination, but it was such a case as Oestwald, in his great treatise on chemistry, had observed, and with regard to which he said: "These phenomena are on the border between chemistry and physics." Another case similar was the difference between the various kinds of carbon, which to a great extent, and especially for a particular purpose, was equally a question of particular constituents. For example, everyone knew that charcoal and what was called black coal were very efficient absorbents, while other forms of carbon, such as diamonds and so on, had no absorbent power. It was exactly the same with coagulated forms. The particles of alumina might aggregate into a harder form than the soft flakes. It was to the flakes on the surface to which the colouring matter was drawn. In what way he did not know, because that entered into the higher theories of all this molecular action. The particles which were more concentrated did not do anything. As to the process of the experiment the water was taken and shaken up, and the difference of time between the precipitation of the heavier material and the other was not sufficient, in his mind, to account for the difference. As to the use of chloride of lime, it must be remembered that chloride of lime was, in fact, soluble, that it dissolved in the water, and that it separated in the water; so that if they had not an ideal regularity of introduction, and no complicated apparatus for measuring the flow of water, and so on, all that righted itself. Of course, any system could be worked in such a way as to become offensive. If, instead of the generally applied quantity of chloride of lime, they applied forty times as much, they might expect to get trouble, and it appeared that this had been the case in Westphalia. Some astonishing figures had been given in recent publications of the quantity of chloride of lime used, which was forty times the quantity advocated anywhere else. Under these circumstances, with such differences in quantities, it was only to be expected that there would be differences in the results. The purifying effect of decantation had been mentioned by the Aberdeen correspondent, and he was taxed with somewhat underrating it. That storage acted as a purifier had been known for fifty or sixty years. The engineer had built storage reservoirs simply for the purpose of storing water when it was plentiful, and he only drew on it when he could not get enough out of the river, and it was found that there had been purification of the water. Since the Thames reservoirs came into use things had been noticed. There was the amelioration in the chemical composition which had been noticed when chemical analysis became a regular concern. When bacteria were "created," about 1884—(laughter)—no one could prove to him that bacteria existed before 1884, but he would compromise and say when bacteria came prominently then it was assumed that sedimentation removed a very big percentage of microbes also. Percy and Grace Frankland discussed this question in their book in 1905, and the purifying power of the reservoir storage had been acknowledged by engineers, and Dr. Houston's work in that respect was merely supplementary. But he never knew of one engineer who had ever got it into his mind to make a reservoir solely for the purpose of purification. He maintained that there were other means, rapid filters and slow filters, which gave purifying results in a much surer, certain and less expensive way, because after all things were concerned with the question of cost. It was a loss to everyone to spend money on things to do something which those things could be done in another way at less cost. The first idea of Dr. Houston was to take water from the river and treat that with lime, and then add it to other water which had been stored, and of which he felt secure. Later on the idea was altered, and it was said the untreated part could also be treated in another way, which must have been simpler or cheaper, because otherwise there would have been no reason why it should not be treated in the same way. Then it was said the two waters could be mixed. He thought that chloride of lime had been suggested for the treatment of the stored part of the water, but why then not treat the bulk in the same way? Mr. Hunter had ably pointed out the question of dealing with lime over large quantities of water. The treating of water by the Clark process was a very big thing; it was certainly a thing to be desired, but there were a lot of things desired which they could not get.

Dr. Thresh said that, with regard to the question asked [illegible] that would lead to a technical scientific discussion which could not benefit any of them present; but if Mr. Blackburn wanted to know his opinion he would tell him that flaginac and aginac were bacilli he strongly objected to, and that flagin was not important unless sagin was present with one or two agin. (Laughter.) Then, with reference to the question as to whether he objected to the B. coli in water, he would say he did not mind drinking water which contained it, or the bacilli typhosus; but, although they did not affect him, and perhaps many other people, there were conditions under which people might be affected by them. They did not consider the presence of coli of any importance because of its presence, save as an indicator. The chemist and the bacteriologist were like the man on a watch tower, who looked out, and if he saw a B. coli he knew there was an enemy about, and so he alarmed the garrison. He knew there was something which wanted investigating, and he warned the engineer. It did not follow that the presence of the B. coli was a serious matter. There was one water company supplying a large population which had always got coli in its water, but he was absolutely certain it did not come from any source of a dangerous character. With regard to "Permutit," he thought they really ought to have a meeting to discuss the whole softening question, because if he had to answer all the questions asked he would have to keep them all the afternoon. I would simply say that carbonic acid did not matter at all. They had made inquiries and experiments with reference to the effect of softened water on boilers, and they found that nearly all those allegations as to what the effect of the softened water was came from certain sources, and his experiments had not confirmed those statements. No one had ever suggested that putting water through "Permutit" affected the bacteria present. It did to a small extent, just as if they ran it through a thickness of 1 ft. of sand, but not more, and it was not suggested that it would do more than that.

NEW PRESIDENT'S THANKS.

Before the close of the meeting, Mr. C. CLEMESHA SMITH (Wakefield) said: "I would like to thank you briefly for the honour you have done me in electing me to the position of president of this institution. I feel I am lacking in a good many of the qualities which have enabled my worthy predecessor and those who have gone before to fill the chair and to raise the institution to the position it now occupies among kindred societies. I feel also that the duties of president each year are growing more and more heavy, and it will only be by the help of the members of the council and of the members of the institution that I shall be able to carry out the duties. I am perfectly sure I shall have the support which has always been accorded to those who have filled the chair of the council, and I give you my word that I shall do my best to maintain the dignity and usefulness of this institution. I have been asked by the Mayor of Wakefield to convey to the institution an invitation to visit Wakefield next year. The institution is no stranger to Yorkshire, for we have already visited Hull, Scarborough and York. Wakefield is not a large seaport, nor has it the amenities of a watering-place, or the antiquarian interest of York. It is an old market town in an industrial centre, but I hope, nevertheless, you will find your visit of great interest, and I can assure you all that you will receive a hearty Yorkshire welcome."

Penceed (Glamorganshire) Sewerage and Sewage Disposal.—At a recent meeting of the Penybont District Council Mr. T. J. Moss-Flower, C.E., of 28 Victoria-street, Westminster, S.W., and Bristol, presented his scheme of sewerage and sewage disposal for Penceed. The work involves nearly 6 miles of sewers. Owing to the configuration of the district it is necessary to lift the whole of the sewage. It will gravitate to the sewage works, where it is proposed to raise it by means of centrifugal pumps. The sewers will be constructed on modern and up-to-date lines as regards gradients, flushing, ventilation, and so forth. The sewage works consist of detritus chambers, screens, and pump well capacious enough to take the night flow, engines and pumps in duplicate, balancing, storm, sedimentation and humus tanks, percolating filters, sludge beds, and such appliances as are necessary to make the works thoroughly efficient. The scheme has been referred to a committee for consideration.

Assistants' and Students' Section.

CONDUCTED BY SYDNEY G. TURNER, ASSOC.M.INST.C.E.

All communications in regard to this page must be addressed to The Editor, St. Bride's House, 24 Bride-lane, Fleet-street, E.C. *Envelopes must be marked "Assistants' Section" in the top left-hand corner. Correspondents are invited to submit questions for consideration and answers to the questions which appear. For the contributions considered to be the most meritorious, one or more premiums in books will be awarded monthly. Diagrams must be drawn to scale on separate sheets, ready for reproduction.*

THE MONTHLY PREMIUM.

The adjudicators have had some difficulty in awarding the premium for December, and have ultimately decided to award books to the value of 10s. 6d. to each of the following contributors:—

Mr. D. G. BEVAN, Town Hall, Darlington.

Mr. H. E. LUNN, Town Hall, Islington.

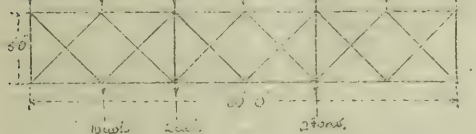
Mr. H. V. OVERFIELD, 8 Walter-street, West Bromwich.

QUESTIONS.

This week answers are invited to the following questions:—

294. Traction.—Compare the tractive force required for heavy vehicles over roads of various surfaces and grades, and show how this affects the cost of transport. (H. V. O., *West Bromwich.*)

297. Lattice Girder.—How would you obtain, graphically and by calculation, the stresses in the members



of a lattice girder braced and loaded as shown in sketch? (T. H., *Leicester.*)

298. Gauging of Streams.—In gauging the quantities of water in small streams over a rectangular notch 3 ft. 9 in. wide (taking the velocity of the stream into consideration) is there any known connection between the velocity of the stream immediately above the gauge and the height of the water above the sill, taking no other quantities into consideration? If there is no general connection between the two is there any within certain limits, and, if so, what are the limits? (E. K., *Sutton Coldfield.*)

299. Surveying. Will some reader kindly give a sketch and description of Colby's Compensation Bars for the accurate measurement of base lines? (Student.)

300. Retaining Wall. A retaining wall is required to support a roadway having no footpath, and consequently heavy vehicles such as steam rollers, &c., will seriously surcharge the wall. The height of the roadway above the adjoining ground is 8 ft., and the filling will be good clay. Design a suitable wall in mass concrete, and show calculations. (D. G. B., *Darlington.*)

[The Editor is at all times glad to hear from readers who desire to submit questions regarding matters of general interest, points of daily practice, &c., for insertion in the "Assistants' and Students' Section." Questions which are published are taken into consideration, as well as other matter, in awarding the Monthly Premium.]

REPLIES TO QUESTIONS.

295. Air Compressors and Ejectors.—Of what horse-power will an electric motor require to be to work an air compressing plant and ejectors to raise 100,000 gallons of sewage a height of 15 ft. in six hours? Show stages of calculations, and state the probable mechanical efficiency of air compressors and ejectors. (D. G. B., *Darlington.*)

The first point to be decided on is the efficiency of the whole plant.

This will be equal to the product of the efficiencies of the various parts of the plant.

The efficiency of the motor would probably be about 90 per cent.

The mechanical efficiency of the compressor would probably be about 85 per cent,

and the efficiency of compression (assuming a single-stage compressor) would probably be about 75 per cent.

$\therefore$ total efficiency of the compressor $= 85 \times 75 \div 100$ p.c

$= 64$ per cent.

Loss in main due to leaks would be 5 per cent per mile of main, and the loss in ejector due to leaks would be 6 per cent.

So that 7 per cent loss due to leaks would be ample to allow in an ordinary case.

Then the efficiency of the ejector and the mains, considered as a pump, would be about 80 per cent.

$\therefore$ efficiency of plant $= 90 \cdot 64 \cdot 93 \cdot 80 \cdot 100$ per cent

$= 42{\cdot}8$ per cent.

or, say, 40 per cent.

$$\text{H.P. required at ejector} = \frac{100{,}000 \times 10 \cdot 15 \cdot 5}{6 \cdot 33{,}000 \times 60 \cdot 11}$$

$= 1{\cdot}26$ H.P.

$\therefore$ motor will require to be of $\left(\frac{1{\cdot}26 \times 100}{40}\right)$ H.P.

$3{\cdot}15$ H.P.

So that if a motor of 3·5-horse power were installed, it would have a slight reserve of power. (H. M. W., *Worcester.*)

296. Tides.—Please explain clearly what is meant by "H.W. of ordinary spring tides" and "L.W. of ordinary spring tides." Also state how the height of ordinary spring tides is arrived at, and over what period the observations or calculations are made. In what respect does an ordinary spring tide differ from an equinoctial spring tide? (Perplexed.)

The tides are due to the attraction of the sea by the sun and moon. By Newton's law of gravitation the force of attraction between two bodies is directly proportional to their mass, and inversely proportional to the square of the distance between them.

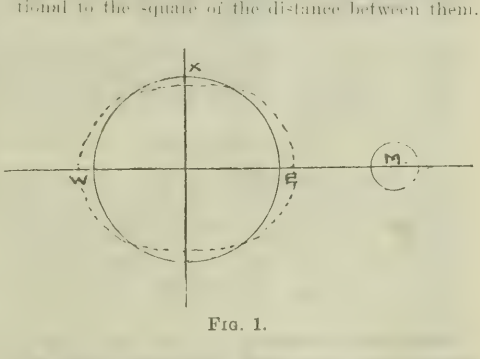


FIG. 1.

So that, although the moon is so much smaller than the sun, its nearness to the earth causes it to have a greater effect on the tides.

The ratio of the moon's attraction to that of the sun is 2·1 to 1.

Let EW (see Fig. 1) represent a plan of the earth taken on the Equator, and assume that the earth is entirely covered with water.

If there were no attracting body present near the earth, the water would form a uniform layer round the earth. Let M represent the moon in position on the meridian of the place under consideration, and neglect the effect of the sun's attraction for the time being.

The water at E will be attracted by the moon more than that at X, and still more than that at W.

The result will be that the water will take up the form of a spheroid with the long axis pointing to the moon, as shown by the dotted lines (see Fig. 1).

This form will follow the moon in its apparent daily course round the earth, so that in every lunar day (of 24 hours 50 minutes) there will be two high

waters and two low waters at every place on the earth. The sun, in the absence of the moon, would produce a similar effect, and would give two high and two low waters in each solar day at every place on the earth.

The actual effect is a combination of the two. As the lunar and solar days are not of the same length, the moon is continually changing its position in the heavens with regard to the sun.

At new moon the sun and moon are in line on the meridian, and are on the same side of the earth.

At full moon the sun and moon are again in line on the meridian, but on opposite sides of the earth.

In both cases their attractions, as regard the water on the earth, are in the same direction, so that we get a tide equal to the sum of the solar and lunar tides. This is called an ordinary spring tide.

When the moon is at its quarters, or at right angles to the sun as seen from the earth, it is trying to produce a high water where the sun is trying to produce a low one; so that the resulting tide is the difference of the lunar and solar tides. This is called a neap tide.

So far we have considered the sun and moon as if they were both on the plane of the Equator, and this is not necessarily the case.

As a matter of fact, the declination of the sun and moon (that is, the angle which their centre makes with the plane of the Equator) varies by just over 20 deg. both north and south of the Equator in the course of the year. It is evident that, when the sun and moon are both on the meridian, they will have a much greater resultant attractive force if they have nearly the same declination than if their declinations are widely different.

Thus we may expect a variation in the range of the tides—that is in the difference in level between high and low water—to follow a variation in the declinations of the sun and moon, as well as a variation in their right ascensions, as shown by the "quarters."

We find that the maximum range for the spring tides occurs near the equinoxes, and the minimum range near the solstices.

So that the difference between an ordinary spring tide and an equinoctial one is a difference of range.

The height of ordinary spring tides is arrived at by taking hourly observations of the level of the sea above some fixed datum line.

These observations must be continued for a period of 369 days and 3 hours, in which time the sun, and the moon with its satellites, will have been in all possible positions with regard to one another. (H. M. W., *Worcester.*)

The Roadman's Wedding.—At the wedding of Tom Stacey, a roadman employed by the Farnham Urban District Council, the music was provided by an Italian organist, whose instrument, operated by means of a handle, was outside the church. A guard of honour was formed by Tom's fellow-roadmen, and the happy couple passed under an arch made of their brooms. —*Star.*

Waterproofing Material.—At the Children's Welfare Exhibition, Olympia, the model boating lake—which is 120 ft. long by 30 ft. wide, and is one of the great attractions of the show—was lined throughout with Callender's sheeting, and so rendered absolutely water-tight. This method of safeguarding water spectacles is not new to Olympia, as on previous occasions Messrs. George M. Callender & Co., Limited, of 25 Victoria-street, London, S.W., have supplied and fixed their special lining with entirely satisfactory results, the fine effect of the winding canal in the Dutch village at a recent exhibition being rendered possible by the help of the material manufactured by this enterprising firm. As is shown by their latest illustrated catalogue (obtainable gratis on application), Messrs. Callender have waterproofed ponds, lakes, reservoirs, aqueducts and similar constructions in all parts of the world. This system, which was originated by them some forty years ago, is both economical and effective, and the adaptability of the material should make it worthy of consideration in connection with ornamental ponds and miniature lakes.

TURNPIKE ROADS AND COUNTY MAIN ROADS.

SOME MILEAGES AND MAINTENANCE COSTS.

In many counties the main roads are for the most part the same as the old turnpike roads. The turnpike trustees were allowed a share of statute labour, or its money equivalent, for the purpose of road maintenance, but this was only a small proportion of their funds, which were mainly derived from tolls. The speeds attained by mail coaches of the period show that many of the roads were maintained in at least a fairly good condition, and considering the important services performed by these highways the annual expenditure per mile was, in some cases, by no means excessive, and in some counties is remarkably near the cost of main road maintenance to-day. The nearest approach to equality, or one of the nearest, is to be found in the case of Staffordshire, in which county there were 691 miles of turnpike road in the year 1839 against 605 miles of main roads in 1911. The cost of maintenance of the turnpike roads, which bore a considerable amount of through traffic, was in that year £98 a mile against £74 a mile for the year 1910—1911, the population of Staffordshire having trebled in the meantime. Another close comparison as regards mileage is furnished by Shropshire, 688 miles of turnpike roads against 696 miles of county main roads, but the figure here given for turnpike roads is not in agreement with those obtained from other sources, according to one of which the mileage was 640, while the other figure—988—was probably set down in error. The mileage, if taken as 688, gives an annual cost of £44 per mile, the cost of maintenance of rural county roads to-day being similarly moderate as compared with other counties—£69 a mile. The population has increased only from 223,000 to 259,000.

In Northamptonshire 358 miles of turnpike roads are represented by 318 miles of county roads, and, in spite of an increase in population from 179,000 to 642,000, the cost is now £80 a mile against £102 for the turnpike roads. In Kent the population has just about doubled, and the mileage of main roads—616—is not much greater than that of the turnpike roads —586—the latter costing, in the 'thirties, about £124 a mile, and the county roads to-day, with surface tarring, about £178. In Warwickshire the population has increased from 337,000 to 907,000, this large population being served by 457 miles of main roads costing £111 per mile, while the 407 miles of turnpike roads cost about £70 a mile.

The nearest approximation in costs of maintenance is afforded by Buckinghamshire, where the main roads cost £94 a mile against £92 for the turnpike roads, the population having increased but little, from 147,000 to 173,000; but the mileage of turnpike roads was only 165 against the 467 miles of main roads, so that this county is one in which the road system has developed, in the narrow sense of the present comparisons, which are strictly limited in their scope in Northumberland, as in Shropshire, the expenditure per mile on turnpike roads was low—£47—and in this county the main road system has extended only moderately beyond the mileage of the turnpike roads, which was 479 against the present figure of 617. The cost of maintenance of the main roads is about twice the expenditure per mile on turnpike roads.

The above examples furnish cases of moderate increases in mileage, and one very large increase, while in Northamptonshire there has been a moderate decrease. More considerable is the decrease in Surrey, where 289 miles of turnpike roads, costing £220 per mile, are represented by 224 miles of county roads costing £422 per mile, the increase in population being from 486,000 to 719 000. The high cost of maintenance is partly due to the fact that the increase in population has been mainly close to the principal through routes, and has been accompanied by an enormous increase in the contributions which London makes to the traffic of the county; but it is interesting to note that the very high cost of maintenance in the coaching days foreshadowed the conditions in Surrey and Kent to-day.

The main point in making the above comparisons is to bring out the often striking correspondence between the county mileages of turnpike roads and those maintained under county management to-day. In some cases, too, the change one way or the other has a significance of no mean importance. As regards costs, it is interesting to find figures of about the same order and even fairly close approximations, but these figures must not, of course, be unduly pressed

The Surveyor
And Municipal and County Engineer.

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or be assumed to have in every case a special significance, since we do not know what was the average serviceableness of the turnpike system in each county, and we have no traffic statistics to make the comparisons of cost tell us more than they do. The figures for turnpike roads are not all of them for the same year, but in each case for a date between 1830 and 1840.

Centralisation of Highway Control.—From an able paper presented to the Third American Road Congress by Mr. W. H. Connell, Chief of Bureau of Highways and Street Cleaning of Philadelphia, Pa., we quote the following brief extract: Assuming (said Mr. Connell) that a highway organisation has reached the stage of development where its personnel is qualified to handle the work, the next and most important step toward efficiency and economy is to centralise the control of the streets. It may appear rather odd to some, but, nevertheless, it is a fact, that very few, if any, highway organisations control the streets coming under their jurisdiction. The control is usually divided up between the street railways, telephone, telegraph, electric light, gas and other corporations. If, when these companies tear up the streets they are permitted to make their own repairs, there results a confusion which takes away from the Highway Bureau the direct control of street repairs. Such arrangements as are necessary should be made to place all repair work directly under the Highway Bureau. If the repair work is done by contract, the contract should be with the city. The Highway Bureau should have sole authority to repair or order repairs, of whatever nature, that are to be made. This would give the bureau a direct control over the contractors, and place the responsibility on the bureau for the condition of the streets and do away with the excuses we so often hear from city officials that the railway or telephone company are responsible for such and such repairs, and we are doing our best to push along the work. With this divided responsibility for the condition of the streets we can never expect to reach the highest point of efficiency in our highway organisation. The parkways and main park driveways should also be under the control of the Highway Bureau, as there should be but one system of highway construction and maintenance in the municipality.

THE LONDON BUILDING ACTS.

SUMMONS AGAINST BERMONDSEY BOROUGH SURVEYOR.

At the Tower Bridge Police-court recently Mr. Cecil Chapman gave his decision on four summonses taken out by Mr. C. A. Daubney, district surveyor, against Mr. R. J. Angel, borough surveyor of Bermondsey, for having failed to give building notices in respect of works at Vine-street, Rouel-road, Rotherhithe-road and Bermondsey-street, and for having begun such works without giving notice.

A brief notice of the case appeared in "Minutes of Proceedings" in last week's issue of THE SURVEYOR, but, in view of the important question raised, the following fuller report will be of interest.

The work for which the district surveyor claimed notices for "digging within 3 ft. of a building" (and it should be remembered that in none of these instances was the fabric of the buildings touched or disturbed) was as follows:—

(1) VINE-STREET.—Laying a drain connection from the sewer in the centre of the roadway to a building and connecting to an intercepting trap at a distance of about 3 ft. under the building.

(2) ROUEL-ROAD.—Laying a sewer from the main sewer in the centre of the road at right angles to a building, passing under the building, and proceeding at the back of the building in the yard at a distance within 3 ft. of the wall.

(3) ROTHERHITHE-STREET.—Laying a pipe in connection with a sewer from the main sewer in the road at right angles to a building, and passing under the building at a depth of about 7 ft., and terminating at the rear wall.

(4) BERMONDSEY-STREET.—Laying a sewer in a passage about 3 ft. wide and below the level of the adjoining buildings.

The learned magistrate, in giving a considered judgment, said that the district surveyor of Bermondsey (representing the London County Council) had summoned the borough surveyor for failing to give him notice under the London Building Act, 1894, before interfering with and replacing the soil under certain houses in the reconstruction of a sewer passing under a block of houses in one place and in close proximity to the sides of houses in another place. The claim was based upon the proposition that anything done within 3 ft. of a building must be work for which notice is required under sec. 145, subsection (a), although the interference was only incidental to the execution of other work which had nothing to do with the buildings. The word "work" in the section which deals with notice to be given was associated with the words "building or structure," and it was natural to infer that it must mean work *ejusdem generis* as building or structure.

The defendant's case was based upon the contention that work which is not directed to a structure or building was outside the scope of sec. 145, although it might be closely associated with and even materially affect a building. In support of this contention the case of *Venner* v. *Macdonnell* was relied upon, in which a solid structure of seats within the Agricultural Hall for the purpose of accommodating hundreds of people was held not to require a notice to the district surveyor.

In his opinion the reasoning in that case applied directly to the one before him, and had, he imagined, governed the action of local authorities ever since the London Building Act was in force. If it had been otherwise the construction of sewers, or the laying of electric cables, or the carrying out of any other works below the surface of London would have been accompanied by endless notices and fees for district surveyors. In his judgment it was unnecessary to discuss the extent of interference with the subsoil of the houses in this case, because he held that whatever was done incidentally to a building in the carrying out of a sewer construction, an entirely different operation, was not a work or structure for which notice to the district surveyor was necessary. The case, therefore, against the borough surveyor was dismissed, with 12 guineas costs.

The learned magistrate consented to state a case for the opinion of the High Court.

City of London Street Lighting.—The system of lighting by lamps suspended in the centre of the streets by wires is to be extended in the City of London, and a saving in the lighting bill of nearly £7,000 is expected.

Law Notes.

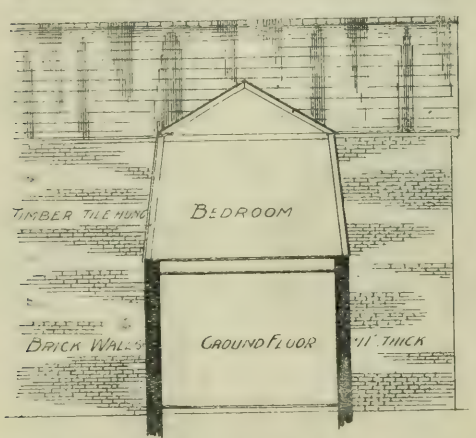
EDITED BY J. B. REIGNIER CONDER, 11 Old Jewry Chambers, E.C., Solicitor of the Supreme Court.

The Editor will be pleased to answer any questions affecting the practice of engineers and surveyors to local authorities. Queries (which should be written legibly on foolscap paper, one side only) should be addressed to "The Law Editor," at the office of THE SURVEYOR, *accompanied by the writer's name and address, but correspondents who do not wish their names to be published should also furnish a "nom de plume." Where necessary, copies of local Acts or documents referred to should be enclosed.* **All explanatory diagrams must be drawn and lettered in BLACK ink only, and in such style as to be fit for direct reproduction—i.e., without re-drawing or amendment.** *Unless these conditions are complied with we cannot undertake to reply to queries.*

QUERIES AND REPLIES.

In order to avoid confusion querists are requested to use distinctive words as nom de plume. The letter X, combinations such as X.Y.Z., and words such as "engineer" and "surveyor," should never be used.

BY-LAWS: EXTERNAL WALLS. "Veras" writes: A plan has been submitted to me showing the form of construction indicated on the accompanying sketch. Our by-laws are the usual with respect to requiring all external walls to be built of brick or other hard and incombustible materials. You will see that the method of construction indicates a brick wall to enclose a ground floor, but the first floor bedrooms are contained between two sloping sides formed of timber studdings, tile hung on the outside. Does this comply with the by-law? The architect's contention is



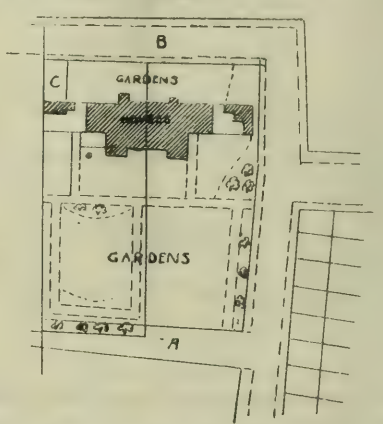
that the first floor bedrooms are in the roof of the building, and that, although this roof is externally somewhat after the shape of a mansard roof, it is not a properly framed mansard roof. The question really is, Do these slightly sloping sides of the rooms form part of the roof or are they the external walls of the first floor of the building? A similar question was answered by you on p. 181 of the issue of THE SURVEYOR dated January 26th last, but the difference in the case of the plan submitted to me is that the tile-hung method of construction applies only to one wing of the building, the other part being taken up two storeys high in brickwork, as shown on the drawing sent herewith. Only the two side walls are proposed to be tile hung, the end walls being of brickwork.

In my opinion these are external walls within the meaning of the by-laws.

BY-LAWS: ROOM IN ROOF.—"A.R.I.B.A. No. 2." writes: I was interested at the time in the reply contained in THE SURVEYOR of April 5th last to the question asked by "A.R.I.B.A." in reference to attics. A similar difficulty has arisen in my locality, but upon a somewhat differently worded by-law—namely, "In any building every habitable room, with the exception of rooms in the roof, shall be in every part 9 ft. in height from the floor to the ceiling, and every habitable room in the roof of any such building shall be at least 8 ft. in height from the floor to the ceiling throughout not less than two-thirds of the area of such room." The sketch accompanying the reply of April 5th will apply to my question, and I shall be glad to have your opinion as to whether a local authority has power under this by-law to disapprove plans showing an arrangement similar to that in the sketch referred to.

The question in the case referred to was whether there could be an attic on the first floor, or whether at least one floor must intervene between the ground floor and an attic. In the present case that question does not arise, the term "attic" not being used in the by-law, which provides that a room in a roof must be 9 ft. high through two-thirds of its area. The area of the room in the former query is not stated or shown on the plan, so that I cannot express an opinion as to whether it complies with the by-law.

PUBLIC HEALTH (BUILDINGS IN STREETS) ACT, 1888. "G. H. W." writes: Will you please give me your opinion on a point under the Public Health (Buildings in Streets) Act, 1888, sec. 3? There are two houses adjoining two front streets (A and B), each 40 ft. wide. The main entrance to these houses is from street A, but there is a secondary entrance for tradesmen, &c., from street B. A proposal has been made to erect a motor garage—marked C on plan—extending to the palisading line in street B. Will it be contrary



to the Act to erect this building without the written consent of the authority? Can it be contended that, notwithstanding the main entrance to the houses is from street A, the proposal is to erect or bring forward part of a house, &c., beyond the front main wall of the house on either side thereof in the same street, or the making of an addition to the building beyond such front main wall? I may add that there is a possibility of streets A and B being extended westward, and of villa residences being erected on the north side of street B.

The question whether a given house is "in" more than one street within the meaning of the Act is a question of fact for the decision of the magistrates on proceedings under the Act (*Warren* v. *Mustard*, 56 J.P., 502). And in considering what is the "front" main wall for the purposes of the Act all the circumstances of the case must be taken into consideration. The building must be looked at as a whole, its character, its position and its distance from the proposed erection must be considered (*Attorney-General* v. *Edwards*, 1891, 1 Ch., 194). In the present case, when the object of the Act is borne in mind, I think it would be reasonable to hold that the houses are "in" both streets, A and B, for the purposes of the Act, and that the wall facing B street is a "front" main wall next that street within the meaning of the Act. I can find no record, however, of a similar case, and the point must be regarded as a doubtful one.

BUILDING BY-LAWS: THICKNESS OF WALLS: "BASE."—"F. L. B." writes: "We have recently had a plan deposited for a picture house, the walls of which are 72 ft. long by 25 ft. wide by 17 ft. high, and are shown to be of 9-in. brickwork. Under our by-laws (sec. 20, a copy of which I forward) these walls should be 13½ in. thick at the base. This is a one-storey building, and our clerk holds that the 13½-in. work should extend to the full height of the wall. I shall be glad to hear if in your opinion this is correct, and your definition of the term "base" in this case, and that of a two-storey building as well."

I agree that the wall must be 13½ in. for its full height. Under clause (*a*) of by-law 20 it must be 13½ in. thick at its base: and under clause (*c*) it must be 13½ in. thick at the top and for 10 ft. below the top, and the remaining 1 ft. must be built solid between straight lines drawn on each side, joining the thickness at the base to the thickness at 10 ft. below the top—in other words this remaining foot must also be 13½ in. thick. I think "base" means the ground-level.

BY-LAWS: INTERNAL WALLS.—"F. R." writes: In my district the Model By-laws are in force. A house has recently been erected, the interior walls of which have not been plastered or otherwise covered. Should I be in order in refusing my certificate—viz., "that the new dwelling house is fit for human habitation"—on

the ground that the internal walls have not been plastered or otherwise faced up?

There does not appear to be any provision in the Model By-laws making it compulsory to plaster or otherwise cover the internal walls of a building. In the absence of any such provision I do not think the surveyor would be justified in refusing his certificate on the ground stated.

ACCOMMODATION ROADS. – "Rural" writes: An accommodation road leading through a farm has been repaired by a rural district council. (1) Does the fact of the council having once repaired make it a highway repairable by the inhabitants at large? (2) Have rural councils power occasionally to repair accommodation roads over which the public have a right of way, and, if so, under what Acts?

(1) No. (2) I do not think the council have power to repair a highway not repairable by the inhabitants at large.

We have to draw the attention of querists to the directions laid down for their guidance in regard to the preparation of diagrams. Rough sketches obviously cannot be made use of, and we should be obliged if correspondents would therefore send only carefully-prepared drawings, preferably about 6 in. in width, and without colouring or wash of any description. Failure to observe these rules will involve the risk of queries remaining unanswered.

CORRESPONDENCE.

For every ill beneath the sun
There is some remedy or none:
If there be one, resolve to find it:
If not, submit, and never mind it.
– ANON., *circa* 1815.

RAIL CORRUGATION AND BRITISH STANDARD TRAMRAILS.

To the Editor of THE SURVEYOR.

SIR,—Mr. W. J. Hadfield, permanent way engineer of the Sheffield tramways, in his remarks on Mr. Wakelam's paper, is reported (p. 819, THE SURVEYOR, December 13th) to have said:—

"With regard to rails they (at Sheffield) had adopted one of the British Standard sections, but found it unsuitable, the web splitting. If a rail were weak enough to split, it would be weak enough to vibrate. He was now using a 120 lb. rail, which was 30 lb. more than the British Standard section."

Such a statement calls for more than passing notice. It would appear therefrom that the Sheffield Corporation have been using tramrails of No. 1 British Standard section, 90 lb. per yard—*i.e.*, the lightest of the whole series of British Standard sections.

Why their advisers should have selected this section is difficult to understand, as it is obvious to anyone experienced in such matters that either the No. 4 (105 lb. per yard) or the No. 5 (110 lb. per yard) British Standard section should have been used for such heavy traffic as on the Sheffield tramways. It is hardly fair, therefore, for Mr. Hadfield now to endeavour to lay the blame for unsatisfactory results upon the design of the British Standard sections.

When the Sheffield tramways were originally laid in 1899—which was prior to the use of covered top deck cars—a rail weighing 107 lb. per yard was used, a section which was at that date the heaviest in the country; this fact makes it the more strange that at a time when covered top decks had become the rule—thereby adding great stress upon the rails—a rail weighing only 90 lb. per yard should have been selected.

From my experience I am inclined to think that an investigation of the facts would show that the splitting Mr. Hadfield mentions is attributable to causes other than that ascribed by him.

I may add that British Standard tramrails have been extensively used for the past ten years on many of the principal tramways all over the world, and probably half a million rails have been rolled to these sections—to which 80 per cent of the tramrails rolled in this country are now made—and not a single complaint of "web splitting" has been received by the Standard Tramrails Committee.—Yours, &c.,

W. J. HOWARD-SMITH.
Chairman, British Standard Tramrails Committee.

Westminster.
December 22, 1912.

WORKING-CLASS HOUSING.

To the Editor of THE SURVEYOR.

SIR,—The interesting paper on this subject by Mr. S. Palmer in your issue of December 20th contains two points which seem to require further consideration. The writer says: "Before we can build really economic buildings we must get the working classes to dispense with that bogey the sitting-room, which is hardly ever used except for knick-knacks." He then describes and illustrates his plan to achieve this end; but long experience of the lives and habits of working people convinces me that his "kitchen scullery" will be used as the living-room and his "living-room" will be given over to the knick-knacks. Thus he will only have intensified the waste he deplores.

My own experience of building houses for the working classes proves that the most economical plan, and one entirely approved by the inhabitants, is to make quite a small parlour into which the front door opens (not much bigger than the "hall" in Mr. Palmer's plans), a large living kitchen containing the kitchen range, and a small scullery with sink and copper, but no fireplace. This prevents the scullery being used except for its proper purpose, and gives the much-prized parlour without any material sacrifice of valuable space.

The other point is Mr. Palmer's suggestion "that fireplaces in the bedrooms might well be dispensed with." This seems to me highly impracticable; anyone who has experience of illness among the poor knows how invaluable an open fire is on occasions.

Yours, &c.,

MARGARET E. TAYLOR.

Bocking.
December 29, 1912.

THE INSTITUTE OF SANITARY ENGINEERS: ELECTION OF COUNCIL.

To the Editor of THE SURVEYOR.

SIR,—I am obliged to "Fellow" for his kind remarks concerning myself, and readily accept his expressions of regret. From the letter I have received from him, and from that appearing in your current issue, I gather that "Fellow" did not intend his first letter should convey to your readers quite the meaning I attributed to it. I regret having so far misunderstood him. As, however, "the president, vice-presidents, treasurer and councillors for the time being together form the council of the institute," in accordance with the Articles of Association, an "entire" change of the council may fairly be interpreted as meaning the whole lot. As such a statement was likely to convey an unfair impression to the minds of the large number of present and prospective members of the institute who are readers of THE SURVEYOR, I felt it my duty to ask your kind permission to reply to it, and the more readily so because what appeared to be an attack on the council was made over a *nom de plume*.—Yours, &c.,

GEO. W. CHILVERS.

Chiswick.
December 30, 1912.

INTERCEPTING TRAPS IN HOUSE DRAINS.

To the Editor of THE SURVEYOR.

SIR,—In reply to Mr. Richard Read's letter, appearing in your issue of the 27th inst., it is only necessary for me to state that the "Closet of the Century" works efficiently with a 2-gallon flush, but obviously, as is the case with all water-closets, the action is still further improved with either a 2½ or 3 gallon flush, which many of the water companies allow.—Yours, &c.,

W. JENNINGS.

Lambeth Palace-road, S.E.
December 30, 1912.

BITUMINOUS MATERIALS.

To the Editor of THE SURVEYOR.

SIR,—At the risk of appearing even too persistent on this particular subject, I would like to take up the cudgels with Mr. Dussek, to whom it seems strange that I should put forward what he considers such a peculiar definition of the word "asphaltum."

I am quite aware that the ancient Greek word "a-phaltos" passed into the Latin as "asphaltum" (English and French—"asphalt" and "asphalte" respectively), notwithstanding which I still contend that the materials known *commercially* to-day as "asphaltums" are the pitchy residues which are obtained

from the distillation of asphaltic or semi-asphaltic base petroleums, and which must not be confused with natural asphalts.

If Mr. Dussek desires confirmation of this I would refer him to two of the largest manufacturers of "asphaltums"—viz., the Standard Oil Company of New York, 26 Broadway, New York, or the United States Asphalt Refining Company, 90 West-street, New York—either or both of which companies would no doubt be courteous enough to enlighten him.—Yours, &c.,

CECIL NATHAN.

3 London Wall Buildings, E.C.
December 31, 1912.

To the Editor of THE SURVEYOR.

SIR,—My principal object in writing you on November 22nd last was to ensure that we should have—more especially in view of the coming International Road Congress—a uniform, consistent system of nomenclature, clearly understood and accepted by all, and that this good end should be attained with the least possible dislocation of popular usage.

The correspondence which followed, which has been most interesting and instructive, shows that wide disagreement exists as to the definition and nomenclature of "asphalt" and "bitumen," and I suggest you can do a considerable service by continuing to give the hospitality of your columns to the discussion with a view to clearing up any misunderstanding which exists, and perhaps obtaining some authoritative expression of opinion on a subject so full of importance to highway engineers, contractors and traders.

I would like to add to my first contribution to this subject that the word "artificial" which I used must not be taken as implying any degree of inferiority.—Yours, &c.,

JOHN HUTCHINSON.

Westminster.
January 1, 1913.

CARDIFF WESTERN OUTFALL SEWER DISPUTE.

SETTLEMENT ANNOUNCED.

At a meeting of the Public Works Committee of the Cardiff Corporation last week, the chairman (Councillor J. Mander) announced, as one of the sub-committee given plenary powers to deal with the dispute with Messrs. Whyte & Co., Limited, over the construction of the western outfall sewer, that a settlement had been arrived at which would obviate any further litigation. It had, he said, been a very long and arduous task, and, as one of the sub-committee appointed to deal with the matter, he was thankful it had come to an end.

It will be remembered that the hearing of the arbitration proceedings lasted forty-two days, the arbitrator being Mr. H. Percy Boulnois, M.INST.C.E., Westminster. The claim which Messrs. Whyte & Co. made against the corporation was for the sum of £53,148, and among the grounds of claim were allegations regarding non-access to the work and unexpected difficulty in the character of the work. The arbitrator's award was for a sum of £20,000 apart from costs, with an additional liability contingent upon the decision of the courts upon reserved issues. The sum which is now to be paid in full satisfaction of the claim is £19,500 inclusive of costs.

Milestones.—It is surely not well known (says Mr. J. Landfear Lucas, of Hindhead, in a letter to the *Surrey Comet*) that milestones still stand about the country indicating, not measured miles, but the "customary" mile, something entirely different (about a mile and a-half by our modern statute reckoning), the origin of which is a mystery. The old milestones, with their "customary" messages, were fixed by order of Quarter Sessions nearly two centuries ago, stating in each case the distance to the nearest market town, and there they stand, reminding us of days when travelling was difficult and perilous, and "intelligence," as the old Sessions orders expressed it, was "difficult to be had." It would be interesting to know how many remain standing to-day, but I have records of several within a single county. The City of London formerly boasted two famous starting points from which to measure milestones—namely, Hick's Hall and the Standard in Cornhill. Few persons to-day, however, could indicate these spots with any precision.

SEWAGE COMMISSION'S EIGHTH REPORT.

AN AMERICAN REVIEW.

We quote the following from the last received issue of the New York *Engineering News*:—

The new standards for sewage treatment and for sewage disposal without treatment announced a few weeks ago by the Royal Commission on Sewage Disposal are as revolutionary for England as they are rational, scientific and practicable for that or any other country. Casting to the winds the old notions long held by many, and recently taken up in this country by increasing numbers of zealous but poorly informed people, to the effect that all sewage should be "purified" before it is discharged into water, and that a single absolute universally applicable standard is both feasible and imperative, the commission has adopted the sound principle that the governing condition in sewage disposal is the prevention of nuisance. Nuisance depends upon the degree of dilution. Given sufficient dilution, no treatment of sewage is necessary. Nuisance conditions having been met, water supply may, as a rule, be left to the water authorities, and all other health conditions left out of account.

Too literal an application of what may conveniently be called the nuisance-dilution principle would result in no general standard, but rather a separate standard for each works, and a changing one at that. This would be embarrassing from both the local and the central administrative viewpoints. Therefore, the commission recommends a few standards, correlated with commonly used and successful methods of complete and of partial treatment, and beyond this a standard is provided for determining when no treatment whatever is needed.

Briefly, the standards are as follows: Where local conditions (chiefly a very low available dilution) demand complete treatment, the effluent shall contain not more than 3 parts of suspended solids per 100,000, and shall not take up more than 2 parts of dissolved oxygen per 100,000 after five days at a temperature of 65 deg. Fahr. (the test to be made without removing the suspended solids). Where partial treatment is all that is required, the standard is the amount of suspended solids in the effluent for varying degrees of dry-weather flow stream dilution (but dissolved oxygen calculations were used in arriving at these standards). For dilutions of 150 to 300 times, the suspended solids in the works' effluent shall not be more than 6 parts per 100,000, which can readily be attained by chemical precipitation; for dilutions of 300 to 500 times, the suspended solids shall not be more than 15 per 100,000, which can be attained by either plain sedimentation or septic tanks. For dilutions greater than 500 times no treatment would be necessary, except such screens or detritus tanks as the "Central Authority" might require.

It should be understood that the highest of the standards cited is to be deemed a "normal standard," of general application except as a "relaxed standard" is authorised by the "Central Authority"; also that the normal standard, according to a formula used by the commission in its calculations, is based on a dilution as low as eight volumes of dry-weather stream flow to one volume of effluent, but that exemptions from the normal standard would not be permissible until 150 dilutions were reached.

In considering these standards, American engineers should remember that the average stream in England is small compared with our own streams, and that, as a rule, British sewage is much stronger than American sewage. Allowance should be made for these and other varying conditions in considering how the British standards may be utilised here.

The basic principles underlying the standards recommended by the Royal Commission on Sewage Disposal are in complete accord with the ideas and practice of most of our best American engineers. The standards themselves, however, seem to be far in advance of any yet proposed for general adoption in any country—not in severity, but in point of scientific analysis of the sewage nuisance problem and in correlation of nuisance prevention with degrees of dilution and degrees of treatment.

Town Planning Schemes.—The Local Government Board have given authority for the preparation of town planning schemes by the Corporations of Warrington, Blackburn, and Luton, which are to relate to areas comprising about 1,475, 887, and 4,766 acres respectively.

LOCAL GOVERNMENT BOARD INQUIRIES.

The Editor invites the co-operation of SURVEYOR *readers with a view to making the information given under this head as complete and accurate as possible.*

INQUIRIES HELD.

Cambridge T.C. (December 17th. Mr. Courtenay Clifton).—£1,224 for works of sewerage in Trumpington-road and Hills-road.—The town clerk, Mr. J. E. L. Whitehead, explained that the borough boundaries had recently been extended, and that it became necessary to connect these new districts to the corporation sewers. At present there were cesspools emptied by the owners. There had not been much inconvenience because they were large houses standing in large grounds. The borough surveyor, Mr. J. Julian, stated that the works had not been begun. The period for which the loan was asked was thirty years. No payments had yet been made with regard to the works. The inspector asked what men were to be employed, and the surveyor replied that it was intended that some of the council's permanent men should be employed. It was impossible to do the whole work with only casuals not used to the work. The inspector: There is no objection to you employing permanent men if they are not paid out of the loan. It was stated that some of the men, although they were not salaried and could be discharged at short notice, were called permanent to distinguish them from men taken on for a few days owing to pressure of work. The general foreman was the only really permanent man. No work of this kind had been done by contract for the past seventeen years, but if the Local Government Board would not allow the men to be paid out of the loan they would have to contract, and 30 per cent would probably be added to the cost.

Farnworth U.D.C. (December 11th. Mr. Courtenay Clifton).—£17,000 for works of private street improvements at Farnworth.—The clerk, in making the application, said the council would like the loan to be spread over ten years, as many of the occupiers of the houses referred to were also owners, and if not spread over a fairly long period it would prove a hardship to them. The suggested improvements had been long advocated by their medical officer of health, and more recently by the county medical officer of health.

Grimsby T.C. (December 20th. Mr. Herbert Ross Cooper). £5,900 for culverting an open stream in the Clee district.—The borough surveyor, Mr. H. Gilbert Whyatt, stated that several open watercourses, bringing water from the country districts into and through Grimsby, met in the Clee district. The north portion of the stream was culverted some twenty years ago, and the open stream had been cleaned and kept in order by the Dyke-reeves until within the last few years, the cost being charged on the agricultural land in the district; but in the lengths within the area built upon the Dyke-reeves had ceased their operations. During certain states of the weather in summer the mud at the bottom of the stream emitted foul emanations to such an extent that the people in the district raised serious complaints. So far as was known no sewage ran into the dyke. During the last two summers the sanitary inspector had caused the two landowners who owned the land forming the bed of the dyke to cleanse the dyke, but the work had not been satisfactory.

Kirkburton U.D.C. (December 19th. Mr. H. R. Hooper).—£600 for works of sewage disposal.—It was stated that the scheme had involved a total expenditure of £7,100, and that the £600 now applied for was the final payment for the work. The engineer, Mr. J. S. Dyson, said the sewage works had been working nearly five years. There had been a little complaint about the effluent varying. At first there was a difficulty in getting suitable filter medium, and they had to use local sandstone. With proper care he saw no reason why everything should not be satisfactory. Mr. Kershaw, district inspector to the Rivers Board, said that for the past two years the effluent had been very satisfactory.

APPLICATIONS FOR LOANS.

Barrow-in-Furness T.C.—£1,750 for the purchase of a site at Newbarns for a new school.

Bingley U.D.C.—£19,645 for bridge and street improvements.

Camborne U.D.C.—£24,752 for works of drainage.

Cambridge T.C.—£6,103 for new tanks at the sewage works.

Carnarvon C.C.—£1,800 for a new school at Cwm.

Easington R.D.C.—£13 000 for building and furnishing a new hospital.

Huddersfield T.C.—£60,000 for extensions to the electricity works.

Warmley R.D.C.—£40,000 for the Siston sewerage scheme.

LOANS SANCTIONED.

Alsager U.D.C.—£330 in connection with the water scheme.

Barnard Castle U.D.C.—£400 for sanitary conveniences.

Cardiff T.C.—£21,300 for the construction of filter beds, the provision of new pumping plant, and laying high-pressure sprinkling mains, and £800 for depot extensions.

Chester-le-Street R.D.C.—£600 for private street works.

Huddersfield T.C.—£15,500 for works of street improvement.

Kingswood U.D.C.—£453 for an improvement at Bush's Hill, Hanham.

Selby U.D.C.—£1,730 for the purchase of sites for two schools.

St. Thomas R.D.C.—£600 for working-class dwellings at Whimple.

FORTHCOMING INQUIRIES.

JANUARY.

	£
6.—**Harrogate.** For street works and the erection of a shelter (Mr. R. H. Bicknell)	5,605
7.—**Ashington.** For road improvement purposes (Mr. M. K. North)	4,000
7.—**Bradford.** For works of paving (Mr. F. H. Tulloch)	13,931
7.—**Dorchester.** For works of sewage disposal (Mr. R. G. Hetherington)	3,500
7.—**Farnham.** For street improvement purposes (Mr. W. O. E. Meade-King) ...	353
7.—**Sheffield.** For the provision of bowling greens (Mr. R. H. Bicknell)	900
7.—**Ystradgynlais.** For the purposes of sewage disposal and water supply (Mr. P. M. Crosthwaite)	33,169
8.—**Blyth.** For the purchase of land for a town hall (Mr. M. K. North)	5,000
8.—**Darlington.** For open spaces, roads, and water supply purposes (Mr. M. K. North)	21,953
8.—**Enfield.** For works of storm-water drainage (Major J. Stewart)	7,365
8.—**Isle of Wight.** For the purchase of the esplanade (Mr. R. G. Hetherington) ...	500
8.—**Penrith.** For works of water supply (Mr. A. A. G. Malet)	1,730
8.—**Pontardawe.** For the purposes of bridge construction (Mr. P. M. Crosthwaite) ...	1,525
8.—**Ystradgynlais.** For the reconstruction of bridges (Mr. P. M. Crosthwaite)	1,875
9.—**Bromley.** For private street works (Major J. Stewart)	3,167
9.—**Cowbridge.** For the provision of a cemetery and water supply purposes (Mr. P. M. Crosthwaite)	1,810
9.—**Handforth.** For works of sewage disposal (Mr. A. A. G. Malet)	—
10.—**Ashby-de-la-Zouch.** For works of sewage disposal (Mr. A. A. G. Malet)	4,875
10.—**Cowbridge.** For works of sewage disposal (Mr. P. M. Crosthwaite)	1,360
10.—**Leyton.** For works of sewerage (Major J. Stewart)	865
10.—**Woking.** For bridge reconstruction (Mr. R. G. Hetherington)	1,337

Deal Pavilion.—Deal Corporation have passed a scheme for building a pavilion, at an estimated cost of £8,673.

Municipal Work in Progress and Projected.

The Editor invites the co-operation of SURVEYOR *readers with a view to making information given under this head as complete and accurate as possible.*

The following are among the more important projected works of which particulars appear below: Buildings—Grimsby, Sevenoaks £7,000, Wandsworth, Wood Green £4,500; housing and town planning—Colne; refuse collection and disposal—Tenby; roads and materials—Bradford, Exeter, Plymouth £10,000; sewerage and sewage disposal—Alsager, Exeter, Worsley £40,000; water, gas and electricity—Basingstoke £12,590, Birmingham, Lexden £7,000, Newport—Particulars of other works projected will be found in our "Local Government Board Inquiries" page.

BUILDINGS.

Coatbridge T.C.—The cart shed at the council's stables is to be enlarged at an estimated cost of £480.

Derby T.C.—A shelter is to be erected in the recreation ground, at a cost of £120.

Exeter T.C.—The formal approval of the Local Government Board has been received to the acquisition of St. Nicholas Priory, and the application of the proceeds of the sale of corporate property in Bridge-street (£1,000) to the restoration of this ancient building.

Forehoe R.D.C.—A proposal has been made for the construction of a bridge in Costessey Water-lane, at an estimated cost of £350, and contributions are being sought from the county council and the Costessey Parish Council.

Grimsby T.C.—The Baths Committee have advocated a scheme for erecting public baths on the site of the electricity works.

Hull T.C.—Alterations are to be carried on at the main entrance to the Guildhall, at an estimated cost of £700.

Sevenoaks U.D.C.—The council have accepted the offer of Mr. E. Kraftmeire of £3,000 for public swimming baths as a King Edward memorial.

Staffordshire C.C.—The tender of Mr. Thomas Godwin, of Hanley, at £5,490, has been accepted for the erection of a council school at Leek.

Wandsworth B.C.—It has been referred to the General Purposes Committee to consider the question of erecting suitable municipal buildings in some central position in the borough.

Wood Green U.D.C.—A central fire station and firemen's dwellings are to be erected, at an estimated cost of £4,500.

HOUSING AND TOWN PLANNING.

Colne T.C.—The council last week adopted a town-planning scheme, and the town clerk was instructed to serve notices on the owners, lessees, and occupiers affected. An application will have to be made for the consent of the Local Government Board to the scheme. The area to be developed is on the Barrowford side of the town, and extends to Red lane and Phillip-lane. Ten, fifteen, or twenty houses per acre are suggested.

Newry No. 1 R.D.C.—The Local Government Board have confirmed the scheme for the provision of a further instalment of labourers' dwellings.

Paignton U.D.C.—The surveyor, Mr. C. O. Baines, has been instructed to prepare a plan and scheme showing the area he proposes to include for town planning purposes.

Peterborough T.C.—Plans are in course of preparation for a housing scheme at Walton. It is proposed to build twenty houses at a cost not exceeding £250 per house.

Totnes T.C.—Plans have been prepared of a housing scheme to consist of seventeen workmen's dwellings.

PARKS AND OPEN SPACES.

Belfast T.C.—The Parks Committee have recommended the council to acquire a portion of the ground adjoining Botanic Gardens Park, having a river frontage, for the purpose of the extension of the park.

Dundee T.C.—Sir James Key Caird, manufacturer, of Dundee, has given £15,000 as a New Year gift to provide a public park for Dundee, and a park on the Lochee estate east of the city has been purchased. It is proposed that a section should be laid out as a golf course. The donor is one of the New Year baronets.

Llandudno U.D.C.—It has been agreed to accept two schemes for the laying out of the Happy Valley and the Wyddfyd estate. The latter was acquired by purchase a year ago, and the former is presented to the town by Lord Mostyn. A large number of plans and specifications were sent in in competition for the premium of 50 guineas offered by the council, and the premium will be divided between the managers of the Lakeland Nurseries, Windermere (Messrs. H. Pierce and J. B. Walker), and Mr. W. H. Matley, architect and surveyor, of Manchester, whose plans have been considered the best.

York T.C.—The Estates Committee will ask the corporation at their next meeting to apply to the Local Government Board for sanction to borrow £1,765 for laying out the "Glen" land at Heworth, which they have recently acquired. It is proposed to construct a bowling-green 120 ft. by 120 ft., four tennis courts, shelters, to plant and lay out the remainder, and to provide a playground, with swings and sandpits, for young children; while the larger field is to be used for cricket and football. It is also proposed to provide a municipal bowling-green at Holgate, and to lay out a small recreation ground in Nunnery-lane, and to apply for sanction to a loan for the purpose.

REFUSE COLLECTION AND DISPOSAL.

Tenby T.C.—A sub-committee has been appointed to consider the question of establishing a dust destructor.

ROADS AND MATERIALS.

Banff C.C.—A grant of £506 is to be received from the Road Board for strengthening and improving the highway between the burghs of Banff and Macduff.

Bradford T.C.—Answering an inquiry with respect to the proposed new road at Thackley, on the Esholt estate, the chairman of the Sewage Committee stated at the last council meeting that the new thoroughfare would be made 120 ft. wide in a district which at present was agricultural, but which in the future, it was hoped, would become residential, and the committee contemplated making this road into a fine boulevard. As the road approached the works at Strangford it would narrow again to 60 ft.

Bromley T.C.—Improvements are to be carried out at Blackbrook-lane and Barfield-road, at a cost of £4,220.

Cheadle U.D.C.—The tender of Messrs. Gosling & Stafford, at £1,580, has been accepted for works of improvement in Bulkeley-road and New Hey-road.

Exeter T.C.—The estimate of the city surveyor, Mr. T. Moulding, for paving Sidwell-street with hard wood is £5,700, or with sectional blocks £5,900, or soft wood £4,400. The Streets Committee have deferred the matter.

Greenock T.C.—Property to the value of £550 has been purchased in The Vennel with a view to a widening scheme.

Middlesbrough T.C.—The General Purposes Committee recommend improvements in Queen's-road and Clairville-road, at a cost of £2,309.

Newton Abbot R.D.C.—The surveyor, Mr. S. Olver, at the last meeting complained that one of the contractors, in spite of repeated instructions, had failed to carry out his road contract satisfactorily, and he (the surveyor) had been obliged to put men on himself. Mr. Cox thought the complaint might be made in many parts of the district. The drains and watertables were not properly cleaned, and this would have to be divided from the road-mending contracts. The chairman (Mr. H. H. Hammaford) said he had advocated that for years. The surveyor said he had stopped payments to several other contractors, but had not reported them this month. It was decided to write the contractor, the surveyor to superintend the work in the meantime.

Paignton U.D.C.—The Road Board have written stating that they are prepared to make a grant of

£540 towards the estimated cost of widening Totnes-road (£1,630).

Plymouth T.C.—Weston Park-road is to be widened at an estimated cost of £10,000.

Plympton R.D.C.—The tender of Mr. T. Shaddock, at £295, has been accepted for carrying out the Higher Compton-road improvement.

Stoke Newington B.C.—The Road Board have promised a grant of £900 towards the cost of repaving Lord-ship-lane.

Todmorden T.C.—It is proposed to purchase land, at a cost of £675, for the widening of Burnley-road.

Windsor T.C.—It has been agreed to support a suggestion from the Association of Municipal Corporations that an authority should be constituted to decide what ought to be the main roads of the country, and which of these main roads ought to be trunk roads. Also, that the State should contribute towards the cost of the main roads the actual half of the cost of maintenance, and that with regard to the trunk roads special additional grants should be made subject to inspection by the central authority.

SEWERAGE AND SEWAGE DISPOSAL.

Alsager U.D.C. The surveyor, Mr. H. V. Lynam, has submitted estimates of the new sewage disposal works, which have been approved.

Bath T.C.—The tender of Mr. J. Toogood, at £380, has been accepted for the construction of a public convenience at Snow Hill.

Bexley U.D.C.—A report has been prepared with respect to a sewerage scheme for East Wickham, the cost of which is estimated to be £1,965.

Cookham R.D.C.—A storm-water sewer is to be provided, at a cost of £388.

Exeter T.C.—The city surveyor, Mr. T. Moulding, has been instructed to prepare plans and estimates for the conversion of the contact beds at Belle Isle and St. Thomas sewage works into continuous filters, also the construction of storm-water tanks, and for the carrying out of other work recommended by him.

Linlithgow T.C.—Certain improvements are being carried out in the system of sewage purification, as suggested by Mr. F. Wallis Stoddart, of Bristol. The works are on the bacteriological system, and the council are having the distributing plant thoroughly overhauled and brought up to date.

Peterborough R.D.C.—A sum of £900 is to be spent upon sewerage works at Fengate.

Warmley R.D.C. The plans have been approved of the sewerage scheme for Siston, the cost of which is estimated at £40,000.

WATER, GAS, AND ELECTRICITY.

Aberdeen T.C.—On the recommendation of Dr. Houston, of the Metropolitan Water Board (London), the Water Committee have decided to make an experiment in the purifying of the Dee water by the addition of lime to the supply. Dr. Houston was of opinion that this would be a satisfactory way of dealing with the water. The scheme will be comparatively inexpensive, and if it proves successful Dr. Houston believes that filtration will not be necessary, so that a large amount of money will be saved in capital cost.

Alsager U.D.C.—Mr. F. W. Stocks, of Middlewich, has been appointed engineer in connection with the proposed water scheme, for which the necessary land has been purchased.

Barry U.D.C.—The seal has been affixed to the supplementary agreement with the Merthyr Corporation for an augmented water supply.

Basingstoke T.C.—The council have decided to adopt the plans of the borough engineer, Mr. F. R. Phipps, for an electricity undertaking, at an estimated cost of £12,590.

Birmingham T.C.—Next week the Electric Supply Committee, accompanied by their engineer and secretary, will visit London, Newcastle-on-Tyne, Glasgow and Liverpool to inspect the most modern power stations before finally deciding upon the details of the equipment of the new Nechells depot, the erection of which was resolved upon three weeks ago. The scheme provides for the construction of a new electricity generating station on the land acquired from the Drainage Board at Nechells. The intention is eventually to erect buildings and plant for the production of 100,000 kilowatts.

Dunoon T.C.—The council have accepted the tender of Messrs. Balfour & Co., Leven, Fife, for the erection of a gasometer, including foundations, at a cost of £4,160, the gasometer to have a holding capacity of 250,000 cub. ft. This is the first instalment of a scheme approved by the council for the reconstruction of the gas-making plant of the burgh, which has been rendered necessary by the increased consumption and also from the fact that the council now undertake the lighting of Sandbank and Innellan.

Edinburgh T.C.—The annual report of the inspector of cleaning and lighting, Mr. G. A. D. Mackay, states that the nett expenditure on cleaning for the year amounted to £58,479, against £56,542. The cost per head was 3s. 7½d., and the cost per £1 on assessable rental 4½d. At May last there were 11,699 electric and incandescent gas lamps under the control of the lighting department. There are 1,248 arc lamps, at an annual cost per lamp of £10. The system of lighting the better class tenement stairs with electricity has been greatly extended during the past few years, and there are now 378 stairs in which that illuminant is used. The nett expenditure of the department for the year has been £44,109, against £44,329 last year. The cost per head was 2s. 9d., and the cost per £1 on assessable rental 3¾d. The value of the lighting plant at May was £19,361.

Fifeshire C.C.—Conditional upon obtaining Parliamentary powers for drawing a new supply of water from the head waters of the Devon, the Dunfermline District Committee have entered into an agreement with the Cowdenbeath Town Council to sell the Loch Glow waterworks to the council for £10,500.

Glasgow T.C.—The Electricity Committee have authorised the electrical engineer, Mr. W. W. Lockie, to prepare specifications for the necessary boilers, condensing plant, and accessories for new electricity generating plant. The Secretary for Scotland has given his consent to the borrowing by the corporation of a further sum of £500,000 for the execution of capital works in connection with the electricity department, raising the total sum authorised to be borrowed for that purpose to £2,500,000.

Glyncorrwg U.D.C. The surveyor, Mr. W. P. Jones, has been asked to prepare plans for an extension of the gasworks.

Greenock T.C.—It has been agreed to accept the offer of the Westinghouse Company for 5,000-kilowatt plant, subject to them providing a condenser of 7,250 square feet area. The new machinery will involve an expenditure of over £12,000.

Holywell U.D.C.—Lady Mostyn of Talacre, as chief riparian owner, has signed a deed granting permission to the council to take from St. Winifride's stream the water necessary for the town's supply, which is provided by the effluent from St. Winifride's Well. The spring is considerably below the level of the town, and the water will therefore have to be pumped up to a service reservoir above the town in the Penyball district.

Lexden and Winstree R.D.C. Consideration is being given to a water supply scheme for Abberton, estimated to cost £7,000.

Maidstone T.C.—A recommendation has been adopted by the Electricity Committee for the provision of a new reciprocating engine at a cost of £5,260, and the extension of the engine-house, at a cost of £500.

Newport T.C.—Mr. Baldwin Latham has received instructions to prepare a report with respect to an additional reservoir at Ynys-y-Fro.

Newton R.D.C.—Negotiations are in progress for the construction of a new reservoir at Denbury.

Shipley U.D.C.—New condensing plant is to be provided at the gasworks, at a cost of £1,200.

Sleaford R.D.C. The council have under consideration a scheme for extending the water mains at Heckington for several miles into the fens, to supply the odd cottages and farms at an estimated cost of £1,800.

Wilton R.D.C. The water mains are to be extended to Quidhampton, at a cost of £475.

MISCELLANEOUS.

Wimbledon T.C.—The first of the two motor fire engines to be bought by the council was delivered last week by the makers, Messrs. Dennis Brothers, of Guildford. The engine is of 65-horse power of the four-cylinder type, and fitted with waterproof magneto and coil ignition. It is the latest Dennis pattern.

with worm drive specially designed for hilly districts. The pump is of the turbine type, capable of delivering 450 gallons of water per minute at 140 lb. pressure. It can be worked direct from the hydrant or by suction in the usual way. The engine carries first-aid apparatus and a 50-ft. sliding carriage escape and an extra 10-ft. length. The delivery hose extends to 1,000 ft., and there is a smoke helmet as well as all other apparatus for saving life at fires. The lamps are lit by electricity supplied from the dynamo, driven off the engine, and when this is at rest the light is maintained by accumulators. A speed of 35 miles an hour can be attained on ordinary roads and 8 miles an hour with full load on a gradient of 1 in 6. The engine has four speeds, forward and reverse, is gate-controlled, and has ball bearings throughout.

PERSONAL.

Mr. J. L. Peacock, at present in the service of the local authority, has been appointed surveyor to the Newtownards Urban District Council, at a salary of £150 a year.

Mr. John Simmonds has resigned his appointments as surveyor and inspector of nuisances to the Eton Urban District Council, owing, we regret to state, to failing health.

Mr. J. L. West, chief assistant to the Berks county surveyor, Mr. J. F. Hawkins, has been appointed surveyor for the West District of East Sussex, not Essex as previously reported.

Mr. C. T. Chadwick, assistant borough surveyor of Maidenhead, has been granted £5 by the Maidenhead Corporation for special services in connection with the laying of a 24-in. and 18-in. storm-water sewer at Maidenhead.

Mr. Arthur N. Johnson, M.AM.SOC.C.E., State highway engineer of Illinois, on December 13th delivered an illustrated lecture on "Cement-Concrete Highway Bridges" before the graduate students in highway engineering at Columbia University.

Mr. Strathen Boulnois, of St. Anne's Cottage, Chertsey, sole surviving brother of Mr. H. Percy Boulnois, M.INST.C.E., died, we regret to state, at Exmouth on December 27th, at the age of seventy-six, after only three days' illness, the cause of death being heart failure.

Mr. Francis P. Smith, M.AM.SOC.C.E., chemical and consulting paving engineer, New York City, on December 20th delivered an illustrated lecture on "The Mining and Refining of Asphaltic Oils," before the Graduate Students in Highway Engineering at Columbia University.

Mr. Harold G. Cordon, Duffield, assistant surveyor and clerk of works to the Belper Rural District Council, has been appointed chief assistant to the Blackwell Rural District Council, and takes up his duties in a month's time. The Belper Rural District Council accepted his resignation with regret, and resolved that a testimonial should be granted him.

Mr. Ewart G. Culpin, secretary of the Garden Cities and Town Planning Association, has accepted an invitation from several organisations in America interested in social and civic improvement, to undertake a lecture tour. Mr. Culpin will sail on the 8th inst., and in the next two months will deliver a course of lectures at some of the principal cities in the United States, as well as at several of the Universities.

Concrete Institute.—At a meeting of this body to be held at Denison House, Westminster, on Thursday next, Mr. W. Valentine Ball, barrister-at-law, will read a paper entitled "Concrete in its Legal Aspect." The chair will be taken at 7.30 p.m.

Sewerage and Refuse Disposal at Southend-on-Sea. The Mayor of Southend-on-Sea on Friday last laid the foundation-stone of a dust destructor which is being erected at Prittlewell in connection with a new scheme of sewerage estimated to cost £200,000 and to make provision for a population of 100,000. The work will be completed early in 1914.

Trolley Omnibuses for Ramsbottom.—The town of Ramsbottom is to be provided with a system of trolley omnibuses on a route from Holcombe Brook to Edenfield, a distance of about 3¼ miles. The urban district council have accepted the tender of Messrs. Stewarts & Lloyds for the supply of the standards and fittings required for the overhead equipment.

FOR OTHER ADVERTISEMENTS

See End of Paper.

BOROUGH OF ILKESTON.

ILKESTON SEWERAGE.

CONTRACT No. 2.

The Mayor and Corporation of the Borough of Ilkeston invite Tenders for the Provision, Laying and Jointing of about—

1,260	lin. yds.	of 30-in.	Cast-Iron Pipe Sewers,
1,180	,, ,,	27-in.	Concrete Tube Sewers,
1,050	,, ,,	24-in.	,, ,, ,,
1,650	,, ,,	18-in.	Stoneware Pipe Sewers,
3,100	,, ,,	15-in.	,, ,, ,,
3,500	,, ,,	12-in.	,, ,, ,,
4,050	,, ,,	9-in.	,, ,, ,,
300	,, ,,	24-in., 18-in., 15-in. and 12-in.	Cast-Iron Pipe Sewers,

together with the Construction of Manholes and Flushing Chambers; the Construction of an Engine-house at Botany Bay, the Provision, Laying and Jointing of 8-in., 6-in., 5-in. and 4-in. Cast-iron Rising Mains, together with various alterations to the existing Pumping Stations and other Works at Botany Bay, Potters Lock and Gallows Inn, in accordance with the Drawings and Specification prepared by the Engineers.

Drawings and Specification may be seen, and Bills of Quantities with Form of Tender obtained, from the Offices of the Engineers, Messrs. Willcox & Raikes, 63 Temple-row, Birmingham, on or after the 6th day of January, 1913, on payment of a deposit of Five Guineas, which will be refunded on receipt of a *bonâ-fide* Tender and return of all documents to the Engineers.

Copies of the Drawings and Specification may also be seen at Ilkeston on application to Mr. F. W. Wright, Resident Engineer's Office, Sewage Disposal Works, Ilkeston.

Sealed Tenders, in envelopes supplied, and endorsed "Ilkeston Sewerage—Contract No. 2," to be delivered at my Office not later than twelve o'clock noon on the 1st day of February, 1913.

The Corporation do not bind themselves to accept the lowest or any Tender.

(By order)

S. F. JAMES,
Town Clerk.

Town Hall,
Ilkeston.

ESSEX COUNTY COUNCIL.

HIGHWAYS COMMITTEE.

The Essex County Council are prepared to receive Tenders for the year ending 31st March, 1914, for the Supply of Norway Granite Kerb and Setts.

Forms of Tender, and the special envelope in which the Tenders are to be delivered, and all other information and particulars can be obtained at the County Surveyor's Office at Chelmsford.

Tenders to be delivered on or before Saturday, the 25th day of January, 1913.

PERCY J. SHELDON, M.INST.C.E.,
County Surveyor.

Office of the County Surveyor,
Chelmsford.
January 1, 1913.

WANTED—Offers for "Proceedings" of the Institute of Civil Engineers, vols. 91 to 188, inclusive; perfect condition; binding as issued.—Box 1,210, office of THE SURVEYOR, 24 Bride-lane, Fleet-street, E.C.

"SEWAGE DISPOSAL WORKS: Their Design and Construction." By W. C. Easdale, M.S.E., M.R.SAN.I., author of "The Practical Management of Sewage Disposal Works."

Detailed calculations based on recommendations of Royal Commission. The whole subject dealt with from an engineering point of view. Many different types of construction described and illustrated. All existing types of apparatus and special systems described. Over 150 illustrations. Price 10s. 6d. nett; post free 10s. 10d.—St. Bride's Press, Limited, 24 Bride-lane, Fleet-street, London, E.C.

INSTITUTION OF MUNICIPAL AND COUNTY ENGINEERS.

SCOTTISH DISTRICT MEETING AT FALKIRK.

Mr. John Bryce, vice-president, occupied the chair at a meeting of the Institution of Municipal and County Engineers held at Falkirk on the 21st ult. The members to the number of thirty-one were welcomed to the town by Bailie J. G. Russell, Convener of the Roads, Streets and Buildings Committee.

The chairman explained that the meeting had been called for the purpose of considering the formation of three committees -viz., a Roads Committee, a Housing and Town Planning Committee, and a General Purposes Committee.

Mr. J. Walker Smith moved and Mr. William Ballantine seconded that these committees be appointed.

ROADS COMMITTEE.

With regard to the Roads Committee the chairman stated that it would collect and tabulate reliable scientific data as to improved methods of road formation, and particularly information as to the effect of climatic conditions taken in conjunction with traffic returns on experimental road lengths laid down in districts in Scotland having distinctive climatological conditions.

The following were elected members of the committee: Messrs. J. Walker Smith, Local Government Board, Edinburgh; Allan Stevenson, county road surveyor, Ayr; David Ronald, burgh engineer, Falkirk; G. Donaldson, county surveyor, Kirkcaldy district, Fife County Council; A. H. Gould e, burgh engineer, Stirling; J. Robb, county surveyor, Midlothian; Thomas Aitken, county surveyor, Cupar Fife; A. A. Turiff, burgh surveyor, Elgin; James Lee, burgh engineer, Paisley.

HOUSING AND TOWN PLANNING COMMITTEE.

The following were elected members of this committee -viz., Messrs. John Bryce, vice-president; James Thomson, city engineer, Dundee; A. H. Campbell, city engineer, Edinburgh; John Young, burgh engineer, Ayr; P. C. Smith, burgh engineer, Arbroath; J. E. Wilkes, town planning engineer, Dunfermline; J. L. Lumsden, burgh engineer, Kirkcaldy; F. G. Holmes, burgh engineer, Govan.

The committee were empowered to add another to their number to bring the committee up to nine members.

GENERAL PURPOSES COMMITTEE.

The following were elected members of the General Purposes Committee—viz., Messrs. F. G. Holmes, burgh engineer, Govan; A. H. Campbell, city engineer, Edinburgh; John Bryce, vice-president; John Young, burgh engineer, Ayr; W. L. Gibson, county surveyor, Western District, Perth County Council; William Ballantine, county surveyor, Eastern District, Stirling County Council; A. Forbes, county surveyor, Dunfermline District, Fife County Council; W. Forbes, chief engineering assistant, Edinburgh; Charles Massie, water engineer, Falkirk; A. Stevenson, county road surveyor, Ayr; W. Watson, burgh surveyor, St. Andrews; David Ronald, burgh engineer, Falkirk; A. W. Allison, burgh surveyor, Crieff.

The committee were empowered to deal with all technical matters pertaining to the work of the institution which do not fall under the Roads and Housing and Town Planning Committees, but not with any matter which would interfere with the present working of the business affairs of the Scottish District of the institution.

APPOINTMENT OF CONVENER, SECRETARY AND COMMITTEE SECRETARY.

It was agreed that these committees should be called together as early as possible, and that each committee elect its convener. It was also agreed that Mr. Ronald should act as secretary to these committees, and that each committee should elect a committee secretary who would act under the direction of the district secretary.

The secretary was instructed to circularise the town and county councils whose officials had been elected members of the foregoing committees, pointing out the work which the Scottish District had undertaken, the general status of the institution, the advantages which will accrue to local authorities by supporting the work of the institution, and requesting local authorities to defray the expenses of their officers attending committee meetings.

DAY OF MEETING.

The question of holding meetings on Saturday afternoon was discussed, and it was agreed, considering that practically only one meeting throughout the year was held on a Saturday, not to alter the day of meeting. It was arranged, however, that the committee meetings should be held on Friday afternoons, and that the first meetings should be held in Edinburgh.

The members were afterwards entertained to tea provided by the Corporation of Falkirk.

PNEUMATIC TAMPING MACHINE FOR STREET PAVING WORK.

An extraordinary vehicle recently appeared on the streets of Berlin. Resembling a railroad freight car, it rumbled along the pavements on wooden wheels with wide steel tyres, and few of the passers-by could imagine for what purpose it was intended. It stopped at a corner where paving was being done, and there it resolved itself into a combination motor truck and pneumatic tamping machine, specially designed for street paving with Belgian blocks.

The motor is an 18-horse power benzol motor, which drives the truck itself and also a compressed-air apparatus for the use of the pneumatic tamping tools. Instead of lifting and dropping the heavy old mauls by hand at the rate of about fifteen a minute, the workmen place the pneumatic tampers on the stone and the motor "does the rest." It delivers ninety blows per minute under pressure of six atmospheres.

PNEUMATIC TAMPERS AT WORK.

and enables one man to tamp 130 sq. yds. in a day of eight hours. By hand the same man could only accomplish about 30 sq. yds. The use of the motor-driven apparatus has also had an unexpected influence on the wages of the workmen. While formerly it was necessary to choose men of superior physique and great endurance and to pay them high wages, it is now possible to use any ordinarily built man to handle the pneumatic machines. The work is comparatively easy, and naturally the wages paid are smaller, despite the fact that each accomplishes four times the amount of work that the more powerful man formerly could perform.

The entire truck is surrounded by a heavy wooden "box" which can be locked and left at the place of street repairs, without necessitating the employment of a watchman to keep guard over it. The compressor can supply air to three to eight men, while the truck pulls a trailer filled with stone blocks, sand and other materials needed in the work.—Theodore M. R. von Kéler, in *Scientific American*.

Society of Engineers: Status Prize.—The council of the Society of Engineers (Incorporated) may award in 1913 a premium of books or instruments to the value of £10 10s. for an approved essay on "A Scheme for the registration of Engineers, including particulars concerning the Registration of Engineers in British Colonies and Foreign Countries." The council reserve the right to withhold the premium if the essays received are not of a sufficient standard of merit. The competition is open to all, but, before entering, application for detailed particulars should be made to the secretary, 17 Victoria-street, Westminster. The last date for receiving essays is May 31, 1913.

SOME RECENT PUBLICATIONS.*

Estimating for Reinforced-Concrete Work. By Major T. E. Coleman. Price 4s. nett. London: B. T. Batsford.

This volume is designed to assist engineers and architects in the preparation of estimates and bills of quantities for reinforced-concrete works. The various notes and data which are ordinarily required for this purpose have here been brought together in a convenient form so as to provide a practical handbook for ready reference.

Full details of the procedure to be adopted in taking off quantities for reinforced-concrete buildings, bridges, retaining walls, piles, and so forth are given, including the mode of measuring all the various items of materials and workmanship. In addition, a comprehensive series of typical items and descriptions for reinforced concrete are systematically grouped for guidance and reference in preparing bills of quantities.

The prices for concretes, reinforcement, &c., are based on the average cost of materials and labour in the London district. A new feature has been introduced into this price-book, inasmuch as the prime cost basis adopted for the respective materials used in each class of concrete is clearly indicated in brackets immediately after the general description of the concrete, so that any adjustments which may be required to suit varying local conditions can be easily made. A complete range of prices for concretes in varying proportions, and based on the same general prime cost value of materials, are available for estimating purposes.

Many useful notes respecting concrete materials and workmanship are also given. Such information will be found especially valuable to those who are engaged in the superintendence and execution of reinforced-concrete work. Engineers, architects and estimating clerks will find in this book all the information necessary to enable them to estimate accurately for reinforced-concrete work.

The Art and Craft of Garden Making. Fourth Edition. By Thomas H. Mawson. Price £2 10s. nett. London: B. T. Batsford.

The fourth edition of this standard work, which has met with such generous recognition from architects, garden designers, and owners of gardens both in this country and on the Continent and in America, is now reissued in a thoroughly revised form. In previous editions the author—who, as is well known, is lecturer on landscape design at the University of Liverpool—has been compelled to rely on drawings to illustrate the matured effect of his designs, but now, after more than twenty-five years' practice, he is able to demonstrate the results of most of the principles described and the methods advocated by photographic views, thus adding enormously to the practical usefulness of the book to all those who have gardens to lay out or to maintain. After dealing very briefly, in the first two chapters, with the history and present position of garden design in this country, the various practical details of garden formation are taken up and described from the choice of the site and its general sub-division down to the finishing touches such as statuary and garden furniture. Technical terms are avoided, and the whole of the matter so written as to be equally serviceable to the landscape architect in general practice or the amateur. The examples of garden design which include the volume have been thoroughly revised and brought up to date, and descriptions of several new and exceptionally interesting gardens added. The chapters dealing with planting have been improved and revised, and, it is hoped, will form a still greater aid to the planter in the selection of suitable varieties of trees, shrubs, climbers and hardy perennials wherewith to stock his garden.

The Law of Extraordinary Traffic on Highways. In eight parts. By Barnard Lailey, Barrister-at-Law, of the Middle Temple and South-Eastern Circuit. Price 7s. 6d. nett. London: Sweet & Maxwell, Limited.

Perhaps no branch of highway law has presented more problems to be solved by the courts than that of extraordinary traffic. The difficulties of the questions involved are, indeed, reflected in the mass of decisions, not always easily reconcilable one with the other. In this little volume these decisions are considered and compared, and the principles which may be gathered from them concisely summarised, occasional extracts being given verbatim from important judgments, and material enactments being set out in full. The first chapter deals with the meaning of the expressions "excessive weight" and "extraordinary traffic," and the remaining seven chapters treat of the recovery of the expenses, showing by whom and from whom and before what tribunal they are recoverable, the preliminaries to and time for taking proceedings, the amount recoverable, &c. Not least important from a practical point of view is the last chapter, which shows the nature of the evidence with which litigants on either side should be prepared in pursuing or (as the case may be) resisting a claim for alleged extraordinary traffic expenses. We can thoroughly recommend the work to highway surveyors and others having to advise on or deal practically with this important subject.

Books that Count. Edited by W. Forbes Gray. Price 5s. nett. London: A. & C. Black.

This work comprises a dictionary of standard books, classified under fourteen headings. It is intended primarily to help the ordinary reader and the young student quickly to ascertain the scope of the most notable books on the various subjects. Thus, there is attached to the reference to each book a brief note indicating its authority, method and scope. Some 5,500 volumes are dealt with in this way, and indexes of authors and titles complete a very useful survey of standard literature. In these days of the making of many books such a guide as this should be appreciated by a wide public.

Australia To-day. (Melbourne: The United Commercial Travellers' Association of Australasia, Limited, price 1s. 6d.) A sumptuous production which reaches us from "the other side." It is an album of the most beautiful illustrations, showing the attractions of all kinds of "the centre of the world's coming markets," where there is "room for 50,000,000 energetic white settlers."

DIARIES AND CALENDARS.

Walker's Diaries. Messrs. John Walker & Co., Farringdon House, Warwick-lane, E.C., issue a series of 1913 diaries which have a distinct individuality of their own, and in arrangement and daintiness of design are perfect enough to suit the most fastidious. Perhaps their best-known special feature is their incorporation of the loose-leaf system, which admits of any number of new pages being substituted for used pages, which can then be destroyed or, if containing notes of permanent value, filed in a transfer case. As a few instances from a list calculated to meet all needs and purses we mention the week-at-an-opening diaries, No. 101 (price 9d.), or with back-loop pencil 1s. 6d., both bound in long grain roan, and similar ones in solid pigskin at 1s. or 1s. 3d., and a day-to-page one (No. 804) in solid pigskin, gilt-edged (price 3s. 6d.), which would make a most handsome as well as useful gift at this season. As a desirable calendar for desk or wall—a block with tear-off dates, showing each day in bold, coloured figures—we cordially commend "The Imperial," price 1s. 9d.

The Adamant Stone and Paving Company, Limited, of Palace Chambers, Bridge-street, Westminster, S.W., are good enough to send us a pocket diary for 1913, enclosed in a leather case with pockets. Not the least noticeable feature of it is the self-denying ordinance which the company have imposed upon themselves in suppressing therein anything like an advertisement of their manufactures. It is quite unobtrusively mentioned only on one page—just sufficiently to associate the diary with its donors. Their works are at Dancing Cairn Quarries, Bucksburn, Aberdeen, and they say that "reconstructed Aberdeen granite may truthfully be said to have come to stay!" We would rather have said that it has come—and stayed! It was laid twenty-five years ago near the Aberdeen fish market, and frequently the winter ice has been dislodged from it by means of crowbars. Yet it shows no perceptible sign of wear at this day!

The Penlee and St. Ives Stone Quarries, Limited, of 67 Queen-square, Bristol, send us, as usual, their calendar desk pad for 1913, a general and most acceptable gift which we find of daily use. It is a roomy pad of blotting sheets, with, attached to the top, a diary for memoranda for each day of the year, showing a week's dates at an opening. Nothing could be more practicable for desk use.

* Any of the publications reviewed, or referred to as received, will be forwarded by the St. Bride's Press, Ltd., on receipt of published price.

REFUSE REMOVAL AT BRADFORD.

CHANGE OF SYSTEM.

Mr. Ernest Call, superintendent, cleansing and destructors department, Hammerton-street, Bradford, writes: "Owing to a change in our system of removal of household refuse from night work to day work, the Cleansing Committee of the Bradford Corporation are anxious to meet with suitable vehicles, both two-wheeled and four-wheeled, for this work. The minimum lightness compatible with strength is required. I should be obliged if you could put a paragraph in your paper regarding the above, which would no doubt come before the notice of many constructors of these vehicles. Illustrations and full particulars should be sent to me at the above address."

INSTITUTION OF MUNICIPAL AND COUNTY ENGINEERS.

President—Mr. R. J. THOMAS, M.INST.C.E., County Surveyor, Buckinghamshire.

SOUTH-EASTERN DISTRICT.

A meeting of members of the above district will take place at Sidcup at 2.30 p.m. on Wednesday, January 8th, when the road sections will be inspected.

Mr. Maybury has kindly consented to supply the revised cost of the trial lengths up to December 31st; the meeting will be followed by a dinner at Frascati's Restaurant, Oxford-street, at 6.30 p.m.

SOUTH WALES DISTRICT MEETING.

District Chairman—Mr. W. HARPUR, M.INST.C.E., Cardiff.

A meeting of the institution will be held in the South Wales District at the Guildhall, Swansea, on Saturday, January 11th next.

PROGRAMME.

11.30 a.m.—Meeting of members of South Wales District at the Guildhall, Swansea, for the purpose of electing a district committee.

12 noon.—General meeting at Guildhall, Swansea, where the members will be received by the mayor. Proceed to Castle-street and inspect street widening and construction of tramways by the corporation and erection of new buildings. Thence to Hotel Cameron.

1 p.m.—Luncheon at Hotel Cameron, High-street (tickets 2s. 6d. each).

2 p.m.—Drive by way of High-street, where tramways recently constructed will be inspected, to destructor (tickets 1s. 6d. each). Inspection of the Pentre Valley, Burlais Brook culvert, the destructor and its recent improvements, the slab-making plant and the houses erected by the corporation.

4 p.m.—Return to Hotel Cameron. Light refreshments provided by the borough surveyor. Discussion on paper entitled "Swansea Tramways, Past, Present and Future," by Mr. G. Swarbrick, deputy borough surveyor (member), and the paper entitled "The Development of the Pentre Valley in Relation to the Destructor," by Mr. G. H. Bell, assistant borough surveyor (Assoc. Member).

Papers will be taken as read.

In order that the necessary arrangements may be made, members must give notice of their intention to be present not later than to-morrow (Saturday), when copy of the papers will be sent in due course.

H. ALEX. CLARKE,
Hon. District Secretary.

Council Offices,
Briton Ferry,

NORTH-EASTERN DISTRICT.

A meeting of the institution will be held in the North-Eastern District at Newcastle-on-Tyne on May 2nd and 3rd next.

Notice is hereby given that, under the provisions of by-law 14, nominations for the council of 1913-14 must be received by me not later than February 1, 1913.

Each member or Associate member of the institution is entitled to nominate one member or associate member for the council. Nominations must be accompanied by the consent of the nominee.

SOUTHERN DISTRICT MEETING.

A meeting of the Southern District will be held at Southampton on Saturday, February 22nd next.

THOMAS COLE,
11 Victoria-street, S.W. *Secretary.*

LOWER THAMES VALLEY DISTRICT SURVEYORS' ASSOCIATION.

President—Mr. HAROLD F. COALES, ASSOC.M.INST.C.E., Engineer and Surveyor, Sunbury-on-Thames.

The usual monthly meeting of this association will be held at the town hall, Twickenham, to-morrow (Saturday), at 6.30, when there will be a further discussion upon Mr. E. Willis's paper, "Notes upon the Effect of Intercepting Traps in House Drainage" [THE SURVEYOR, December 13th], and the question as to the availability for use by other persons and authorities of fire hydrants provided and maintained by local authorities will again receive consideration.

Members are requested to make a special endeavour to be present on this occasion.

APPOINTMENTS VACANT.

Official and similar advertisements received up to 4.30 p.m. on Thursdays will be inserted in the following day's issue, *but those responsible for their despatch are recommended to arrange that they shall reach* **THE SURVEYOR** *office by noon on* **Wednesdays** *to ensure their inclusion in the weekly list of summaries. Such advertisements may, in cases of emergency only, be telephoned (No. 1359 Holborn), subject to later confirmation by letter.*

SURVEYOR.—January 11th.—To take charge of construction of sewage disposal works, for the Chesterfield Rural District Council.—Mr. R. F. Hartwright, clerk.

ROAD SURVEYOR.—January 11th. Inverness-shire County Council. £200 per annum.—Mr. W. Mackay, district clerk, 19 Union-street, Inverness.

HIGHWAY SURVEYOR.—January 17th.—Dulverton Rural District Council. £130 per annum.—Mr. R. Sowton Barrow, clerk.

BRIDGE AND ROAD SURVEYOR.—January 18th.—Devon County Council. £400 per annum.—Mr. F. Bailey, clerk, The Castle, Exeter.

ROAD FOREMAN.—January 20th.—Stourbridge Urban District Council. 35s. per week, with house. Mr. Fredk. Woodward, surveyor.

SANITARY INSPECTOR.—January 23rd.—Islington Borough Council. £148—£184.—Mr. W. F. Dewey, town clerk.

MUNICIPAL COMPETITIONS OPEN.

Official and similar advertisements received up to 4.30 p.m. on Thursdays will be inserted in the following day's issue, *but those responsible for their despatch are recommended to arrange that they shall reach* **THE SURVEYOR** *office by noon on* **Wednesdays** *to ensure their inclusion in the weekly list of summaries. Such advertisements may, in cases of emergency only, be telephoned (No. 1359 Holborn), subject to later confirmation by letter.*

SWAFFHAM.—January 25th.—Plans, specifications and estimates for workmen's dwellings, for the rural district council. A premium of £10 is offered to the selected plan.—Mr. Sydney Matthews, clerk.

JAMAICA.—January 31st.—Plans for municipal buildings to cost £9,000. A premium of £100 is offered. Messrs. Young, Limited, 60 Fenchurch-street, London, E.C.

HEMEL HEMPSTED.—January 31st.—Design for a housing scheme, comprising twenty-five houses, for the town council.—Mr. A. E. Usher, town clerk.

HARROGATE.—February 3rd.—Designs for a council school, for 675 children.—Mr. C. E. Rivers, ASSOC.M. INST.C.E., borough engineer.

DUBLIN.—February 6th.—Designs for municipal buildings for the corporation. The proposed expenditure is £50,000, and the author of the design placed first will be appointed to carry out the scheme on a 5 per cent basis. Premiums of £150 and £100 are offered. The assessor is Mr. Albert E. Murray, F.R.I.B.A —The Town Clerk.

RANGOON.—March 1st.—Designs for municipal buildings. Premiums are offered of £300, £200, and £100.—The Clerk to the Rangoon Municipality.

WINNIPEG.—March 1st.—Designs for city hall. Limited to British architects in Canada. Premiums are offered of 5,000 dols., 3,000 dols., and 2,000 dols.—The Clerk.

MUNICIPAL CONTRACTS OPEN.

Official and similar advertisements received up to 4.30 p.m. on Thursdays will be inserted in the following day's issue, *but these responsible for their despatch are recommended to arrange that they shall reach* THE SURVEYOR *office by noon on* **Wednesdays** *to ensure their inclusion in the weekly list of summaries. Such advertisements may, in cases of emergency only, be telephoned (No. 1569 Holborn), subject to later confirmation by letter.*

Buildings.

CHATHAM.—January 4th.—For the erection of a school, for the Education Committee.—Mr. G. F. Bond, High-street, Rochester.

SOUTHAMPTON.—January 4th.—For the execution of alterations in Oxford-avenue, including the erection of boundary walls and laying tar paving, for the corporation.—Mr. R. R. Linthorne, town clerk

HINCKLEY.—January 4th.—For the erection of brick chimney shaft, for the urban district council.—Mr. E. H. Crump, engineer and surveyor.

STANLEY.—January 6th.—For building a brick culvert, for the urban district council.—Mr. A. Routledge, surveyor.

GLASGOW.—January 7th.—For the erection of new dining hall at Coplawhill, Albert-road, for the corporation.—Mr. J. Lindsay, town clerk.

MANCHESTER.—January 8th.—For reinforced concrete work, for the corporation.—Mr. Thos. Hudson, town clerk.

ANTRIM.—January 9th.—For building caretaker's house and laying out burial ground, for the rural district council.—Mr. J. L. Clark, clerk.

WEST RIDING.—January 10th.—For the erection of a school, for the Education Committee.—Mr. Francis Alvey Darwin, clerk, County Hall, Wakefield.

CORNWALL.—January 11th.—For building a school at Tintagel, for the Education Committee.—Mr. F. R. Parsons, secretary, County Hall, Truro.

PEMBROKE.—January 11th.—For the erection of a school, for the Education Committee.—Mr. H. E. H. Jones, clerk, County Education Offices, Haverfordwest.

ILFORD.—January 11th.—For the erection of a refuse destructor, for the urban district council.—Mr. Adam Partington.

HADLEIGH.—January 11th.—For the erection of eight cottages, for the urban district council.—Mr. C. J. Grimwade, clerk.

HASTINGS.—January 12th.—For building two cottages at the waterworks, for the corporation.—Mr. Ben. F. Meadows, town clerk.

FLINT.—January 14th.—For the erection of an elementary school, for the county council.—Mr. Sam. Evans, county surveyor, County Offices, Mold.

DURHAM.—January 14th.—For the erection of an infants' school, for the county council.—Mr. A. J. Dawson, clerk to the Education Committee, Shire Hall, Durham.

LANCASHIRE.—January 14th.—For the erection of a school, for the Education Committee.—Mr. H. Littler, county architect, 16 Ribblesdale-place, Preston.

HASTINGS.—January 14th.—For the erection of a concrete and rolled steel joist bridge, for the corporation.—Mr. Ben. F. Meadows, town clerk.

MANCHESTER.—January 15th.—For the construction of a public library, for the corporation.—Mr. Thos. Hudson, town clerk.

KIRKCONNEL.—January 15th.—For the erection of a public school, for the School Board.—Mr. R. Wilson, clerk, Sanquhar.

ST. HELENS.—January 21st.—For the erection of a school, for the Education Committee.—Mr. P. Sharp, secretary, 17 Cotham-street, St. Helens.

HARROW-ON-THE-HILL.—January 25th.—For the erection of public offices, for the urban district council.—Mr. J. P. Bennetts, surveyor.

EGYPT.—February 1st.—For the erection of pumping station buildings at Kafr el Gamus, for the Public Works Ministry.—Controller-General, Main Drainage Department, Public Works Ministry, Cairo.

BARNSLEY.—For the extension of the public baths, for the corporation.—Mr. W. P. Donald, town clerk.

Iron and Steel.

NOTTINGHAM.—January 4th.—For the supply of steel rails and fishplates, for the Tramways Committee.—Mr. A. Brown, city engineer, Guildhall.

BLAYDON.—January 7th.—For the supply of oil engines and pumps, for the urban district council.—Mr. Henry Dalton, clerk.

RYE.—January 8th.—For the supply of cast-iron socket pipes and irregulars, for the corporation.—Mr. W. Dawes, town clerk.

SWANSEA.—January 9th.—For the supply of steelwork, for the Harbour Trustees.—Mr. T. Strick, clerk.

MANCHESTER.—January 10th.—For the supply of a mechanical washer of the vertical type at the Bradford-road station, for the Gas Committee.—Mr. Thomas Hudson, town clerk.

CHORLEY.—January 11th.—For the supply of two gas engines and two pumps, loan of portable boiler, and laying water mains, for the rural district council.—Mr. R. E. Aspden, clerk.

MADRAS.—January 22nd.—For the supply of English stoneware pipes and specials, varying from 4 in. to 21 in. internal diameter, and aggregating a length of about 165 miles, for the corporation.—Messrs. James Mansergh & Sons, agents, 5 Victoria-street, Westminster.

ELLESMERE.—January 31st.—For providing and laying 9 000 yds. of 4-in. and 3-in. cast-iron mains, sluice valves, fire hydrants and air valves, for the rural district council.—Mr. H. R. Giles, clerk.

BOMBAY.—February 18.—For supplying and laying about 19 miles of 50-in. diameter steel main, for the municipality.—Mr. H. J. Trivess Smith, hydraulic engineer, Municipal Offices, Bombay.

Roads.

DORSET.—January 4th.—For steam rolling on 458 miles of main roads for three years, for the county council.—Mr. W. Townshend Fletcher, county surveyor, Dorchester.

DORSET.—January 4th.—For the supply of granites, basalts, quartzites, limestones and tar-macadam, for the county council.—Mr. W. Townshend Fletcher, county surveyor, Dorchester.

NORTH RIDING.—January 4th.—For work of steam rolling and scarifying, for the county council.—Mr. W. G. Bryning, county surveyor, County Hall, Northallerton.

BEXHILL.—January 4th.—For making up four roads, for the corporation.—Mr. T. E. Rodgers, town clerk.

HERTS.—February 5th.—For the supply of granite and slag, for the county council.—Mr. A. A. Smith, county surveyor, Hatfield.

SUNBURY-ON-THAMES.—January 6th.—For the supply of 4,000 gallons of refined tar, for the urban district council.—Mr. H. F. Coales, surveyor.

GLANFORD BRIGG.—January 6th.—For the supply of granite and slag, for the rural district council.—Mr. Frank C. Hett, clerk.

KENSINGTON.—January 6th.—For making up certain roads, for the borough council.—Mr. W. Chambers Leete, town clerk.

GLASGOW.—January 6th.—For paving with tar-macadam, for the corporation.—Mr. J. Lindsay, clerk.

EASTHAMPSTEAD.—January 7th.—For the supply of broken or unbroken granite, slag, limestone and flints, for the rural district council.—Mr. C. B. Wilson, clerk.

SWANSEA.—January 7th.—For the execution of private street works, for the corporation.—Mr. H. Lang Coath, town clerk.

PERRY BARR.—January 7th.—For the supply of Rowley rag and blast furnace cinder, for the urban district council. Mr. Ernest Ward, clerk, 20a Temple-street, Birmingham.

PORTSLADE.—January 7th. For the supply of granite, for the urban district council.—Mr. E. H Kemp, clerk.

SWANSEA.—January 7th. For carrying out private street work, for the corporation.—Mr. H. L. Coath, town clerk.

BOSTON.—January 7th. For the supply of granite and slag, for the rural district council.—Mr. H. Snaith, clerk.

BRENTFORD.—January 7th.—For the supply of Kentish flints and granite, for the urban district council.—Mr. J. W. Croxford, surveyor.

EAST GRINSTEAD.—January 8th.—For the supply of 20,000 gallons of tar, prepared in accordance with the Road Board's specification for tar No. 1, for the rural district council.—Mr. Francis S. White, clerk.

KESTEVEN.—January 8th.—For steam-rolling work, for the county council.—Mr. W. B. Purser, county surveyor, Grantham.

BUCKLOW.—January 8th. For making up Oldfield-lane, for the rural district council.—Mr. George Leigh, clerk.

LLANTRISANT AND LLANTWIT.—January 9th.—For making up private streets, for the rural district council.—Mr. Thomas Saunders, surveyor, School-street, Pontyclun.

HARDINGSTONE.—January 10th.—For the supply of granite and slag, for the rural district council. Mr. J. R. Phillips, clerk, 2 St. Giles's-square, Northampton.

LANCASTER.—January 10th.—For the supply of setts, flags, and kerbs, for the corporation.—Mr T. C. Hughes, town clerk.

MIDHURST.—January 11th.—For the supply of granite and tar-macadam, for the rural district council.—Mr. A. G. Gibbs, surveyor.

ANTRIM.—January 11th. For tar treatment and steam rolling in certain roads, for the county council.—Mr. Alexander Millar, deputy-secretary, County Courthouse, Belfast.

BOURNE.—January 11th.—For the supply of granite and slag, for the rural district council.—Mr. T. Lake, district surveyor.

GLOUCESTER.—January 13th.—For the supply of road stone, for the county council.—Mr. S. E. Sinnott, county surveyor, Shire Hall, Gloucester.

MERIDEN.—January 13th.—For carrying out various works in Coleshill-road, for the rural district council.—Mr. A. W. Liggins, clerk.

WOODSTOCK.—January 13th.—For the supply of hand-picked unbroken stone, best broken stone (2-in. gauge), best double-screened nuts (1½-in. gauge), best double-screened coarse chippings and binding chippings, and best rubble, for the rural district council. Mr. A. G. Higgs, clerk.

HENDON.—January 13th.—For making up certain roads, for the urban district council.—Mr. S. S. Grimley, engineer.

GRANTHAM.—January 15th.—For the supply of granite and slag, for the rural district council.—Mr. Aubrey H. Malim, clerk.

HESTON.—January 15th.—For the supply of tar and Tarvia, for the urban district council.—Mr. H. J. Baker, clerk, Council House, Hounslow.

CHELMSFORD.—January 16th.—For carrying out street work, for the corporation.—Mr. G. Melvin, town clerk.

SPILSBY.—January 17th.—For the supply of 5,630 tons of broken granite, 9,500 tons of broken slag, and 450 tons of slag chippings.—Mr. G. Beaumont Walker clerk.

CARLISLE.—January 17th.—For diverting, widening, strengthening, altering gradient, and metalling Blackwell-road, and other work, for the rural district council.—Mr. H. B. Lonsdale, clerk.

WIRRAL.—January 17th.—For making up work, for the rural district council.—Mr. W. H. Churton, clerk to the Highways Committee.

CUCKFIELD.—January 17th.—For the supply of 7,000 tons of broken granite, tarred material, and flints, for the rural district council.—Mr. C. H. Waugh, clerk.

NORFOLK.—January 18th.—For the supply of roadmen's tools and implements, for the county council.—Mr. T. H. B. Heslop, county surveyor.

NORFOLK.—January 18th.—For the supply of granite, for the county council.—Mr. T. H. B. Heslop, county surveyor.

HAILSHAM.—January 18th.—For the supply of granite, stone, flints, beach, and cartage, for the rural district council.—Mr. Edmund Catt, clerk.

ESSEX.—January 18th. For the supply of broken granite, for the county council.—Mr. Percy J. Sheldon, county surveyor, Chelmsford.

SURREY.—January 21st.—For the supply of high-class granites, basalts, limestone, slag, tar-macadam, bitumen, pitch, tar, and tar oils, for the county council.—Mr. A. Dryland, county surveyor.

SCUNTHORPE.—January 29th.—For making up a certain street, for the urban district council.—Mr. W. M. Hett, clerk.

HERTFORDSHIRE.—February 5th.—For the supply of broken granite and slag, for the county council. Mr. Urban A. Smith, county engineer.

GLOUCESTERSHIRE.—For surface tarring about 65 miles of main roads, for the county council.—Mr. E. S. Sinnott, county surveyor.

SOUTHAMPTON.—For the formation of gravelled footway with turf edging and kerb, for the county council.—Mr. H. Barber, clerk, The Castle, Winchester.

Sanitary.

BRANDON AND BYSHOTTLES.—January 4th.—For laying a 9-in. sewer, for the urban district council. Mr. Geo. G. Donkin, surveyor.

CASTLE DONNINGTON.—January 6th.—For the construction of a Dortmund tank new mud beds, and other works at the sewage farm, for the rural district council.—Mr. F. E. Burton, clerk.

STANLEY.—January 6th.—For building a brick culvert, for the urban district council. Mr. John Geo. Ridley, clerk.

CLEETHORPES.—January 6th. For the construction of an underground convenience, for the urban district council.—Mr. C. H. Waithman, engineer and surveyor.

POOLE.—January 7th.—For the erection of public conveniences, for the corporation.—Mr. Samuel J. Newman, borough surveyor.

BUNTINGFORD.—January 8th.—For the construction of a precipitation tank at sewage works, for the rural district council.—Chairman of the Council.

HAMBLEDON.—January 8th.—For laying stoneware pipes and manholes, for the rural district council. Mr. F. F. Smallpiece, clerk.

HALE.—January 8th.—For laying stoneware pipe sewers, for the urban district council. Mr. J. G. Whyatt, clerk.

EASTBOURNE.—January 11th. For additions to sanatorium, for the corporation. Mr. W. C. Field, borough architect.

BERMONDSEY.—January 14th.—For the erection of a public convenience, for the borough council. Mr. F. Ryall, town clerk.

MALDEN AND COOMBE.—January 14th. For supplying and fixing 50 B.H.P. Diesel oil engine, new skylights, engine foundation, general builder's work, 8-in. centrifugal pump, feed pump, shafting and pulleys, belting, and repairs to existing pump at sewage works, for the urban district council.—Mr. James W. Johnson, clerk.

CLEETHORPES-WITH-THRUNSCOE.—January 16th.—For the construction of an underground convenience.—Mr. C. H. Waithman, engineer and surveyor.

LONDON.—January 21st.—For the construction of public conveniences, for the county council.—Sir Maurice Fitzmaurice, County Hall, Spring-gardens.

HOVE.—January 24th.—For the removal of house refuse, for the corporation.—Mr. H. Endacott, town clerk.

PORT SAID.—March 1st.—For the construction of drainage works, for the municipality. Mr. A. L. Webb, C.M.G., Queen Anne's Chambers, Broadway, Westminster.

Stores.

SLOUGH.—January 4th.—For the supply of stoneware pipes, gullies, Portland cement, tar oil, distilled tar, Tarvia and prepared granite or macadam, for the urban district council.—The surveyor.

BARNSLEY.—January 8th.—For the supply of road materials and other articles, for the corporation.—Mr. W. P. Donald, town clerk.

ST. PANCRAS.—January 13th.—For the removal of road sweepings and gulley soil, horsing water vans, horsing road-sweeping and other machines, cartage, supply of timber and joinery materials, creosoted deal blocks, jarrah wood blocks, barrows, truckles, handles, paints, oils, candles, smiths' and founders' works, ironmongery, tools, Yorkshire stone and artificial paving slabs, granite kerbs, paving setts, broken granite, Kentish rag, gravel, bass brooms, tarpaulins, paints and rubber goods, pitch, tar, creosote oil, carbolic powder and coke, for the borough council.—Mr. C. H. F. Barrett, town clerk.

CHISWICK.—January 15th.—For the supply of horses and drivers, oils, motor spirit, drysaltery, ironmongery, disinfectants, cement, Kentish flints, Guernsey granite, granite kerb, channel and setts, York paving, tarred granite and limestone paving, for the urban district council.—Mr. E. Willis, surveyor.

LAMBETH.—January 16th.—For the supply of materials and services, for the borough council.—Mr. H. Edwards, borough engineer.

PLYMOUTH.—January 18th.—For the supply of paints, varnish, ironwork, petroleum oil, broomheads, household brushes, iron, steel, carbolic powder, Portland cement, lubricating oils, tar, pitch, painters' brushes, explosives, soap, wood blocks, creosote, road metal, disinfectant fluid, granite kerbs, setts, white lead, refilling machine revolving brooms, benzoline and motor spirit, tools, india-rubber goods, hose, ship chandlers' goods, for the corporation.—Mr. James Paton, borough engineer and surveyor.

MIDDLESBROUGH.—January 20th.—For the supply of annealed scoriæ (broken rough blocks and blocks), bricks, castings, concrete flags and kerbs, Portland cement, pitch and tar, sanitary pipes, gullies, junctions, slag, tarred whinstone, limestone, granite, timber, granite setts, brushes, bolts, nuts, screws, disinfectants, general stores, glass, hardware, india-rubber goods, iron, steel, leather beltings, oils, paints, varnishes, packings, picks, shovels, shafts, polishes, cleaning materials and ropes, for the corporation.—Mr. S. E. Burgess, borough engineer.

CAMBERWELL.—January 20th.—For the supply of timber, harness, varnishes, brooms, shovels, hire of horses, harness, ragstone, broken granite and asphalt paving work, for the borough council.—Mr. W. Oxtoby, borough engineer.

Miscellaneous.

SKIPTON.—January 9th.—For a creosoted red wood fence 250 yds. in length, for the urban district council. Mr. Richard Wilson, clerk.

POPLAR.—January 20th.—For the supply of iron castings for sewerage and drainage works, stoneware sewer and drain pipes, scavengers' brooms, rotary machine sweeping brushes, paints and varnishes, for the borough council.—Mr. Leonard Potts, town clerk.

TENDERS FOR MUNICIPAL WORKS OR SUPPLIES.

The Editor invites the co-operation of SURVEYOR *readers with a view to making the information given under this head as complete and accurate as possible.*

* Accepted. † Recommended for acceptance.

CHEADLE.—For private street works in Bulkley-road and New Heyroad, for the urban district council:—

Gosling & Stafford, £1,580.

KEIGHLEY.—For extensions at the institute, for the Education Committee:—

E. Turner, mason	£6,150
S. Eccles & Co., (limited), joiners	2,759
T. Alcock, plumber	1 037
E. Thompson, painter	92
J. Greenwood, painter	903
T. Nelson & Son, slaters	238

NEWTHORPE.—For several outfall works at Newthorpe, Notts.—Engineer & Surveyor:—

A. H. Price & Co., Nottingham	£790
Lane Brothers, Mansfield	740
C. Rayner, West Bridgford, Nottingham	630
G. F. Tommeson, Derby	618

NANTWICH.—For sewerage works at Wilaston, for the rural district council:—

Jowett Brothers, Lancaster	£9,003
A. Harris, Birkenhead	8,900
T. Hutton & Co., Northwich	8,689
Bennie & Thompson, Warrington	7,575
F. Hayes, Liverpool	6,896
H. Holloway, Wolverhampton	6,800
T. G. Huxley, Malpas	6,220
F. Barker & Son, Stoke-on-Trent	6,166
G. P. Trentham, Birmingham	5,886
W. L. Meikle, Liverpool*	5,630
H. H. Barry, Nottingham	5,600

SOUTHEND.—For work of making-up streets, for the corporation:—

Heldaville-drive.—Parsons & Parsons, £890.
Lovelace-gardens.—W. Iles, £378.
Westborough-road.—Parsons & Parsons, £809.
Fleetwood-avenue.—Parsons & Parsons, £1,683.
Grand-drive.—W. Iles, £585.
Stornoway-road.—W. Iles, £2,725.

MEETINGS.

Secretaries and others will oblige by sending early notice of dates of forthcoming meetings.

JANUARY.

4.—Lower Thames Valley District Surveyors' Association: Meeting at Twickenham Town Hall. 6.30 p.m.
8.—Institution of Municipal and County Engineers: South-Eastern District Meeting at Sidcup.
8.—Junior Institution of Engineers:—Captain H. Riall Sankey on "Heating of Buildings by means of Hot Panels," Institution of Electrical Engineers, Victoria-embankment. 8 p.m.
9.—Concrete Institute: Mr. W. Valentine Ball, Barrister-at-Law, on "Concrete in its Legal Aspect." 7.30 p.m.
11.—Institution of Municipal and County Engineers: Meeting at Swansea.
23.—Institution of Municipal and County Engineers: West Midland District Meeting at Birmingham.
30.—Institution of Municipal Engineers: Visit to Woolwich Arsenal.

FEBRUARY.

3.—Royal Institute of British Architects: President's address to students; presentation of prizes.
8.—Institution of Municipal and County Engineers: East Midland District Meeting at Newark.
22.—Institution of Municipal and County Engineers: Meeting at Southampton.

APPOINTMENTS OPEN.

DULVERTON RURAL DISTRICT COUNCIL.
APPOINTMENT OF HIGHWAY SURVEYOR.

The Council invite applications for the post of Highway Surveyor for their district. Estimated mileage of roads 220 miles.

The person appointed will be required to devote the whole of his time to the duties of the office, to keep his own books, to reside where the Council require him, and to give security through an approved Guarantee Society in the sum of £100. The officer must be a competent Road Surveyor, able to prepare plans and specifications, estimates and bills of quantities. He should also have had experience in the preparation of detailed estimates for the maintenance and improvement of roads, and working and management of steam rollers and scarifiers, and the supervision of workmen, whether under contract system or by direct labour.

Canvassing, either directly or indirectly, by or on behalf of any candidate is strictly prohibited, and will disqualify.

The appointment will be made subject to the approval of the Somerset County Council.

The salary will be £130 per annum, to include all travelling expenses.

Three months' notice on either side must be given to terminate the appointment.

Applications (upon Forms which will be supplied by the Clerk to the Council), in candidate's own handwriting, stating age (not more than 35), qualifications and previous experience, accompanied by copies of not more than three recent testimonials (which should be written on foolscap paper, and which will not be returned), to be sent to me on or before Friday, the 17th day of January, 1913, endorsed "Surveyor."

Notices will be sent to selected candidates, whose personal attendance is required on the day of election, and third-class railway fare will be paid.

Duties to commence at once.

(By order of the Council)
R. SOWTON BARROW,
Clerk to the Council.

Dulverton.
January 1, 1913.

PUPIL.—The Borough and Waterworks Engineer of Leamington (A.M.I.C.E.) has a vacancy in his office for a Pupil.—Address, Town Hall.

THE URBAN DISTRICT COUNCIL OF STOURBRIDGE.

APPOINTMENT OF ROAD FOREMAN.

The above-named Council require the services of a Competent Road Foreman to superintend, under the direction of the Surveyor, the workmen employed by them.

Applicants must have had experience in the maintenance of roads, tar-macadam work, and be accustomed to the management of men and horses.

The salary offered is 35s. per week, with a house rent free.

Applications, endorsed "Road Foreman," in candidate's own writing, stating age, present and previous occupations, with copies of not more than three recent testimonials, must be sent to the undersigned not later than 12 o'clock (noon) on the 20th day of January, 1913.

FREDK. WOODWARD,
Surveyor.

The Town Hall,
Stourbridge.
December 31, 1912.

CHESTERFIELD RURAL DISTRICT COUNCIL.

GRASSMOOR AND WINSIC SEWERAGE AND SEWAGE DISPOSAL WORKS.

The above Council require immediately the services of a young Surveyor to take charge of the Construction of the above Works, under the direction of their Resident Engineer. The works will take about eight months to complete. Salary 45s. per week. Applications, stating age, experience and qualifications, together with copies of two testimonials of recent date, to be sent to the undersigned not later than the 11th January, 1913.

R. F. HARTWRIGHT,
Clerk to the Council.

Rural District Council Offices,
Chesterfield.
December 31, 1912.

APPOINTMENTS WANTED.

ASSISTANT (20), B.Sc.(Tech.), in Municipal and Sanitary Engineering desires position. Good surveyor and leveller, neat, quick draughtsman, good knowledge sewerage, sewage disposal, road and building construction, ferro-concrete, chemistry, &c. —C. M., office of THE SURVEYOR, 24 Bride-lane, Fleet-street, E.C.

ASSISTANT (21), A.M.I.Mun.E., Stud.I.M. and Cy.E., passed whole P.A.S.I.; Board of Education, Stage III.; City and Guilds of London Inst. Quantities, 1st class; requires appointment. Five years' experience in progressive U.D., Surveying, Working Drawings, Private Street Works, &c.; excellent references.—Box 1,209, office of THE SURVEYOR, 24 Bride-lane, Fleet-street, E.C.

ASSISTANT to Surveyor of large Urban District in Essex seven years seeks permanent appointment. Salary £91. Experienced in Architecture and all branches of Municipal Engineering; excellent testimonials.—Romesx, office of THE SURVEYOR, 24 Bride-lane, Fleet-street, E.C.

TENDERS WANTED.

SURREY COUNTY COUNCIL.

MAIN ROADS UNDER DIRECT COUNTY MANAGEMENT.

URBAN DISTRICTS OF WALTON-ON-THAMES AND WINDLESHAM, AND RURAL DISTRICTS OF GUILDFORD AND HAMBLEDON
(Portsmouth-road north of Godalming only).

MATERIALS.

Tenders are invited for the Supply of high-class Granites, Basalts, Limestone, Slag, Tar-macadam, Bitumen, Pitch, Tar, and Tar Oils, delivered at Railway Stations; also for Flints and Fine Gravel for Footpaths, delivered either at Stations or at the Roadside.

Specifications, Schedules, and Forms of Tender may be obtained on application to the County Surveyor, County Hall, Kingston-upon-Thames, to whom Tenders must be sent in sealed and endorsed envelopes so as to reach his Office on or before the 21st day of January, 1913.

(By order)
A. DRYLAND,
County Surveyor.

County Hall,
Kingston-upon-Thames.
December 23, 1912.

SPILSBY RURAL DISTRICT COUNCIL.

TENDERS FOR GRANITE AND SLAG.

The above Council are prepared to receive Tenders for the supply of about 5,000 tons of Broken Granite, 9,500 tons of Broken Slag, and 450 tons of Slag Chippings, to be delivered in such quantities and at such times as the Council shall require and direct.

Specifications, Conditions of Contract and Forms of Tender, showing the stations at which the material is to be delivered and the approximate quantity to be delivered at each station, may be obtained on application to Mr. Wm. Cooke Brakenridge, District Surveyor of Highways, Spilsby, to whom a small sample box of stone must be sent.

Tenders, endorsed on the cover "Tender for Road Material," must be delivered at my office not later than Friday, the 17th day of January.

The Council do not bind themselves to accept the lowest or any Tender.

(Signed) G. BEAUMONT WALKER,
Clerk.

Spilsby.
December 30, 1912.

BOROUGH OF PLYMOUTH.

Notice is hereby given that, after the expiration of ten days from the date hereof, the Corporation intend to enter into Contracts for the Supply of the following Goods and Materials for one year, with the exception of Schedule No. 26 (Cartage of Materials), which is for 1 or 3 years, from the 1st April, 1913:—

Schedule No. 3.—Paints and Varnish.
" " 5.—Ironwork.
" " 7.—Petroleum Oil.
" " 8.—Broomheads.
" " 9.—Household Brushes.
" " 11.—Iron and Steel.
" " 14.—Carbolic Powder.
" " 15.—Portland Cement.
" " 16.—Lubricating Oils.
" " 17.—Tar and Pitch, includes refined tar for use in the construction of tarred macadam roads and for tar spraying.
" " 18.—Painters' Brushes.
" " 19.—Explosives.
" " 22.—Soap.
" " 23.—Wood Blocks, Soft.
" " 24.—Creosote.
" " 27.—Road Metal.
" " 28.—Disinfectant Fluid (Bacteriological Test).
" " 29.—Granite Kerbs, Setts, &c.
Schedule No. 30.—White Lead, Red Lead, Linseed Oil, and Turpentine.
" " 31.—Refilling Machine Revolving Brooms.
" " 33.—Benzoline and Motor Spirit.
" " 34.—Tools.
" " 35.—India Rubber Goods, Hose, &c.
" " 36.—Ship Chandlers' Goods (Sundry Oils, Waste, Grease).

Tenders must be based on the whole of a Schedule (with the exception of Schedules No. 4, 22, 29, and 36), and not on any particular item contained therein.

Schedules may be obtained on payment of a deposit of £1 in cash for each Schedule. The deposits on the Schedules will be returned, provided *bonâ-fide* Tenders are received on or before the 18th January, 1913. Should the Contractor withdraw his Tender, or fail to send in one, the amount of his deposit will be forfeited, and the Contractor who applies for the Schedules must do so on the distinct understanding that he is willing to abide by the terms of this advertisement.

The lowest or any Tender will not necessarily be accepted.

Tenders to be delivered not later than Saturday, January 18th, 1913, addressed to the undersigned.

JAMES PATON,
Borough Engineer and Surveyor.

Municipal Offices,
Plymouth.
December 24, 1912.

ESSEX COUNTY COUNCIL.

Tenders are invited for the Supply of Broken Granite for the repair of the Main Roads in the County of Essex, to be delivered at various Railway Stations and Wharves as per schedule, which will be forwarded upon written application to the County Surveyor, Chelmsford, on or before Thursday, the 16th January, 1913.

Sealed Tenders, in the envelope supplied, to be delivered at the County Surveyor's Office, Chelmsford, not later than Saturday, the 18th January, 1913.

The Council does not bind itself to accept the lowest or any Tender.

PERCY J. SHELDON, M.INST.C.E.,
County Surveyor.

Chelmsford.
January 1, 1913.

BOMBAY MUNICIPALITY.
SUPPLYING AND LAYING 50-IN. DIAMETER STEEL MAIN.

The Corporation of Bombay invite Tenders for Supplying and Laying complete about 19 miles of 50-in. diameter Steel Main between Nevada and Ghatkoper, in connection with the Water Supply to Bombay.

Drawings may be inspected, and copies of the Specification, Form of Tender, and Bill of Quantities can be obtained, from Messrs. John Taylor, Sons & Sam'l Cramp, Caxton House, Westminster, S.W., on payment of Twenty Shillings (cheques only), which will be refunded on receipt of a *bonâ-fide* Tender.

Tenders, in sealed envelopes, endorsed "50-in. Tansa Main," addressed to the Municipal Commissioner, Bombay, must be delivered on or before the 18th day of February, 1913.

The Corporation do not bind themselves to accept the lowest or any Tender.

(By order of the Municipal Commissioner)

H. J. TRIVESS SMITH,
A.M.I.C.E., M.I.M.E.,
Hydraulic Engineer.

Municipal Offices,
Bombay.
December 2, 1912.

ROAD BOARD IMPROVEMENT WORKS.
COUNTY OF ANTRIM.

The Antrim County Council invite Tenders for Tar Treatment and Steam Rolling of certain Roads in the following Rural Districts, in accordance with the Specifications of the Road Board and the County Surveyor of Antrim, viz.:—

Antrim Rural District. Resurfacing with Tar-macadam about 13,800 square yards.

Ballycastle Rural District.—Resurfacing with Tar-macadam about 5,280 square yards.

Ballymena Rural District.—(*a*) Resurfacing with Tar-macadam about 11,400 square yards; (*b*) surface tarring about 4,800 square yards.

Ballymoney Rural District. (*a*) Resurfacing with Tar-macadam about 8,400 square yards; (*b*) surface tarring about 4,800 square yards.

Belfast Rural District. Resurfacing with Tar-macadam about 5,040 square yards.

Larne Rural District. (*a*) Resurfacing with Tar-macadam about 8,400 square yards; (*b*) surface tarring about 9,000 square yards; (*c*) cutting off two corners.

Lisburn Rural District. Resurfacing with Tar-macadam about 8,700 square yards.

Aghalee Rural District. Resurfacing with ordinary Macadam about 3,000 square yards.

Tenders, in writing, stating the security proposed, are invited for each Rural District separately. Forms of Tender can be obtained at this Office and Specifications and Drawings may be seen at the Office of the County Surveyor, County Courthouse, Belfast.

Tenders must be lodged with the under-signed on or before Saturday, the 11th January, 1913.

The County Council do not bind themselves to accept the lowest or any Tender.

ALEXANDER MILLAR,
Deputy Secretary of the Council.

Secretary's Office,
County Courthouse,
Belfast.
December 14, 1912.

SAINT PANCRAS BOROUGH COUNCIL.

The Highways, Sewers, and Public Works Committee of the Council of the Borough of St. Pancras invite Tenders from persons willing to execute Contracts for the Work or Materials below described for one year commencing April 1st, 1913.

Tenders, under endorsed covers (supplied), to be delivered at the Office of the Department of Works at the Town Hall, Pancras-road, N.W., not later than 12 o'clock noon on Monday, the 13th January, 1913.

1.—Removal of Road Sweepings and Gully Soil
2.—Horsing Water Vans.
3.—Horsing Road Sweeping and other Machines.
4.—Cartage.
5.—Timber and Joinery Materials.
5a.—Creosoted Deal Blocks.
5b.—Jarrah Wood Blocks.
6.—Barrows, Trucks, Handles, &c.
7.—Paints.
8.—Oils.
9.—Candles and other Chandlery.
10.—Smiths' and Founders' Works.
11.—General Ironmongery.
12.—Tools and other Hardware Goods.
13.—Yorkshire Stone and Artificial Paving Slabs.
14.—Granite Kerbs, Paving Setts, Broken Granite, and Kentish Rag.
15.—Gravel and other Roadway Materials.
16.—Sundry Materials (Lime, Cement, Bricks, Stoneware Pipes, and other Glazed Goods).
17.—Bass Brooms and Horse Brush Stocks.
18.—Tarpaulins, Hemp and Rubber Goods.
19.—Pitch, Tar, Creosote Oil, Carbolic Powder and Coke.

No Tender will be considered unless made out on one of the printed Forms, without any alteration thereof, which, with any further particulars, can be obtained on application to Mr. Wm. Nisbet Blair, M.INST.C.E., Borough Engineer and Surveyor, up to the morning of the said Monday, the 13th January, 1913.

The Council do not bind themselves to accept the lowest or any Tender.

Intending Contractors are not required to attend the Committee.

(By order)

C. H. F BARRETT,
Town Clerk.

Town Hall,
Pancras-road, N.W.
December 23, 1912.

MERIDEN RURAL DISTRICT COUNCIL.
TO ROAD CONTRACTORS.

The Highways Committee of the above Council are prepared to receive Tenders for carrying out various Road Works in Coleshill-road, near Coleshill, within their District.

Plans and Conditions of Contract may be inspected, and copies of Specification, Bill of Quantities, and Form of Tender obtained, upon deposit of the sum of One Guinea, to be returned to the depositor upon the receipt of a *bonâ-fide* Tender and the return of the documents supplied.

Sealed Tenders, endorsed "Coleshill-road," to be delivered to the undersigned by 12 o'clock at noon on Monday, the 13th day of January, 1913.

The Council do not bind themselves to accept the lowest or any Tender, and the Contract will contain a "fair wages" clause.

A. W. LIGGINS,
Clerk to the Council.

11 Priory-street,
Coventry.
December 19, 1912.

GLOUCESTERSHIRE COUNTY COUNCIL.
SURFACE TARRING ON MAIN ROADS.

The Highways Committee of the Council is prepared to receive Tenders for Surface Tarring about 65 miles of Main Roads at various places in the County during 1913.

General Conditions, Specification and Form of Tender may be obtained from the undersigned.

The Committee does not bind itself to accept the lowest or any Tender.

E. S. SINNOTT, M.INST.C.E.,
County Surveyor.

Shire Hall,
Gloucester.
January, 1913.

The Surveyor

And Municipal and County Engineer.

Vol. XLIII. JANUARY 10, 1913. No. 1,095.

Minutes of Proceedings.

Traffic Records: A Proposed International System

The importance of collecting traffic statistics according to some definite method and of preserving them in a prescribed form is recognised by the American Society of Municipal Improvements. Their committee charged with the study of traffic on streets and roads has recently issued a useful report on this subject, and through the courtesy of Colonel J. W. Howard, chairman of the committee and literary author of the very lucid report, we have been enabled to reproduce it in another part of the present issue. Colonel Howard, who is well known as an authority on street pavements, has lifted this subject in New York from the slough of "politics" to the realm of professional studies, and his recent activities in this matter will be within the recollection of our readers. In a covering letter to THE SURVEYOR, Colonel Howard suggests that the adoption in Great Britain and Continental Europe of one method of collecting and recording traffic statistics would be of much advantage, since comparisons would then be possible between different cities, and the experience of one would benefit others. That some such general agreement is desirable seems to be clear, but the nature and range of the records intended for international comparison demand careful consideration. To begin with, "enough is as good as a feast," and if the material collected in a single country is substantially enough for all practical purposes it may not be worth while to go further afield. This consideration, of course, involves the assumption that going further afield leads to some loss in the value of the reports or to additional complication, which is probably the case. The traffic of one city often differs so much from that of another city in the same country that the adoption of a "normal significance" method of recording items of traffic involves some sacrifice of the absolute and local value of the records, and still more is this likely to be the case when the method adopted is one devised to apply to the conditions in different countries. As regards country roads this point is of greater importance. Tons per yard width, for instance, means one thing on a road which is narrower than it would be if traffic and the nature of the crust determined its width, and quite another thing on a road situated on open ground, on favourable strata, where ample width has been given in order that relatively soft materials may be economically used for the road crust. Again, on strong roads the damage done or wear caused by heavy motor vehicles is often small compared with the damage or wear under swift motor traffic, and conversely on weak roads. Even on similar roads different kinds of traffic are not comparable, ton for ton. The heavy farm wagon, designed for use on road or field, laden with several tons of lime or sand, and drawn by a team of three or four strong horses, causes much less wear per ton than does a narrow-tyred vehicle, especially if the latter be overloaded and underhorsed; and the farm wagon is, on the average, much less heavily laden per inch width of tyre, and is driven much more slowly than the average two-horse wagon used in the distribution of coal or beer, for instance. In many cases it is much more important to distinguish between a traction engine and a good type of heavy motor car than it is to record the estimated weight of each vehicle. Our own Road Board has attempted to get over such difficulties by assigning factors of relative severity; but different factors are really required for different districts, and this device must be regarded rather as a means of preparing local records for general comparison than as applicable to the statistics of a whole country. Further, the significance of the amount of traffic or of tonnage per yard width depends, as Mr. R. J. Thomas has recently pointed out, on the actual amount of the traffic and the extent to which it is accordingly compelled to spread over the road. The width principally used by the traffic is what affects the life of the crust, and this is quite a different thing from Colonel Howard's "effective width," which is merely the actually used roadway width. A record of the actual width is therefore of importance as an item of information at each of the census stations; but even when this is combined with the amount of traffic per yard width we have not a basis for strictly comparable data, since the extent to which the traffic spreads or concentrates depends upon the nature of the dominant vehicles, the relative speeds of those classes which pass in considerable numbers, and some other factors.

* * *

The Nature and Range of Traffic Records.

What it all really amounts to is this: that the opinion of the surveyor, aided when necessary by a consulting engineer of greater general experience, is, when applied to the actual problems of the locality, worth more than comparisons with other localities and other

conditions reduced to some more or less common denominator. At the same time there are some traffic data which are worth studying in the light of similar data derived from other places, if—and it is a big "if"—the effects of the traffic, the average duration of the life of definitely described road crusts. and the state of the surface under different weather conditions have *also* been described and recorded. The smaller the range and the less the complexity of the records desired, the more worth while is it to decide upon some common method of obtaining and presenting them. Since the actual width of the road in each case is included in the forms prescribed by Colonel Howard's committee, these are probably sufficiently definite and, at the same time, simple enough for the purpose of general comparison. The "final consolidated traffic record" of Form III. (see the end of the report) could hardly be made simpler without a sacrifice of utility, and it may, therefore, be suggested that while each country may pursue its own method, an abstract in this form, but with the omission of some of the data, should be prepared for general comparison. Similarly the record proper to any particular locality should be summarised in a form suitable for comparison with records from other localities. The full local records would contain sufficient material common to all localities, in form, to admit of the abstraction of material for national comparison, and the latter records would be capable of being further summarised for international comparison.

Colonel Howard's report is an excellent summary of the main features of the subject. Some passages in it suggest, for this very reason, the kind of difficulty to which we have alluded above. The consideration that records should not be made in exceptional weather immediately suggests the further thought that in countries where extreme conditions permit for long periods the distribution of the traffic between the months or seasons is different from what it is in countries with mild climates. A record of the weather conditions and of the duration of each type of extreme weather is, therefore, essential if we are to compare the traffic of one country with that of another. The total wear and tear of the roads will depend upon the number of days during which traffic such as that recorded is met with on the roads. Otherwise we cannot compare, for instance, New York State with Wessex, or Alberta with Hungary. Again, the hours chosen for taking a traffic census must depend upon conditions which are often strictly local. The hours—from 7 a.m. to 7 p.m.—do not include, for example, a very busy part of the day in the portion of London where theatres are numerous, and in some, but not others, of the main routes therefrom. To take another instance of the danger of generalisation—the adoption of an average weight of $1\frac{3}{4}$ tons for all motor vehicles would be quite useless in this country, and, one would have thought, in any country. The weight would be much too low on some motor-omnibus routes in London, and much too high on some main routes leading out of London. On some country roads it would be too low on weekdays other than Saturdays, too high on Saturdays, and very much too high on Sundays. On many country roads it would be always too high. It is better to make the wildest of guesses at the real weight of each vehicle. Indeed, a pencil seems the proper instrument for the use of the census-taker; the punch is too limited in scope—one can make marks with it, but not remarks. As regards horsed vehicles, it is suggested in the report that a one-horse vehicle shall count as one ton, a two-horsed vehicle as two tons, and vehicles drawn by three or more horses as three tons. But in many districts the average vehicle drawn by three or more horses is different in type from two-horse wagons, and wears the roads much less, partly because the tyres are much wider, and partly because it is amply horsed, but moves slowly, while the two-horse vehicle has heavy loads per tyre-width if it is a coal or beer wagon, and if it is a delivery-van its speed is relatively great, and, owing to the fact that its load will be distributed a little at a time, the horse is somewhat overloaded at the beginning of the journey, which results in increased wear of the road when he is going uphill. Even for vehicles of the same type the number of horses often depends on the length of the trip and not on the weight carried, a load which is hauled by two horses for a distance of six miles being on another occasion hauled fifteen miles by four horses with less effort and less damage to the road per mile. "There are more things in heaven and earth, *Statistico*, than are dreamt of in your philosophy."

Traffic records are of great value, though there is a tendency in some quarters to overrate their importance as compared with the exercise of judgment, and there is more than a tendency to overrate their comparability. The contribution which Colonel Howard and his committee have made towards the organisation of some general method of preparing reduced or summarised records is timely and welcome, and it is to be hoped that it will serve to stimulate British road surveyors to use their pens for the purpose of comment on the points dealt with, and suggestions relating to the subject generally.

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Closing Order Inquiries.

In commenting upon the last annual report of the Local Government Board in a recent issue we drew attention to the good work which had been accomplished by local authorities under those sections of the Housing, Town-Planning, &c., Act, 1909, which conferred upon them increased powers in regard to making closing orders in relation to insanitary dwellings. Those sections effected a radical change in the procedure to be adopted in making such orders by transferring the jurisdiction from the petty sessional courts which had hitherto exercised it to the local authorities themselves. Since the Act came into operation it has been suggested with some insistence in certain quarters that property owners have a substantial grievance in the fact that the power to make closing orders is no longer vested in a judicial tribunal. The Act itself provides a rather elaborate system of safeguards to prevent injustice. In the first place an appeal lies to the Local Government Board against an order when it has been made; then, the owner may ask the local authority to determine an order at any time, and if such determination is refused, a further appeal may be made to the Board against the refusal. There is a further provision that an appeal cannot be dismissed by the board unless they first hold a public local inquiry.

The practice of the board in these matters was called into question in a case—*Rex* v. *The Local Government Board*—which came before the High Court at the end of last sittings. The procedure which has been adopted, and which was challenged in that case, is to hold the public local inquiry by an inspector appointed by the board in the usual way, the decision being given by them after considering the report made by the inspector. This course was pursued in the case we have just referred to, but it was argued on behalf of the property owner that the appeal was judicial in its character, and that in addition to appearing before the inspector, he was entitled to appear before the board itself, or some member or officer of it, who would have power not merely to report, but to decide the case. It was said that it is the inherent right of an appellant to present his case orally before the tribunal charged with the duty of deciding it, and that, although the board had complied with the terms of the statute in holding the public local inquiry, they were bound on this principle themselves to hear the appellant. In the result the court upheld the procedure of the board on the broad ground that it was sufficiently indicated in the statute with which they had no jurisdiction to

interfere. It may be pointed out, however, that there are many cases of appeal to the board in regard to other matters under the Public Health and other Acts, in which they have adopted similar procedure, and it has been said in more than one case that, although the board are bound to give an appellant full opportunity of presenting his case, there is no general principle that they must hear him *orally*. It may be that the new procedure laid down in the Act of 1909 is more cumbersome and less satisfactory than the old. That is a matter as to which there may be legitimate difference of opinion, and one which can only be remedied by fresh legislation. In our view the decision was perfectly right, and also in accordance with public convenience. To have decided otherwise would have been to put a check upon a piece of legislation which, with all its defects, has been instrumental in producing a considerable improvement in the condition of many working-class dwellings.

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Civic Art.

One of the results of the interest which has been awakened in town planning in recent years is that greater consideration has been given to the artistic side of the development of our cities. A case in point is that of Preston, which is already possessed of an entrance approach of which it has been said that "Nature, art, and even the railway companies have conspired to make it incomparably beautiful;" and now, by the munificence of Miss Haslam, the town has an opportunity of laying out the park which bears her name in such a way as further to beautify the surroundings of the city. That the corporation intend to make the most of this opportunity is shown by the fact that they have asked Mr. Thomas H. Mawson, the well-known garden architect and author of "Civic Art," to report to them as to the best and most appropriate scheme to adopt in laying out the new park. In his report—some account of which appears in another column—Mr. Mawson takes a very optimistic view of the possibilities of artistic development for Preston, and points out that there exists already almost all the material for one of those connected rings of park land round the town which make so many Continental cities delightful.

Those who are familiar with the effect produced by the Ringstrasse at Vienna will envy Preston the prospect of possessing for itself a similar feature. The natural advantages of the new park are considerable, inasmuch as in certain directions there are fine, unobstructed views into well-wooded country. In other directions, however, the new park looks on to factories and residential areas, which are to be screened from view, and on to undeveloped building land. Great care will have to be taken in the development of the latter in order to secure that the amenities of the new park are not interfered with. A great deal of the ultimate effect will depend upon the manner in which these estates are laid out, and the powers of the corporation under the Housing, Town Planning, &c., Act, 1909, might be useful in this connection. The works which Mr. Mawson advises the corporation to undertake are estimated to cost upwards of £10,000, including the formation of an artificial lake and the provision of a bandstand and pavilion shelter. The whole design is based upon the assumption that Haslam Park should not be regarded as an isolated unit, but rather as part of a larger and comprehensive park system which some day may be completed by the provision of connecting parkways in the nature of a "Ringstrasse."

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The Swansea Meeting.

The South Wales District meeting of the Institution of Municipal and County Engineers which will be held at Swansea to-morrow should attract a large attendance of members, by reason both of the important district business to be transacted and also of the very interesting programme which has been arranged. It may be pointed out, moreover, that the chairman of the district is Mr. W. Harpur, M.Inst.C.E., the city engineer and surveyor of Cardiff, whose services to the institution for many years past may appropriately be recalled in view of to-morrow's meeting. The first business will be the election of a district committee—a matter of great importance under the new constitution—and this having been disposed of, a civic reception in the Guildhall will be accorded to the members by the mayor. We have on former occasions pointed out the unfailing courtesy with which the members of the institution are received by the authorities of those places in which the meetings are held, and it is again gratifying to observe that this pleasing feature will not be wanting at Swansea. Two papers will be submitted for discussion, the first being on "Swansea Tramways, Past, Present, and Future," by Mr. G. Swarbrick, the deputy borough surveyor; and the second dealing with "The Development of the Pentre Valley in Relation to the Destructor," by Mr. G. H. Bell, the assistant borough surveyor. In addition to the consideration and discussion of these papers, the proceedings will include visits to some interesting works, among them being tramways in course of construction in Castle-street, the Burlais Brook culvert, the destructor and its recent improvements, and the slab-making plant. Enough has been said to indicate that the meeting will be of a most interesting character, and one which, as we have said, should attract a large number of members.

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Rural Water Supplies.

An interesting case under the Public Health (Water) Act, 1878, came before the Sittingbourne county bench a few days ago. It will be remembered that section 6 of the Act prohibits the occupation of newly-erected houses in any rural district unless and until a certificate has been obtained from the sanitary authority that there is provided within a reasonable distance a sufficient available supply of wholesome water. In the case in question the owners of two houses had been prosecuted by the district council for occupying them without having first obtained such certificates. Of this offence they were duly convicted, and they then proceeded (as the statute provides) to apply to a court of summary jurisdiction for an order authorising the occupation of the houses, notwithstanding the refusal of the certificate. Such an application is of course usually made in cases where the certificate has been refused, and the owner is anxious to occupy his house; and the interest of the present case lies in the fact that the owners had actually been convicted under the act of unlawful occupation. In the result the magistrates refused the application, with costs

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Next Week's Issue.

The twenty-first anniversary of The Surveyor will be marked next week by the issue of a special coming-of-age number, a prominent feature of which will be comparisons of the practice in the chief branches of municipal engineering twenty-one years ago and to-day. In addition to the usual weekly articles and news matter, the progress in connection with highways, sewerage and sewage disposal, water supply, municipal building work, electricity supply, refuse disposal, tramways, and street lighting, and the developments in legislation affecting municipal work which have taken place, will be carefully reviewed, providing a record which should prove of the utmost interest and value. The price of the issue will be as usual—namely, 6d.—and as there is likely to be a considerable extra demand for it, orders for copies should be given without delay to prevent disappointment. We would take the opportunity of reminding readers that our special annual issue is due to appear on the 31st inst., and asking all those who have still to furnish returns of works projected, for inclusion in the number, to do so within the next few days.

Road Maintenance in the North of Scotland.

THE PROBLEM OF OUTSIDE MOTOR TRAFFIC.

We have received from the Road Board the official report of the proceedings—already briefly recorded in our columns—in connection with the deputation which waited on Sir George Gibb at the House of Commons on December 13th last with the object of securing for the northern districts of Scotland special consideration in the matter of road grants by reason of the burden thrown upon the local rates owing to the growth of motor traffic. Sir George Gibb was accompanied by Sir J. H. A. MacDonald, K.C.B., and Sir Charles D. Rose, Bart., members, and Mr. W. Rees Jeffreys, secretary of the board.

Lord Lovat, who introduced the deputation, said the special consideration which they sought at the hands of the board was in respect of sparse population, long road mileage, high rates, small assessable valuation, the increased cost in the maintenance, and the demands for improvement of the roads entailed by outside motor traffic. That, practically, was the whole of their case. In the North they had practically reached breaking point on the subject of road rates. In certain cases the road rates had gone up from 1s. to over 2s. in the £; there was throughout the Highlands no expansion of rateable value, and they found they could not keep up the roads to meet modern conditions and the increased traffic which now went over them owing to outside motor traffic. They had been very thoroughly into this matter. They had taken the numbers of motor cars which plied on the roads, and found that in many cases only one in eleven that used the roads in the summer months belonged to the district or to people who paid rates in the district. That was to say that their roads—which were in no way created in the first place for motor traffic, being very narrow and very often without any bottom—were cut to pieces by motor cars belonging to people who paid no rates in the country, but who travelled right through in, perhaps, a couple of days, and left nothing behind but broken roads and a smell of petrol. It was felt that this was a state of things which was not only likely to be maintained, but also might be worse in the future. They knew that in a great many places roads were being destroyed; they knew, speaking generally, that their roads were in a much worse state than ever they were ten years ago, and this notwithstanding the fact that road rates had gone up in many cases 40 to 50 per cent, and in other cases had more than doubled. What was desired in the North—where the road rates had gone up in some places from 1s. to 2s. in the £—was a higher grant than had yet been allowed. The financial position of the North of Scotland did not permit of higher rates being paid, and they were face to face with the alternative of letting the roads go down—as had already been done by some authorities—which was of advantage neither to Scotland nor to motorists.

Representatives of Elgin, Argyllshire, Banffshire, Aberdeenshire, Sutherlandshire and Perthshire having spoken,

Sir George Gibb replied as follows: I am bound to say that very little has been said with which I do not find myself personally in agreement. You want special consideration for the Northern counties, and you very properly dwell on the burden that has been thrown on the roads in those counties by motor traffic. One speaker put it that the repairs which are needed to keep those roads in a condition suitable for their traffic were really repairs necessitated by extraordinary traffic. Our difficulty is that the law does not recognise that position. I am afraid the real state of the law is that the ratepayers, whether they like it or not, have to maintain the roads in a condition suitable for the traffic which is now using them. Formerly they were in the fortunate position of having only to maintain them for horse-drawn traffic, but now they must maintain them for motor traffic; and I doubt myself whether the position that you take up, that motor traffic is extraordinary traffic, would stand examination in a court of law. However that may be, there is no question whatever that the burden thrown upon roads, and upon ratepayers, by motor traffic is very large indeed. Some of you said that the burden is greater than you can bear, that the rates are as high as they can be made, and still the roads do need further expenditure upon them. Well, I am very much inclined to agree with that view, and I suppose that you will make representations of that sort, not to the Road Board, who have really no power to deal with the burden of maintenance which is pressing upon you, but in more influential quarters. The only thing that I think I would not agree with is the exceptional position which you claim for yourselves. I suppose we are always inclined to think our own case very exceptional, and our own burdens very severe; but I think, as a matter of fact, you will find that the burden which is falling upon you is really falling with quite as much weight on the majority of highway authorities throughout the country. Indeed, it is falling with heavier weight upon, I should think, the majority of them, because in a great many cases they cannot conceivably escape the burden in a way, for example, which Elgin has done. I think for some time Elgin took the position that they would not spend 1d. more on the roads, that even if grants from the Road Board were available to assist them in further expenditure they would not accept those grants, but would simply not spend the money. I have been rather surprised myself that more counties have not adopted that attitude.

One of the speakers said that the Road Board asked them to spend money on the roads—additional money on the roads. I do not think that is quite the sound way of putting it. We do not ask, we do not urge counties to spend more money; that is a matter for themselves; they have to decide whether it is economically sound to spend the additional money required to improve the roads. If they come to the conclusion that they want to do so, that they want to spend money, then we can relieve their burden by bearing a share of it; but we never go the length of urging a county to spend money which it is not prepared to spend on the local consideration of its own circumstances. Now, you have urged that we should give you a larger proportion of the expenditure on improvements. If we did so, the result would be that there would be less work of improvement done. It would simply mean there would be less money spent, less work carried out, because the money that we have available for grants is not an unlimited sum. If we gave more—I cannot say to Shetland, because it is said we have given none, but to several of the counties represented here—we would have to take it from somebody else.

Now, from whom do you suggest we should take it? The amount allocated to Scotland has been allocated, more or less, on a population basis; indeed, we give Scotland perhaps a little more because of the consideration that there are a great many foreign motors using the Scottish roads; but, roughly speaking, it is very difficult to justify the division of any national taxation between the countries of Scotland, England and Wales, except on some such basis as population. Now, given the application of that, or any other method of division which is practicable, it results in a certain definite figure being available for grants in Scotland. If we give more grants to the Northern counties, we must grant less money to other counties in Scotland. I do not think that on the facts in regard to each county that one could well justify reducing the amount of money granted to, we will say, some Southern counties, or Midland counties, in Scotland, in order to give it to the counties you describe as of sparse population; because you must remember the needs of the other counties are really greater than yours; whether the burden is greater it is very difficult to judge.

I do not find, looking at the expenditure per £ of assessable value throughout the various counties of Scotland, that the burden varies so much as one would expect. The expenditure in the richer counties, which are the more populous counties, is necessarily at a higher rate per mile on the roads than in the counties of sparse population; so that, in the end, it comes back to a figure per £ of assessable value which, although it varies in particular districts, does not vary so very widely if you take the total expenditure in the county; and really, also, the expenditure in Scotland per £ of assessable value is not substantially greater, if, indeed, it is greater at all, than the expenditure in England. The truth is

it is impossible to find anything that would enable one to say that the burden is in fact greater on the ratepayer in counties of sparse population than it is on those in other counties, while, on the other hand, I do not think it can be denied that the need for expenditure is less in the counties of sparse population than in other counties.

A figure has been quoted to-day of the number of motor cars in a week in summer passing along a road in the North of Scotland. Now, that number is just about the same as passes in a single hour in a road within 50 miles of London; and if you try to measure the need for expenditure, and the need of the various counties for assistance, you do find practically that the need is greatest where the traffic is greatest. The counties of denser population are faced with the same problem, only faced with it far more severely, of having, whether they like it or not, to reconstruct their roads; and I am afraid, therefore, it is impossible to say that one could justify deliberately taking money from counties where the traffic is great and the need is great for the purpose of spending it in counties where the population is sparse. I do not quite know to what conclusion that leads you. It is, perhaps, not a very satisfactory conclusion to say that if, for example, in the county of Sutherland, it is necessary to spend £20,000 for the purpose of making a certain mileage, not a very large mileage, of the roads into a good condition, for the purpose of the motor traffic, that you must not spend it. If you balance the desirability of incurring that expenditure against the desirability of spending the same sum on roads carrying a very large amount of motor traffic, and being destroyed at a very rapid rate by that motor traffic, I think it is very difficult to say that you could justify spending such a large sum in the county of Sutherland as compared with other counties where the need is more.

I must say I am inclined to think that until the needs of the more important roads throughout the country, the roads that are now bearing the greatest volume of motor traffic, have been, not fully met, but approximately met, it would not be sound policy to divert the money that it available for those roads and apply it to roads which in fact have to bear a very small volume of motor traffic. No doubt that means that the less important roads remain for a longer time in an unsatisfactory condition. But, then, what are you to do, if you have a limited fund which can only be spent by degrees, and you are presented with a choice either of spreading it out so thin that it would probably do no good anywhere, or concentrating it in certain instances on important roads, and leaving even the important roads of Shetland for consideration at a later date.

Now one more word as to the proportion. I am sure the board sympathise with you in your reluctance to bear any large additional expenditure, but I do not know whether many of you really would prefer that the work that is now being carried out with the assistance of our grants should be made even less than it is by our granting a larger proportion than we do. Of course, we do not act on any rigid rule; we take the circumstances of each case into consideration; but would it be wise policy to reduce the amount of work to be done by encouraging us to grant a larger proportion of the actual cost of the improvement? I do not think in dealing with the counties individually that we are excessively hard in fixing the percentage. We generally find at the end of a talk that the county fairly recognise that with a definite sum available they had better try to get as much work done as they can without unduly straining the patience of their ratepayers; and I doubt whether it would be good policy for us, in a general way, to increase the proportion of the expenditure we pay. That does not mean that we should not give consideration to the circumstances of special cases. I think we should; and we are quite prepared to do so. But I do not gather from this deputation that you would really urge that we should do that to any great extent. Because, remember, the more we do it the less money there must be for those special cases that deserve special consideration; and it probably would be wiser to adhere mainly to the principle we have adopted of looking to the authority to pay as much as it reasonably can towards the cost of any improvement work. . . .

There is no doubt at the present time the trouble is that the motors are destroying the roads faster than you can cope with them, as it were, by annual expenditure, and the need is rapid reconstruction of those roads that have to bear a large quantity of motor traffic. Once they are reconstructed and made suitable for motor traffic, then I do not anticipate that there is going to be any permanent great increase in maintenance expenditure, because motors do not destroy a properly constructed bituminous-bound road to any substantial extent. I am not speaking now of the great heavy traction engine with its trailer and the motor lorry, because they may do infinite damage to any road not strong enough to bear the strain put upon it; but the ordinary motor car may go in its thousands over a properly constructed road and do just as little damage to the road as a carriage and pair did to our water-bound roads. But then, if the road is not in suitable condition, the motors may do great damage, and that is why we are anxious, in the first place, to get those roads rapidly put right which have to bear the strain of the greatest volume of traffic. . . . Whether we are right or not, we are taking the most extensive interpretation of the word "improvement" we can do, and I think you will all agree that is the wisest course to adopt.

THE HIGHWAYS OF MARYLAND.

REPORT OF THE STATE ROADS COMMISSION.

The State Roads Commission of Maryland was organised in 1908, Mr. W. W. Crosby, chief engineer of the Geological Survey, being appointed chief engineer of the commission. The engineering work of the two departments was thus placed under one head and duplication of offices avoided. The main features of the work of the highway division of the Geological Survey, and other interesting matter relating to the roads of this small but historically important State formed the subject of a report already reviewed in these columns (see March 17 and 24, 1911), and the report now before us, for which we are indebted to the courtesy of Mr. Crosby, brings the subject up to date, and, relating only to the highway work from 1908 to 1911, puts this in a form convenient for reference or review. The volume consists of some 180 pages of text, and a dozen plates, and a map of the State, on the scale of about five miles to an inch, is conveniently placed in a pocket at the end. The statements of construction expenses, in tabular form, provide very useful comparative data, and to a considerable extent indicate the nature of the work undertaken. The photogravures are of exceptional interest, the field of view having been chosen, in many cases, with great care, so that the picture conveys precise information as to the piece of work illustrated, topographical features or roadside conditions being included to an extent which enables the reader to form an idea of the character of the road at the particular spot and the nature of the difficulties likely to be encountered. The large scale photographs of finished road surfaces which in several cases accompany the general views form a striking feature of the report, many of them being to a scale of about one-third, in linear dimensions, or even larger, the photographs having been taken vertically, looking down on to the road surfaces.

The additional mileage of construction work put in hand in 1911 was about 77 miles, and in the same year 110 miles were accepted as completed, the total of the work accepted as completed by December 31st of that year being 168 miles, of which all but about ¾ mile were in the counties. In 1910 and 1911 some 189 miles of existing turnpike roads were purchased by the board, and were placed under the maintenance division. A considerable amount of important bridge work is in hand, the illustrations relating to some of these works being sufficient to show clearly their general character.

Wirral Town Planning Scheme.—It is stated that the Local Government Board have given the Wirral Rural District Council authority for the preparation of a town-planning scheme for an area of about 5,800 acres, consisting of the parishes of Great Sutton, Little Sutton, Childer Thornton, Hooton, and Eastham.

Illuminating Engineering Society.—On Tuesday evening next, at 8 o'clock, papers on "Acetylene Lighting" and "Petrol-Air Gas Lighting" will be read by Messrs. C. Hoddle and E. Scott Snell respectively, at a meeting of the Illuminating Engineering Society to be held at the Royal Society of Arts, John-street, Adelphi, W.C.

Traffic Recording Methods.

A PROPOSED INTERNATIONAL SYSTEM.

[Report of the Committee on Traffic on Streets and Roads of the American Society of Municipal Improvements presented in November last by Col. J. W. Howard, M.Am.Soc.C.E., Chairman of the Committee.]

Records of traffic on streets are of great importance and utility, as is known to all engineers connected with their construction, maintenance and use. The quantity and weight of traffic on a street or road has generally been one of conjecture, and not based on actual count. A traffic regarded in small cities as numerous and heavy is light traffic in larger ones, although in both places it passes over the same kind of pavement and is under other similar conditions. Although the engineers of the Department of Bridges and Roads of France, who have charge of construction and maintenance of streets and roads of that country, have for fifty years recorded traffic and reduced it to the quantity per metre of width, there has been comparatively little done in other countries. London, Berlin and a few other European cities have taken some records. In the United States it was not until 1885 that records were taken on a few streets of ten cities, more for the purpose of promoting a special class of pavement, then little used, than to determine the relation of quantity of traffic to wear, cost of maintenance of pavements, and other important factors. Since 1900, records of various kinds have been made at a few places in several cities, as the importance and great cost of pavement and road construction, and especially maintenance, have been recognised.

There is as yet no standard method for recording and comparing the traffic on different streets of a city, nor traffic on streets of one city with those of another. The object of this report is to suggest a uniform method of recording, analysing and standardising quantity and weight of traffic on streets and roads, and for reducing it to unit bases of quantity and of tons per yard of used traffic width of roadway per day, or per square yard of used roadway surface, which is the same thing.

It is wise to recall the two legitimate causes of wear and destruction of pavements. They are traffic and weather, separately and combined. In some cases where traffic is very light and weather severe, weather does the greater damage. In other cases where traffic exceeds certain minimum (the minimum being different for different kinds of pavements and roads), the traffic is a greater function of wear than weather. But in every case traffic must be considered. Whether or not a pavement has been properly constructed with durable foundation and a wearing surface of any one of the many kinds in use, and the pavement properly maintained or not, traffic records give very important data on which to base the selection of future pavements, to estimate the value of first construction and the cost of maintenance.

Traffic records not only show what kinds of pavements are most economical from the standpoint of durability and maintenance, but also show the approximate cost of maintaining the kinds of pavements which add to the comfort and health of people using them or living near them, aside from the factor of durability.

Traffic records are also essential to handling traffic and to effective city planning and administration. They show how to relieve traffic congestion by constructing new thoroughfares and their relations to old ones; what streets must be widened, what streets can have their roadways made narrower to reduce cost of paving, street cleaning, and for beautifying them by parkways and otherwise.

This report is based on official traffic records of several European and American cities, made at various intervals during the past thirty-nine years, and on other documents, supplemented by personal knowledge of many of the streets of these cities and experience in making actual traffic records.

The various and widely divergent analytical records made in the past few years at a few points in the United States have been consulted. Most of these records have failed to state the width of the streets or roads, and are defective in other respects. Many cannot be reduced to any unit basis for comparison with each other. Many have unnecessarily subdivided the vehicles into too many kinds, sizes, &c., by methods which are complicated and unnecessary for practical general use.

Traffic records should be based on a simple, accurate method of counting and recording traffic, and reducing it to standard units of quantity and tonnage. The method should be such as to be quickly understood and applied. This report presents such method with forms for practical use.

The period during which traffic should be counted is for twelve consecutive hours, from 7 a.m. to 7 p.m., and during six consecutive or other different week-days. If average weather and what is known to be average traffic conditions are selected, then a record for only three consecutive week-days gives valuable information. No traffic should be counted in abnormal seasons of snow and ice, nor during continuous rainy, very cold, or excessively hot days. The foregoing applies to all cities. Nevertheless, local special conditions on a few principal thoroughfares of cities, say above 500,000 inhabitants, sometimes require records of traffic during the twenty-four consecutive hours of each day for several days. The location where the traffic is counted must be at or near the centre of a block, and not at an intersection of two streets. The traffic is that which passes both ways along the street or road. It can be counted from the sidewalk or other convenient location; best from a room with window facing the street.

In order to determine the total traffic on a street or road, and so tabulate it that the results can be reduced to standard bases, and do this at least possible expense and by simplest method, certain items or factors must be carefully noted, as shown in the accompanying forms.

The general classification of vehicle traffic for practical results is as follows: First, horse vehicles, subdivided into three divisions, having one horse, two horses, three or more horses; second, auto vehicles.

The vehicles and horses must both be considered in computing the weight, &c., of traffic from the quantities counted and recorded. This is because they both occupy space on a roadway and both help wear and injure the surface. Experience has shown that, for general traffic counting and the reduction of the quantities of vehicles to tonnage of traffic, the average weight of all vehicles (empty and loaded) drawn by one horse can be taken as one ton of 2,000 lb.; by two horses as two tons; by three or more horses as four tons. In like manner the average of all auto vehicles (loaded and empty) for transportation of persons and goods can be taken as one and three-fourths tons. All bicycles and ridden horses, because light and very few, are best omitted from street traffic recording. If ridden horses are at all numerous on a park, suburban or country road, they are best recorded and estimated as one-horse vehicles. Unusual subdivision of vehicles into sizes and kinds, also street cars on their rails and other data, in special cases, can be recorded on separate slips. But this adds greatly to the difficulty of recording correctly, and seldom furnishes any needed or practical information as far as streets themselves are concerned.

The forms for counting and recording traffic, hereto attached, are self-explanatory. They should be explained and distributed in advance to the traffic observers or recorders.

Form 1. Traffic Recording Slips. This consists of sets of four cardboard slips, about 9 in. by 2 in., fastened together at the end. Twelve sets are needed. One set is used for each hour. But if traffic is very numerous, one or more extra sets can be used for one hour. Each set is marked for location where traffic is counted, name of observer, date, the hour represented by the set (as 7 a.m. to 8 a.m., &c.). There must be at least two observers for each location, to relieve each other at the end of each hour or two hours, because one recorder cannot work accurately for a longer period. An ordinary conductor's punch is needed, and a hole is punched in a slip for each vehicle passing in either direction along the street in front of the recorder. One-horse vehicles are punched in the white cardboard, two-horse in the

yellow, three and more horse vehicles in the red; all auto vehicles are punched in the blue slips. The number of holes in each are not counted until after a recorder stops observing the traffic. He can count the holes when relieved by the other recorder, or at the close of the day's work. On counting he should write on each slip the total number of holes in it.

Form 2. One Day Traffic Record.—This consists of a consolidated record of the quantity of traffic during each of the twelve hours from 7 a.m. to 7 p.m., with totals and reductions to unit bases. It gives details of name of city, width of roadway, effective width used by traffic, which averages ½ yd. less on each side, or 1 yd. less than the full width between kerbs or edges of the streets. The kind of quality of pavements, the weather and other needed facts are shown. This form reduces the one day's traffic to standard units, which are the total vehicles and total tons of traffic on the whole street; also per yard of effective width of the street. This is the equivalent of number of vehicles and tons per square yard of used roadway surface.

Form 3. Consolidated Traffic Record.—This form is compiled from records on several Forms 2. It consists of a condensed statement covering the six or other number of days' traffic. It shows the data day by day, together with the final totals and the averages per day. These totals are reduced in quantity and tons to the standard units of yard of effective width (square yard) of roadway surface subjected to the traffic. These are the true bases for comparing the traffic of one street with another, and for establishing the relation of different amounts of traffic to wear on pavements, cost of maintenance, and for many other useful purposes.

Traffic records are seldom needed annually, but at longer intervals up to once in five years, or according to local changes of traffic conditions and other necessities in cities, counties or states.

In connection with the foregoing description of how traffic can be simply and accurately recorded, and reduced to standards of quantity and of tons per yard width of roadway, the following actual records of traffic in various representative cities and on a few suburban and country roads will aid in establishing a basis showing the various degrees of intensity of traffic: First, very light; second, light; third, moderate; fourth, heavy; fifth, very heavy; sixth, extra heavy.

These quantities are compiled and computed from old official and later traffic records, and are excellent illustrations of quantities, tonnage and degrees of intensity of traffic per yard of effective width on used roadways. In many cases the records were made in such different ways, and without proper classification of vehicles, that the data in such cases was not sufficient to supply the omissions, indicated in the table by (x). The traffic is the average of several days of twelve hours from 7 a.m. to 7 p.m., or, in a very few cases, a close approximation.

As soon as cities, counties and states have recorded, tabulated and reduced the traffic on their roadways, on the standard bases and units set forth in this report, then they will have accumulated very valuable data for comparing the results between the streets and roads of the same and other places. This data will be of much assistance thereafter in economically and efficiently solving all problems connected with the construction and use of all arteries of public travel and transportation used by horse and auto vehicles.

[Instead of reproducing the forms the following descriptions have been substituted.—ED. SURVEYOR.]

Form 1.—This is sufficiently described in the text above.

Form 2.—The data noted are: Site, day of week, place, width between kerbs, effective traffic (1 yd. less than width), kind of pavement, quality of surface, condition of surface (wet, dry, dirty, clean), weather (rain, fog, dry, approximate temperature), street car rails (single, double), general kind of rail (flat with groove, ell, tee shape), average approximate speed of horse vehicles and of motor vehicles.

The table has thirteen spaces through its length, one for each hour, and one for the totals. The headings of the columns are: Number of horse vehicles (1) (2) (3) (three columns, 1 horse, 2 horse, 3 or more horses), (4) total horse vehicles, (5) total motor vehicles, (6) total tons horse vehicles, (7) total tons motor vehicles, (8) total number all vehicles, (9) total tons all vehicles, (10) total vehicles per yard effective width, (11) total tons per yard effective width.

Place.	Street.	Totals on whole width of roadway.		Total per yard effective width of roadway.		Relative intensity or degree of traffic.
		Vehicles.	Tons.	Vehicles.	Tons.	
Paris.	Rivoli-st.	33,232	49,041	2,767	4,087	Sixth.
,,	Opera-av.	29,460	42,216	1,789	2,558	,,
,,	Madeline-bl.	17,524	24,776	1,019	1,385	,,
,,	Italiens-bl.	20,124	27,651	1,093	1,500	,,
,,	St. Honore-st.	16,598	22,952	1,976	2,732	,,
Berlin.	Potsdam-pl.	14,221	29,656	1,016	2,832	,,
,,	Leipzig-st.	9,596	26,139	720	1,961	,,
,,	Friederichs-pl.	13,479	33,529	963	2,395	,,
London.	Strand	16,208	27,878	1,430	2,460	,,
,,	Cheapside	11,019	18,953	1,136	1,954	,,
,,	Gracechurch-st.	12,148	20,894	1,149	2,154	,,
New York.	Fifth-av., nr. Fifty-eighth-st.	8,665	12,091	673	946	Fifth.
,,	First-av.	2,301	3,391	131	192	Third.
,,	Broadway, nr. Franklin	3,277	3,554	266	288	Fourth.
,,	Wall-st.	2,443	3,555	305	444	,,
,,	Qns. Br., Hillside-av.	1,304	1,529	157	184	Third.
,,	Bnx. Br., White Plains-rd.	342	536	49	75	First.
Washington.	Fifteenth-st.	4,687	6,456	335	461	Fourth.
,,	Ninth-st.	1,965	2,478	123	155	Third.
Chicago.	State-st.	6,048	(x)	430	(x)	Fourth.
,,	Clark-st.	4,691	7,728	335	552	,,
,,	Wabash-av.	3,794	8,643	237	590	,,
,,	Sheridan-rd.	5,736	11,925	465	994	Fifth.
Philadelphia.	Broad-st. N. Chest.	6,176	11,154	105	607	,,
,,	Filbert-st.	5,185	8,102	576	900	,,
St. Louis.	Locust-st.	3,496	5,308	318	484	Fourth.
,,	Broadway	3,150	4,976	197	311	,,
Buffalo.	Main-st.	2,941	3,836	166	217	Third.
,,	Linwood-av.	697	1,541	60	129	Second.
Boston.	Devonshire	5,410	7,380	676	923	Fifth.
,,	Kilby-st.	3,503	4,555	455	591	Fourth.
Newark.	Broad-st.	2,400	(x)	126	(x)	Third.
,,	Bridge-st.	2,522	(x)	205	(x)	Fourth.
Massachusetts.	Shrewsbury-rd.	484	770	97	154	Second.
,,	Medford-rd.	434	669	47	72	First.
,,	Weston-rd.	964	1,260	161	210	Third.
Rhode Island.	E. Providence-rd.	463	172	77	112	Second.

NOTE.—One-horse vehicles average 1 ton.
Two-horse vehicles average 2 tons.
Three or more horse vehicles average 3 tons.
Motor vehicles average 1¾ tons.

Form 3. "Final Consolidated Traffic Record."—The data noted are: Period (so many days of twelve hours, 7 a.m. to 7 p.m.), date, days of week, place, width of roadway between kerbs, effective traffic width (one yard less than full width), kind of pavement, quality of surface of pavement, condition of surface of pavement (wet, dry, dirty, clean), weather (rain, fog, dry, approximate temperature).

The table has eight designated spaces, one for each of six days, one for totals, and one for averages per day of twelve hours. The headings are: (1) and (2) Total number of vehicles (horse, motor), (3) total tons horse vehicles, (4) total tons motor vehicles, (5) total number all vehicles, (6) total tons all vehicles, (7) total vehicles per yard effective width, (8) total tons per yard effective width.

The Design and Construction of Breakwaters.

By FRANK L. SMITH.

Natural harbours are usually provided with a shelter in the form of headland, but where no shelters are available, as in the case of artificial harbours constructed on the open sea coast, breakwaters have to be constructed in order to provide protection for ships. The "fetch," or proximity of the nearest coast in the direction of prevalent winds, will determine the most advantageous position in which a breakwater should be erected. If protection from one direction only is needed, a single pier on roadstead breakwater running out from the shore will probably suffice. But if a larger area must be sheltered, two converging piers, with either one or two entrances, or a detached breakwater, will meet the case.

WAVE ACTION.

Waves break in a depth of water equal to their height, so that where sand banks or bars are formed at the entrance to a harbour the waves are reduced

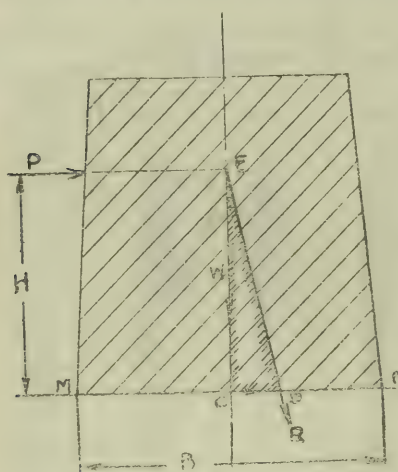


FIG. 1.

considerably in passing over them. The force which a wave can exert on a breakwater depends upon the size of the largest wave which can reach it, a force of as much as 3½ tons per square foot having been recorded in one instance; the force also varies as the sin.^{2} of the angle of incidence.

As an instance of the destructive action of the waves, it may be mentioned that at Genoa,* in 1898, during a severe storm, blocks of stone weighing 40 tons each were carried away a distance of 160 ft.

The forces acting on the breakwater consist of: (*a*) A direct horizontal force; (*b*) a vertically downward force due to the wave breaking either on top or on the back of the superstructure; (*c*) back draught; (*d*) a vertically upward force on any projection; horizontal projections should therefore be avoided. Due to these forces the wall may fail either by shearing or sliding along any joint, by crushing of the material at the joint, due to excessive compressive stress, or by overturning.

To determine the maximum force P which a breakwater will withstand at a given joint MN (Fig. 1), without tension at M, we have

$$\frac{W}{B} = \frac{6H}{B^2}, \text{ i.e., } P = \frac{WB}{6H},$$

the line R cutting within the middle third, for CD representing the force P to the same scale that EC represents the weight W.

In Fig. 2, let P = the total force per lineal foot of the wall, acting at a height H; let B = breadth of the wall and W the total weight of masonry per lineal foot (the weight of the volume of water displaced by the portion immersed).

Then to prevent overturning at A,

$$P \times H \text{ must be } < \frac{W \times B}{2}$$

* "Proceedings," Institution of Civil Engineers, Vol. 138, p. 349.

In the mound type of breakwater the weight in tons W of the face blocks which should be used in terms of the fetch F in miles is given by—

$$W = \cdot 3\sqrt{F}.$$

A rough rule for calculating the pressure exerted by the wave is as follows:—

$$P = \frac{Kw}{2g} A \left(V + v\right)^2$$

where K is a factor (1.46); w = 64 lb.; A = area exposed to the blow; V = the velocity of the wave, and v the velocity of a particle in the wave (= ⅓ V approximately) —*i.e.*:

$$P = 1{\cdot}46\, A\left(\frac{4V}{3}\right)^2$$

As regards the apparatus used for measuring the compressive force of the wave stroke, it may be said that no really satisfactory method has yet been devised, that at present used consisting in principle of a buffer compressing a spring, which registers automatically the force exerted on it.

Fig. 3 is a diagram showing the variation in stress over the base of a breakwater. Let W = superimposed load in lb., A the area exposed to this load, M the bending moment due to eccentric loading, then the stress

$$f = \frac{W}{A} \text{ and}$$

$$\frac{M}{I} = \frac{f_1}{y}, \text{ i.e., } f_1 = \frac{My}{I}$$

$$F = f \pm f_1 = \frac{W}{A} \pm \frac{My}{I}$$

Draw ABCD to represent the uniform stress on the base AB—*i.e.*, AD = f. Set off BN vertically downwards equal to $f + f_1$, and AM vertically upwards equal to $f_1 - f$. Joining MN, we get the variation in stress shown by the shaded portion, it being zero at G.

A rule for determining the height H of the waves in feet, in terms of the fetch F, which must not be less than 30 miles, is given by—

$$H = 1{\cdot}5\sqrt{F}.$$

The direction of the entrance channel should coincide with the direction of the largest waves if possible, and should be at least five vessels breadth—that is to say, the entrance channel should be made five times wider than the beam of the largest vessel which is likely to pass through it in the near future.

If the wave stroke is direct the piers should be curved, with convex faces opposed to the waves, and all concavities should be avoided.

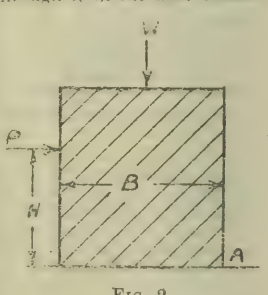


FIG. 2.

Breakwaters may be divided into three types: (1) The mound, (2) the composite type, and (3) the vertical pier, the particular type to be adopted depending upon the depth of water at the site, the nature of the sea bed, and the materials available in the locality which are required for its construction.

The mound type, as its name implies, consists of a mound of stones, usually protected by an apron of concrete, or of large concrete blocks tipped into the sea from barges or staging, and is provided with a roadway, sheltered from the seaward side by a vertical wall. Fig. 4 shows a section of the Kingstown breakwater, and Fig. 5 a plan, giving approximate dimensions. As the amount of stone required increases rapidly with the depth, it is obvious that this type of breakwater would only be adopted where the depth of water is not excessive, and where large quantities of stone could be obtained near at hand. It possesses an advantage in that no expensive appliances are required for its construction; but, on the other hand, on account of its comparatively small slope, it is impossible for ships to be moored against it, and extra stone has to be deposited from time to time to make up for wear.

The composite type is a combination of the mound and vertical types, and consists of a concrete or stone superstructure, mounted on a mound of stones, as shown in Fig. 6. It is adopted where the depth of sea is considerable, and, as in the case of the mound, where the bed of the river is somewhat irregular, and where there is no good natural foundation. It possesses an additional advantage in that it provides a quay for ships.

The mound should be left to settle for some time

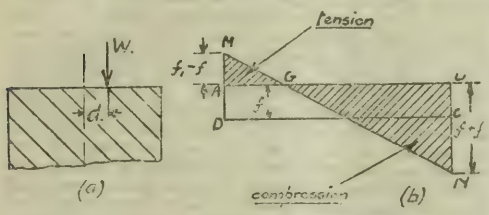


FIG. 3.

before the superstructure is erected, as otherwise the latter may tilt sideways, due to the unequal settling of the stones. This unequal settlement is sometimes allowed for by depositing the blocks for the superstructure in a series of unconnected rows, at an angle of from 65 deg. to 70 deg. with the horizontal, as illustrated in Fig. 7, the arrow shown pointing towards the harbour. Fascine mattresses are frequently used to prevent the stones from sinking. These consist of bundles of brushwood or willow bound together,

damage done to this pier during 1905-6 was caused by the undermining action of the waves.

The vertical type of breakwater is constructed entirely of concrete or stone, or of a combination of both, and requires considerably less material than either

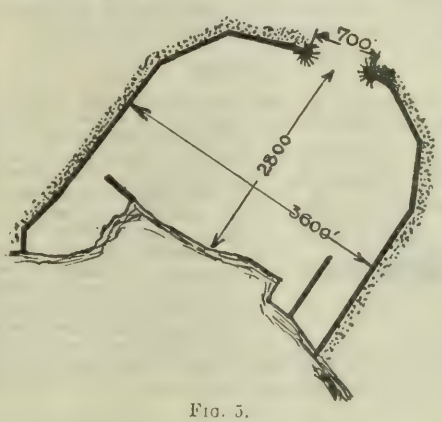


FIG. 5.

of the foregoing types, although its total cost is greater. If carefully constructed, however, it requires practically no expenditure for upkeep, and it is exceedingly strong; providing also, as in the composite type, a quay for ships, either for loading or unloading pur-

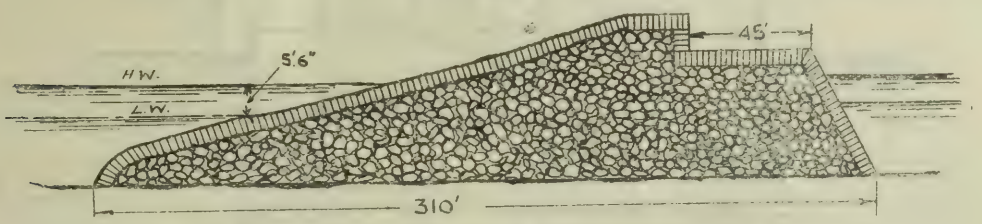


FIG. 4.—MOUND TYPE.

and fixed in position by stakes driven into the bed of the river. They project for some distance beyond the edge of the mound. Firm sand which is not covered by mattresses is capable of withstanding a load of from 2 to 3 tons per square foot.

Although the superstructure protects the top of the mound, it increases the recoil of the waves, due to

poses. The breakwater should be built up to such a height above high water (about 10 ft.) that vessels may be moored alongside. Fig. 8 illustrates a vertical breakwater, the subway shown being provided for the conveyance of pipe lines, &c.

The piers terminate in a head, which is generally of one of the four forms shown in Fig. 9, carrying a

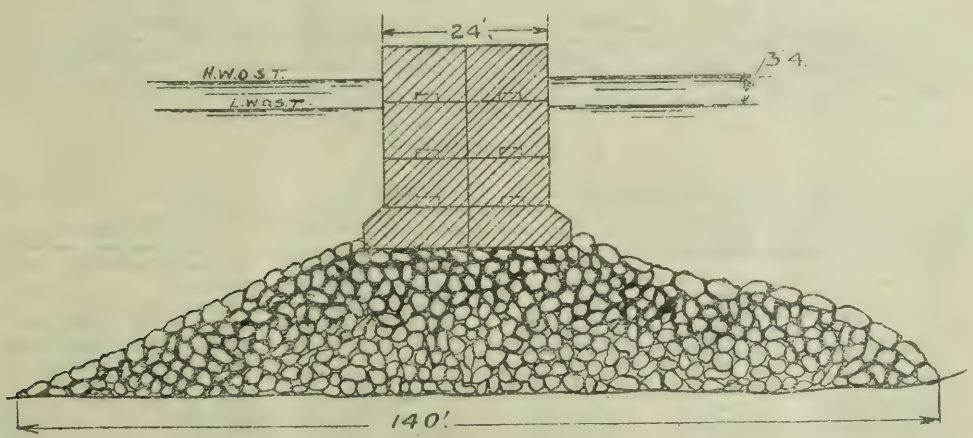


FIG. 6.

its perpendicularity, and is liable to be undermined on this account if the base is not adequately protected. Large concrete blocks or stones are usually placed round the base of the superstructure to effect this purpose, and the latter should commence at a depth of not less than 5 fathoms. A very interesting paper was read before the Institution of Civil Engineers (vol. 180, p. 133) on the "Reconstruction of the Tyne North Pier," in which it was stated that the

lighthouse and fog signal. Two lights are sometimes arranged so that when a vessel approaches them in a straight line it steers direct for the harbour entrance. At Kingstown Harbour there is a lighthouse on each pier, that on the east pier revolving, and being visible for a radius of 9 miles in clear weather.

CEMENT.

Results of tests of cement in sea water indicate

that the cement is improved if small proportions of natural are added to artificial cements.

Some natural cements give good results in frosty weather, but others are destroyed, and it is on this account advisable to put the concrete in position before freezing commences, and then protect it by means of packing.

CONCRETE.

Concrete may or may not be impervious to water; concrete which is not impervious to water is decomposed by sea water. This decomposition has been attributed to the presence of lime in the cement, which, by combination with the magnesium sulphate in the sea water, forms calcium sulphate, this being washed out. It is more probably due, however, to an insufficient quantity of water being used during the mixing of the concrete, and also to insufficient mixing. Providing, therefore, that the concrete is well mixed and the proper consistency is obtained, it will be found to be practically impermeable. At the same time, the proportion of lime in the cement should be comparatively small. Lime concretes should never be used in frosty weather.

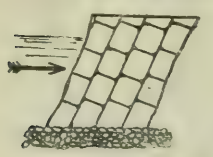


Fig. 7.

Shrinkage and Expansion at the End of Three Months after Mixing

Material.	Shrinkage when hardened in air (linear).	Expansion when hardened in water (linear).
Neat Portland cement	$\frac{1}{200}$ — $\frac{1}{400}$	$\frac{1}{400}$ — $\frac{1}{1000}$
1 part sand to 1 part cement	$\frac{1}{400}$ — $\frac{1}{1000}$	$\frac{1}{1000}$ — $\frac{1}{2000}$
3 parts ,, ,, ,,	$\frac{1}{600}$ — $\frac{1}{1500}$	$\frac{1}{2000}$ — $\frac{1}{5000}$

Concrete blocks are made in a yard close to the site, and vary in weight according to the facilities for making them. In constructing the wall at Dublin, foundation blocks weighing 350 tons each were used. These were constructed on staging running down into the water, and were afterwards placed in position by a floating derrick. The cost of the floating plant was about £19,000. Generally, however, blocks weighing from 20 to 40 tons each are used.

The concrete may be either machine or hand mixed, and in regard to the former method of mixing, many machines are described by Mr. J. S. Owens in his paper read before the Civil and Mechanical Engineers' Society on December 7, 1905.

In hand mixing, the stones, sand and cement are measured respectively in wooden frames containing no bottom, resting on a wooden platform, and the materials are laid one on top of the other in this order. They are now turned over dry three or four times, water is next added, and the mixture again turned over three times. The concrete is placed in timber moulds of the required size, which have previously been greased or coated with some preparation to prevent adhesion, and allowed to set for about two weeks. The frames are afterwards removed, and the blocks are left to harden in the open air for at least a month before being transferred to the site. Pieces of wood are inserted in suitable positions in the block as soon as it is placed in the mould, so that holes may be formed for lifting purposes. Concrete enclosed in jute sacks, weighing from 10 tons each upwards, have been introduced for the portions of the structure below low water, as they readily adapt themselves to an irregular bottom. Concrete in bags has also been used for protecting the upper surface of a rubble mound.

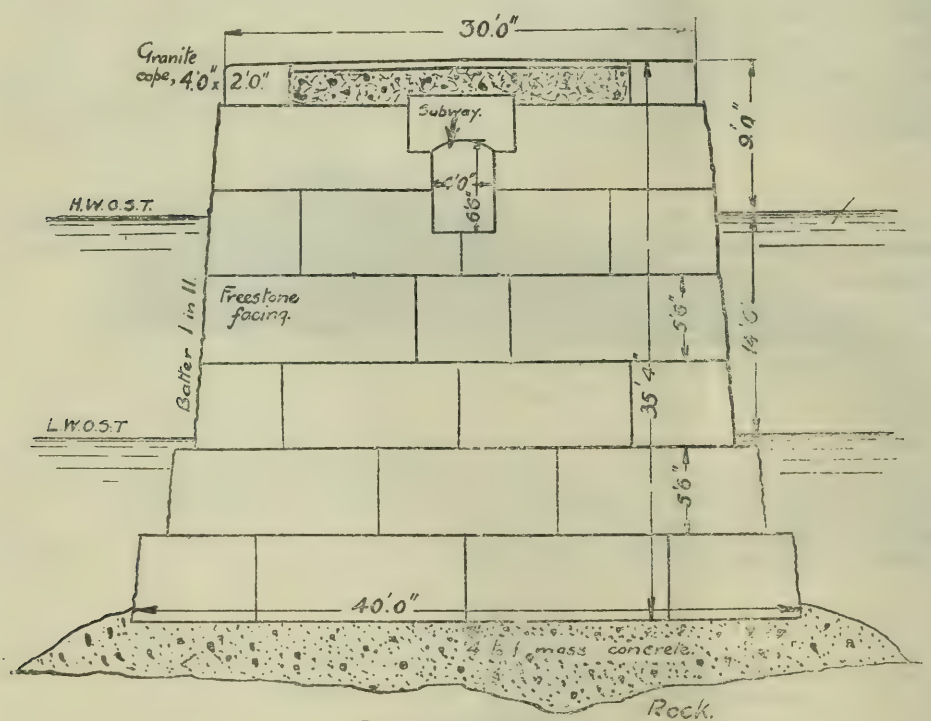


Fig. 8.—Vertical Type.

Three parts sand to 4 of shingle and 1 of Portland cement are the proportions often adopted for concrete in bags. For face blocks, 6 of aggregate to 1 of cement is a good proportion; these are very often formed of granolithic, consisting of finely broken granite and Portland cement.

Cement adheres more firmly to angular, rough, clean surfaces, and angular or jagged stones make a stronger concrete than smooth stones. These should be of such a size that they will pass through a 2-in. diameter ring. "Plums" or larger stones are very often placed in the concrete to save expense, and these should be placed at a distance of not less than 6 in. apart, and not less than 6 in. from the face of the block.

As regards the strength of concrete, results of a series of tests on blocks about two years old gave the following results:—

Concrete.	Average crushing load.
4 : 1	93 tons per square foot.
8 : 1	60 ,, ,,

FOUNDATIONS.

The question of foundations is an exceedingly im-

portant one, more especially when the bed of the river is composed of soft material, and when rock cannot be struck for some considerable depth. In such cases, steel cylinders or piles are driven to reach the rock: these are afterwards filled with concrete, and the weight of the breakwater transmitted to them in the usual way. When, however, the rock is not at too great a depth, timber piling is resorted to. If rock lies at the surface the wall may, of course, be erected upon it immediately, after having been levelled by divers.

CONVEYANCE OF BLOCKS.

The blocks are transferred to the site by means of a Goliath, and delivered to a Titan crane having an arm of from 60 to 80 ft. radius, which in turn lowers them into position. Caissons, or floating iron boxes, are often used for conveying the blocks to the site.

BOND.

To minimise the effects of any unequal settlement, thereby causing a part of the breakwater to sink, the blocks are interlocked by allowing projections on the under side of them to fit into grooves formed in the upper faces of those below. Another system of bond is to arrange apertures on the underside of each block, so that they will coincide with similar

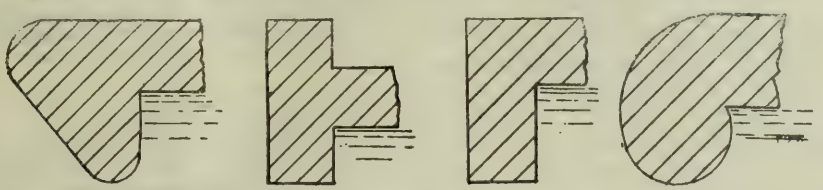


FIG. 9.—TYPES OF PIERHEADS.

apertures formed in the upper face of the one below, and when they are set in position the holes are filled up with concrete.

DIVING BELL.

Adding greatly to the divers' safety and ease of working, the diving bell is an interesting and indispensable part of the equipment for vertical breakwater construction. This appliance is capable of accommodating from one up to about fifteen divers, according to its size, and is constructed of steel plates riveted together and rendered perfectly watertight. The interior is equipped with tools and working shelves, and pipes communicate with the top of the bell for supplying fresh air and telephonic connection.

COST.

Turning next to the cost of breakwaters, it is impossible to give any general figures, as much depends upon individual conditions. Taking the cost of rubble stone as being 1s. 6d. per ton, the total cost of supplying stone and erecting the mound will be in the neighbourhood of 3s. per cubic yard; the material forming a protection for the mound will cost about twice this amount. Adopting these figures for a breakwater of this type, 250 ft. mean width and 50 ft. high, the cost per lineal foot works out at about £75. For concrete, either in mass or blocks, or for masonry, the cost may be about 20s. per cubic yard, or even more.

Business Announcement. — Mr. Herbert Haines, A.R.I.B.A., for the past twelve years with the firm of Messrs. J. Carter Jonas & Sons, land agents, surveyors and auctioneers, Cambridge and London, has opened offices at No. 117 Midland-road, Bedford.

Paris Street Improvements. — The *Times* Paris correspondent reports that the Municipal Council of the French capital on Saturday last adopted an important proposal for the extension of the Boulevard Haussmann across the Rue Taitbout, the Rue Lafitte, and the Rue le Peletier to the corner of the Rue Drouot, where it will join the Boulevard Montmartre and the Boulevard des Italiens. This extension is intended to relieve the Boulevard des Italiens and the Boulevard des Capucines from a portion of the heavy traffic to the Opéra, to the St. Lazare Station, and to the Etoile. The Prefect of the Seine will soon submit to the council details of other important alterations, which include the lengthening of the Rue de Rennes to the new bridge to be built across the Seine between the Pont des Arts and the Pont Neuf.

UPKEEP OF MAIN ROADS.

A PROPOSED NATIONAL CHARGE.

An important recommendation with reference to the upkeep of main roads is, the *Times* notes, made in a special report [347] just published by the Select Committee on Local Legislation.

There were referred to the committee all private Bills promoted by municipal and other local authorities by which it is proposed to create powers relating to police, sanitary, or other local government regulations in conflict with deviation from, or excess of, the provisions of the general law. Among the Bills considered was one promoted by the Keighley Corporation, which obtained powers to run trackless trolleys on specified routes, both within and beyond their boundaries. On district roads and county roads beyond the corporation boundaries it was provided that for widenings deemed necessary by the road authority, and approved by the Board of Trade, the corporation shall pay one-third of the cost, but shall not be required to contribute to the cost of widening a bridge or acquiring any building for the purpose of widening any road. Having regard to the particular circumstances of the locality, it was not thought right that the corporation be called on to contribute to repair of the roads outside their boundaries over which the trolleys will run.

The committee, after recording these decisions, say: "Your committee is of opinion, in view of what has taken place over the Bills promoted by the corporations of Keighley, Rotherham, and other bodies, that the time has arrived when an authority should be constituted to decide which roads should be the main roads of the country, and that the cost of their maintenance should be taken off the rates and put upon the taxes."

COUNTY OF MIDDLESEX LIGHT RAILWAYS AND TRAMWAYS.

The last bridge widening in connection with the above scheme will soon be completed, the work in question being across the main Great Northern Railway near Southgate Station, Friern Barnet. Altogether no fewer than thirty-three bridges have had to be either rebuilt, widened or strengthened, the cost averaging from about £20,000 to £3,000 per bridge.

Work has been in progress since 1903, and during that time an expenditure of about £2,000,000 has been entailed in carrying out the following—viz., the acquisition of something like 1,730 properties for road widenings; the construction of about 100 miles of tramway track; about 1 mile of heavy retaining walls (reinforced and otherwise); 153,500 lin. yds. of granite kerbing; 151,350 lin. yds. of granite channelling; 1,101,000 super. yds. of hardcore; 1,899,750 super. yds. of granite metalling; 167,400 yds. of footpath paving; 226,600 super. yds of gravelled footpaths; 500,800 super. yds. of wood paving; 30,450 super. yds. of granite-sett paving; 28,520 lin. yds. of sewers; 780 manholes and side entrances to sewers; 49,000 lin. yds. of gas mains (diverted and new); 38,000 water mains (diverted and new); 6,800 cables (diverted and new); 507,500 cub. yds. of concrete, and 990 500 cub. yds. of excavations.

The figures above given with the descriptions of works carried out are interesting, and show the variety of works that Mr. Wakelam, the county engineer of Middlesex, has been responsible for in connection with the undertaking, in addition to the ordinary work of the county, during the period of construction.

Institute of Sanitary Engineers. — The annual dinner of this institute will take place at the Holborn Restaurant on Monday, February 3rd, at 7 p.m.

CORRESPONDENCE.

For every ill beneath the sun
There is some remedy or none;
If there be one, resolve to find it;
If not, submit, and never mind it.
—ANON., *circa* 1843.

BACTERIA AND OTHER ORGANISMS.

To the Editor of THE SURVEYOR.

SIR,—In a leader in THE SURVEYOR of the 3rd inst. you mention the interesting question of useful work brought about by higher forms of life (than microbes).

I have always held the view that such larval life is most useful in breaking up organic matter in filters, and in my book on sewage purification I have said, "... it seems highly probable that higher forms of life—such as worms and larvæ of different kinds—play a much more important part in the breaking down of organic matter than has hitherto been attributed to them, and the subject is well worthy of more consideration than has been devoted to it." Whether these organisms do very much more than prepare, so to speak, the matter for microbial action may at present be doubtful, but they unquestionably do this much, and a very important work too. If, say, the carcase of a dead bird were unattended by burying beetles, &c., and antecedently to burial by flies, the processes of decomposition and oxidation would be very much slower than they are.

With regard to the Thysanuran *Podura aquatica*, mentioned in Mr. Bell's interesting report (which I have read), I suppose that there is no doubt that the eggs mentioned belonged to *P. aquatica*? My entomological knowledge is somewhat rusty now, but there are, I believe, several species of *Thysanura*, two at least of which are aquatic insects (*P. aquatica* and *Isotoma palustris*), while *Anurida maritima* is a creature extremely like *Aquatica* and lays eggs. Quoting from Mr. Bell's report, he says that he "has succeeded in separating the tiny colonies of globular cells or eggs of the *Podura*, and hatching same out in the incubator." *P. aquatica* is popularly supposed to lay no eggs, but to be viviparous and to have no metamorphoses! the young insects only being distinguishable from their parents by their smaller size.

I have frequently kept *Aquatica* with a view to working out its life history, but so far I have not had the leisure; it would, however, be exceedingly interesting to have it.

Is it possible that *Aquatica* is viviparous during certain months of the year, and later on, before the winter, deposits ova to tide over inclement weather? (Do not some of the aphides do this?) The mature *Aquatica* has no wings and cannot fly, the springing movements being derived from a two-pronged process lying under the tail, and extended suddenly for springing purposes; the mouth is provided with very "practicable" mandibles for eating purposes. The small white bran-like scums often seen on percolating filters are the remnants of the cast-off skins of *Podura*.

With regard to *Psychoda sexpunctata*, another of the commonest of the insects frequenting sewage works, the life history has been worked out—I think by Mr. Miall.—Yours, &c.,

G. BERTRAM KERSHAW.

West Wickham,
Kent.
January 7, 1912.

BITUMINOUS MATERIALS.

To the Editor of THE SURVEYOR.

SIR,—I have read with some interest the correspondence on the nomenclature of bituminous materials. To the writer it seemed from the first that there should be no difficulty in dealing with the matter; it was obvious that there were natural bitumens and artificial bitumens, natural asphalts and artificial asphalts, and there it should end. If a natural bitumen requires defining it should be that it applies to "all bitumens found in a native state which are not treated by any process involving the removal of bituminous or other oils." Artificial bitumens would be "all bitumens that are artificially produced, such as tars, residual from oils, &c." Natural asphalt would be "the material that is naturally formed sufficiently impregnated with bitumen only to require breaking up, heating and mixing to enable it to be laid in its required position." Artificial asphalts are those "asphalts that are synthetically made, such as that laid on the Thames Embankment, &c."

The letter of "Original" gives a very exhaustive exposition, and ably clears up any doubts on the subject.

Mr. Dussek would like to contend that Trinidad Lake bitumen is an asphalt simply because the Trinidad Government is pleased to call it by that name. (Is it not the fact that it is called "pitch," and the lake the "Pitch Lake"?) "Asphalt" is simply a "concrete"; it is called asphalt because it is a composition of material bound together with bitumen in the same manner that concrete is a term that is used for a composition of materials bound together by cement. Probably the Trinidad Government called the material from the lake by the name "asphalt" because it was a bitumen peculiarly fitted for the manufacture of asphalt. If the time has come for a revision of the names, then this misnamed "asphalt" should have its proper name of "bitumen." Mr. Nathan's suggestions are out of court altogether. Imagine any engineer talking about 'asphalt" while his *vis-a-vis* had "asphalte" in his mind.

By the method indicated above the road engineer, if he requires a natural bitumen, so specifies the material, and similarly if he requires an artificially made bitumen. If he asks for asphalte or asphalt or asphaltum (let them all have the same meaning as they etymologically have), then he can be satisfied with the natural rock asphalt or the artificial asphalt or mastic asphalt, whichever pleases him—no one is misled as to what is wanted or specified.—Yours, &c.,

FRANCIS WOOD.

Town Hall,
Fulham.
January 3, 1913.

RAIL CORRUGATION.

To the Editor of THE SURVEYOR.

SIR,—Referring to Mr. Howard-Smith's letter in your issue of the 3rd inst., the Sheffield Corporation have not been using No. 1 B.S.S. rails, weight 90 lb. per yard, but the heaviest section quoted by Mr. Howard-Smith in his letter—viz., B.S.S. No. 5, weight 119 lb. per yard—and many of these rails have split, during fishing, in the manner stated by me.

I note Mr. Howard-Smith says that 80 per cent of the tram rails rolled in this country are now of British Standard Sections. At the same time he will, no doubt, be aware that Leeds, Liverpool and Sheffield have recently adopted sections of their own, which are not Standard Sections.

The rail now used in Sheffield weighs 120 lb. per yard, and it is a mistake to say that we are using a rail 30 lb. heavier than the B.S.S.

Whether the mistake was made by me in the course of my remarks or by your reporter I will not venture to say, but there are two or three points in the report which require correction, and it seemed to me better to wait for the proof which is usually submitted to speakers before their remarks are printed in the official proceedings of the institution rather than communicate with every journal which reported what I said.

I am sorry Mr. Howard-Smith has been misled.—Yours, &c.,

W. J. HADFIELD.

Town Hall,
Sheffield.
January 7, 1913.

THE DISPOSAL OF HOUSE REFUSE.

To the Editor of THE SURVEYOR.

SIR,—On behalf of engineers who are wearing out their brains unnecessarily, I venture to suggest that you give up a page of your interesting journal to female contributors. Women have brilliant ideas—sometimes, and *very often* think of things that are overlooked by men *because such things are so simple.*

Thanks to THE SURVEYOR, I know quite a lot about sewage disposal, refuse destructors, and such things. I know that refuse destructors are desirable for getting rid of the large quantities of waste material that come from markets and shops, but *house* refuse can so easily be destroyed at home, thereby doing away with those evil-smelling receptacles usually called "ash-bins." My "ash-bin" has never held anything but ashes. My 'kitchen stuff" is burned after each meal. Empty tins are taken to the brickworks once a week (I do not know what they are used for) by a man who considers himself well repaid for the trouble by the gift of all bottles, jam pots and waste paper.

It is some satisfaction to feel that the world is not

less clean, nor more sordid, because oneself is living in it.

Servants usually object to the burning at home at first, but they very soon admit that it is much less trouble than the other way.

Why bother to think of ingenious ways of consuming house refuse before the most obvious and the cleanest has been tried?

Why should not municipalities offer a reduction of rates to those who burn their own stuff? If the householder gave to his servants the money that was so deducted I think we should see fewer of those disgusting carts that so often annoy us; and he (the householder) would breathe purer air, and have no hideous spots within his own gates.—Yours, &c.,

AN ESSEX HOUSEWIFE.

December 17, 1912.

To the Editor of THE SURVEYOR.

SIR,—I shall be glad to hear through the medium of your valuable journal from any surveyor or sanitary inspector in borough or urban districts of not more than 12,000 population where by-laws have been adopted under the Public Health Acts Amendment Act, 1890, sec. 26 (2), for the removal of house refuse.—Yours, &c.,

W. BEVAN.

Council Chambers,
Haverfordwest.
January 7, 1913.

To the Editor of THE SURVEYOR.

SIR,—It may perhaps interest you to know that within three days of the appearance of your notice of my dustbin (referred to by me before the Institute of Sanitary Engineers) I had quite a number of inquiries from borough engineers and others. With best thanks, yours, &c.,

J. O. NEUMANN.

62 Selwyn-avenue,
Richmond, Surrey.
January 7, 1912.

COLUMBIA UNIVERSITY HIGHWAY ENGINEERING COURSE.

The "announcement" dealing with instruction in highway engineering at Columbia University in the City of New York includes a description of the equipment of the laboratories, and other information as to the course itself and the allied subjects studied at the same time. As indicating the present tendency to interleave practical and theoretical work the following "general statement" is of interest:—

"The graduate work in highway engineering and allied subjects leading to the degree of Master of Arts has been arranged especially for men engaged in the practice of highway engineering. The courses are given only during the months from December to March, inclusive, which period is equivalent to one half-year. This plan affords the highway engineers, especially first, second and third year graduates, an opportunity to obtain advanced knowledge during the season of the year when a leave of absence may be easily obtained. Since a residence of one academic year is required of candidates for the Master's degree, it will be necessary for graduate students in highway engineering to be in residence during two winter periods. This plan has the enthusiastic support of many of the foremost highway officials and engineers in the United States. On account of the international movement for the improvement of highways, many positions have been created which should be filled by men with special training. These positions occur in the following well-defined fields: The highway departments of municipalities and towns; those of states, counties and parks; the engineering organisations of contractors, and the engineering and sales departments of companies dealing in materials and machinery used in highway work."

Sewage Disposal in the United Kingdom (By Henry Lemmoin-Cannon, P.A.S.I. Price 7s. 6d. London: St. Bride's Press, Limited, 24 Bride-lane, E.C.) . . . gives a concise but comprehensive outline of the present position with regard to the question of sewage disposal. The main portions of the book are wholly of present-day interest, and it contains a great deal of information of practical value to students, engineers and surveyors.—*Glasgow Herald.*

INTERNATIONAL ROAD CONGRESS AND EXHIBITION.

Although several months have still to elapse before the opening of the Road Exhibition in the Royal Horticultural Hall, the preliminary arrangements have all been completed, and over half the available stands have been already applied for. The exhibition will be attended by representatives of highway authorities from all parts of the world. It will be unique in its character, and will bring together for the first time a representative exhibition of road-making materials and appliances, including heavy road machinery.

The organisation of the exhibition is in the hands of a committee of which the Right Hon. Earl Beauchamp, K.C.M.G., is president. Other members of the committee are Sir Maurice Fitzmaurice, C.M.G., Colonel R. E. Crompton, C.B., Messrs. Alfred Dryland, Howard Humphreys, T. Richards, Wallace E. Riche, Gibson Thompson, J. Walker Smith, John Willmot and Rees Jeffreys. The hon. secretary is Mr. H. P. Maybury, and the assistant secretary and manager Captain L. A. Kingston. The Exhibition Committee is assisted by an Advisory Committee of traders and exhibitors. The members of this committee are Messrs. H. Pitts (chairman), H. Beadle, H. D. Blake, F. E. Bristowe, E. B. Chittenden, D. G. Comyn, W. Penrose Green, F. W. Manuelle and H. L. Wettern.

The following table shows the position of the letting of stands at the present time. It is to be regretted that the limitations of space will preclude all the firms who desire to do so from exhibiting.

No. of stands.	In hall.	In machinery section.
Let	26	7
Under negotiation	14	6
Reserved for foreign exhibitors .	10	4
Unlet	16	8
Total	66	25
Grand total	91	

Among the exhibitors in the Horticultural Hall (for small exhibits) will be found Messrs. J. & P. Hill, Galloways, Limited, the Anglo-Mexican Petroleum Products Company, Limited, the Limmer Asphalte Company, Limited, Taroads, Limited, the Neuchatel Asphalte Paving Company, Limited, Roadamant, Limited, Tarmac, Limited, the Gas, Light and Coke Company, Limited, Rocmac, Limited, Roadite, Limited, the Canadian Mineral Rubber Company, Limited, the Enderby and Stoney Stanton Granite Company, Limited, F. E. Bristowe & Co., Krupka & Jacoby, Ellis & Everard, Iliffe & Sons, J. Hutchinson, Crompton & Co., Good Roads, Roads Improvement Association and THE SURVEYOR, &c.

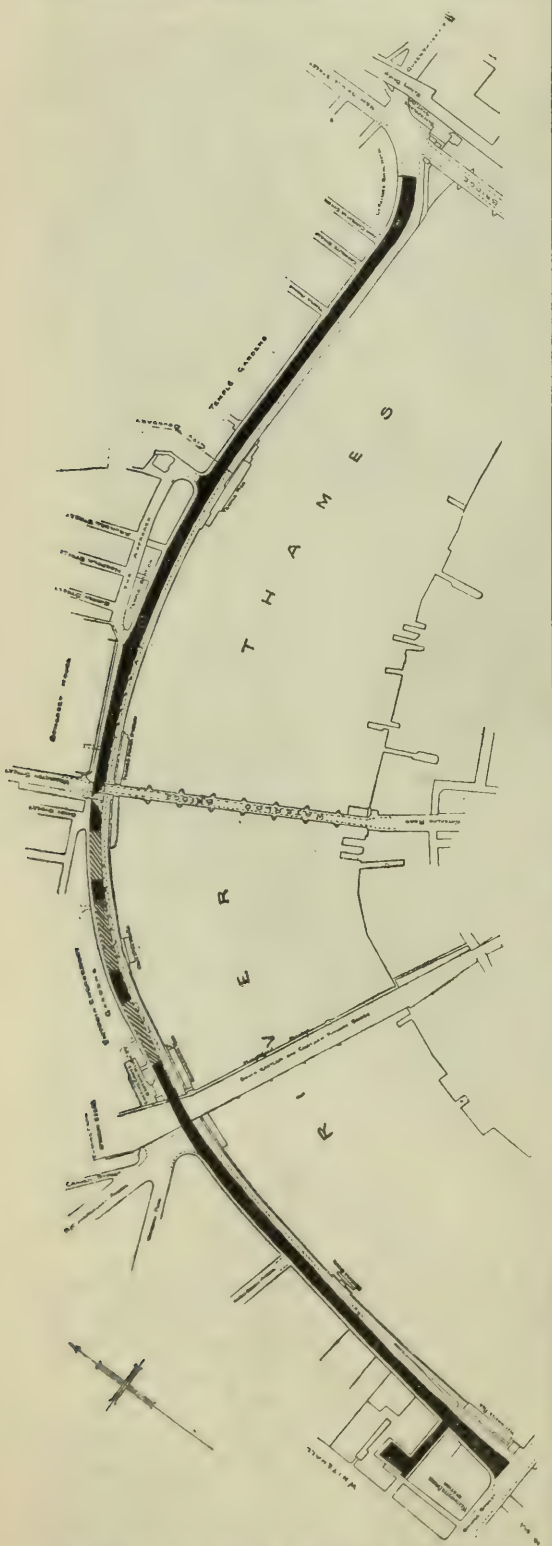
The exterior section of the exhibition, which will be held on a piece of ground close to the hall, will be devoted to heavy machinery, and for the convenience of stall holders will be completely roofed over. Arrangements have been made to allow exhibitors to give practical demonstrations and to show their machines at work. The firms of Messrs. Aveling & Porter, Barford & Perkins, T. Green & Sons, Mann's Patent Steam Wagon Company, Limited, Yorkshire Steam Wagon Company, Limited, and Eckhard, Limited, have already selected stands, and a number of others are under consideration.

The exhibition will be open daily from 9 a.m. to 8 p.m. to members of the congress and their friends, and in view of the fact that the meetings of the congress will take place in close proximity to the hall, the exhibition will form a rendezvous for informal discussions. Afternoon tea will be provided at the exhibition for members of the congress immediately after the formal meetings have been concluded.

The Executive Committee will be glad to welcome any offers of assistance, and at present the matter of laying out the footpath of the exterior section is under consideration. The paths, which are of the width of 12 ft. throughout, and cover some 750 sq. yds., could be apportioned in sections to road surfacing and other firms who desire to make a display of their various specialities in paving. Applications for further particulars can be obtained from Mr. W. Rees Jeffreys, hon. secretary, Local Organising Committee of the International Road Congress (London, 1913), 72 Queen Anne's Chambers, Westminster, S.W.

VICTORIA EMBANKMENT PAVING.

In the accompanying plan of the Victoria Embankment the blacked-in portions of the roadway indicate the sections of asphalt pavement, amounting to



29,580 sq. yds., laid by the Trinidad Lake Asphalt Paving Company, Limited, London. The remaining areas, totalling 4,091 sq. yds., and shown by hatching, were the work of another firm.

THE ROAD BOARD.

GRANTS TO HIGHWAY AUTHORITIES: NINTH LIST.

During the months of October, November and December last the Road Board, with the approval of the Treasury, made advances amounting to £82,722 from the Road Improvement Fund to county councils and other highway authorities as follows:—

	£
For road crust improvements	73,409
For road widenings and improvement of curves and corners	3,753
For road diversions	2,553
For reconstruction and improvement of bridges	3,007
For construction of new roads and bridges...	—

The total grants, after deducting grants cancelled, up to December 31, 1912, are as follows:—

	£
For road crust improvements	735,314
For road widenings and improvement of curves and corners	78,959
For road diversions	23,759
For reconstruction and improvement of bridges	39,482
For construction of new roads and bridges...	16,078

Advances by way of loan have also been arranged to the sum of £124,632.

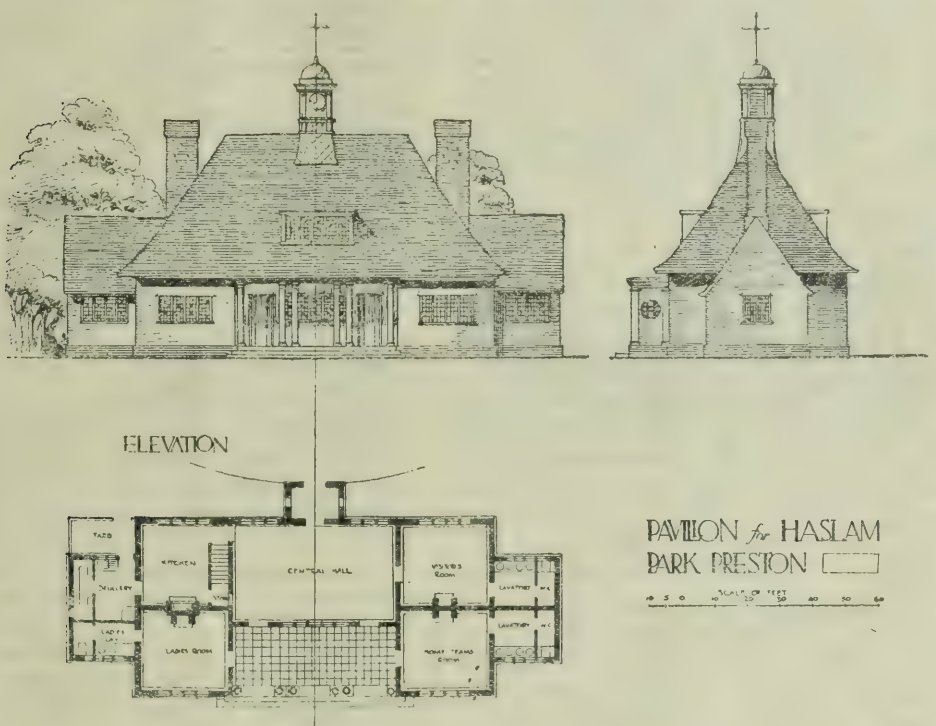
Authority.	Improvement of road crusts.	Widenings, corners and diversions.	New roads and bridges and reconstruction of bridges	Total.
	£	£	£	£
Bedford C.C.	3,705	—	—	3,705
Cheshire C.C.	—	—	1,250	1,250
Cornwall C.C.	1,543	—	—	1,543
Devon C.C.	13,621	—	—	13,621
Essex C.C.	300	—	—	300
Gloucester C.C.	700	—	—	700
Hertford C.C.	2,227	—	650	2,877
Isle of Wight (St. Helens U.D.C.)	174	—	—	174
Lancashire C.C.	6,840	—	—	6,840
Leicester C.C.	—	3,102	828	3,930
Middlesex (Edmonton U.D.C.)	—	900	—	900
Northumberland C.C.	1,575	—	—	1,575
Nottingham C.C.	—	277	—	277
Rutland C.C.	450	—	—	450
Somerset C.C.	137	—	—	137
Stafford C.C.	200	—	—	200
Stoke Newington (Metropolitan Borough)	1,000	—	—	1,000
Sussex (East) C.C.	11,750	200	—	11,950
Westmorland C.C.	—	50	—	50
Yorkshire (West Riding) C.C.	2,587	—	—	2,587
WALES.				
Anglesey C.C.	13	—	—	13
Carmarthen C.C.	901	—	—	901
Carnarvon C.C....	800	870	—	1,670
Denbigh C.C.	—	225	—	225
Montgomery C.C.	261	—	—	261
Pembroke C.C.	500	—	—	500
Radnor C.C.	—	20	—	20
SCOTLAND.				
Argyllshire C.C. (Cowal Dist.)	486	352	279	1,117
,, (Lorn Dist.)	790	—	—	790
Ayrshire C.C. (Ayr Dist.)	887	—	—	887
,, (Kilmarnock Dist.)	1,260	—	—	1,260
,, (Northern Dist.)	1,094	—	—	1,094
Fife C.C. (St. Andrew's Dist.)	438	—	—	438
Forfar C.C. (Forfar Dist.)	475	—	—	475
Grangemouth T.C. (Stirlingshire)	100	—	—	100
Kirkcudbright C.C. (Eastern Dist.)	620	—	—	620
,, (Southern Dist.)	527	—	—	527
,, (Western Dist.)	789	—	—	789
Peebles-shire C.C.	148	150	—	298
Selkirk C.C.	—	52	—	52
Wigtownshire C.C. (Machars Dist.)	375	—	—	375
,, (Rhins Dist.)	327	—	—	327
IRELAND.				
Antrim C.C.	2,885	108	—	2,993
Down C.C.	677	—	—	677
Dublin C.C.	200	—	—	200
Kerry C.C.	7,197	—	—	7,197
Kilkenny C.C.	1,750	—	—	1,750
Meath C.C.	1,000	—	—	1,000
Roscommon C.C.	1,400	—	—	1,400
Waterford C.C.	700	—	—	700

In addition further advances amounting in the aggregate to about £1,467,504 have been indicated to highway authorities towards works of road improvement of which the details are still under consideration and discussion.

The Laying Out of Public Parks.

MR. THOMAS MAWSON'S REPORT TO PRESTON CORPORATION.

Of all English towns, Preston, says Mr. Thomas H. Mawson, the well-known garden architect, in a report to the corporation of that town regarding the laying out of Haslam Park, is the most fortunate in its possession of an entrance approach which Nature, art, and even the railway companies have conspired to make incomparably beautiful. In his recently published work, "Civic Art," this quality has been thus referred to: "The singularly beautiful approach to Preston from the south, with its carefully preserved river bank, and its fine park crossed by railways splendidly screened by trees, and their miles of embankments relieved by carefully arranged plantations, is almost a classic example of what can be done under the most difficult conditions. The success of this work should prove an incentive to other towns to co-operate with the railway companies to secure parkways alongside the railway approaches to their towns or cities. In no other department of civic activity is there such opportunity for beautifying their town as is here provided."



Mr. Mawson suggests that the excellent work should be maintained, and the exceptional opportunity which the munificence of Miss Haslam has created grasped and made the most of. Not only, he adds, is Preston exceptionally fortunate in its parks, but there exists already almost all the material for one of those connected rings of parkland round the town which make so many Continental cities delightful, as, for example, the Ringstrasse at Vienna. In the course of further remarks, Mr. Mawson says that what he particularly wishes to impress upon the authorities of Preston is the necessity for regarding Haslam Park not as a unit, but as part of a larger park system which some day may be completed by the provision of connecting parkways.

While complete in itself, a park should also be a feature of the town plan, and this consideration has had some influence on the design for Haslam Park which he has submitted.

Apart from the pleasant drives and promenades thus provided, Mr. Mawson points out that one of the attractions of a series of parks is that each presents some unique features. "Sometimes Nature provides these or gives the incentive to the design; it is so in Preston. Thus, beginning with the cricket fields, you have the quiet flats, which in turn give place to the beautiful undulating lawns and knolls in Miller and Avenham Parks, so cleverly planted by the late Edward Milner, and his even more famous son, the late Ernest Milner, to accord with the elevated group of old trees in which the park ends. In Moor Park the keynote is expansive playing fields, suggesting a fine lung to your town. Here there is little beyond the lime avenue to indicate the artificial lay-out, trees which are indigenous to England being planted in large masses. Those of foreign origin, shrubberies, and ornamental flower gardens are merely introduced at one or two convenient points to give a touch of colour and richness."

Mr. Mawson insists that before a park or garden scheme can be successfully designed, its author must consider what are the existing features which add to its interest, also those which detract from it. In Haslam Park, he observes, the work already carried out has decided its landscape character, which will approximate to that of Moor Park. Here is the same lime avenue, and the same treatment of playing fields. In principle this is to be commended, and in his design he has accepted what has been done. He thinks, however, he has recognised certain opportunities, which, though not great enough completely to change the character of the park, will, nevertheless, give a distinctive interest to it.

In Haslam Park there are fine open views into well-wooded country which must be retained. In other directions there are factories and residential areas which need screening by new plantations. In addition, there are large areas of adjoining building land which may or may not ultimately be developed so as to enhance the appearance of the park. The writer of the report regrets that his instructions did not include the planning of these areas, for he believes that this more comprehensive scheme would have proved distinctly advantageous to adjoining owners, and at the same time would have secured to the park visitors a more harmonious composition than is now possible. He adds: "In no department of town development is there such lack of imagina-

tion as in the laying out of residential areas. This is particularly noticeable in the vicinity of public parks."

The report continues: "An exceptional opportunity is provided by the stream which runs through the park, which, even during a phenomenally dry summer that has been experienced, has given a constant supply of fairly clean water, sufficient to form a boating pond of considerable extent. The levels of the ground, the fall of the stream from end to end, and the nature of the soil and subsoil, make such a lake a sound proposal, which by the hire of boats would probably earn interest on the outlay, or at least provide a considerable sum annually towards maintenance. In the original plan the park boundary was, I am informed, intended to follow the stream, whereas in my design I have considered it wise to advise the enclosure of an additional 9¼ acres for the purpose of securing a larger water area, and, what is most essential, a forest-like background of trees."

Referring to the park in detail Mr. Mawson says: "Starting with the main avenue, I suggest that a double line of limes be planted as in Moor Park. The present weakness of this avenue is that it has no proper termination at the west end. I suggest that this feature could be most quickly and simply attained by a suitable pair of high-gate piers, with wing walls on either side, or, better still, by a gate-house with an arched opening for the entrance. To gain a proper effect, this feature would have to be set well back into the park in order to bring the entrance gates on to the level of the avenue. It would thus be approached . . . by a flight of spreading steps, which would add a pleasing feature to the design. . . . The wriggling line of plantation adjoining the railway is rather irritating as at present arranged, and I therefore propose to straighten the outline, giving whatever variety is needed by an arrangement of shrubs, which should, for the most part, be evergreens such as broad-leaved hollies.

"On the playing-field side of the avenue, and about equidistant between the two entrances, I suggest a shelter pavilion, which should be simply but none the less architecturally treated, and provide, in addition to a shelter, good dressing-rooms and conveniences. In the sketch here illustrated the accommodation provided is as follows: Porch, 7 ft. by 4 ft. 6 in.; central hall, 25 ft. by 15 ft.; open verandah, facing playing field, 24 ft. 6 in. by 11 ft.; separate rooms for visiting and home teams, each 13 ft. 6 in. by 12 ft., with good lavatory accommodation attached. A ladies' room is provided on the opposite side, with conveniences; also a kitchen and scullery for the supply of refreshments; while in the roof are two good bedrooms for the use of the caretaker. On the opposite side of the avenue, but on the centre axis of the shelter, I propose to re-erect the drinking fountain.

"The playing fields, which would be improved by the removal of the existing roadway, would gain in shape by the masses of trees arranged in outline along the northern side and by the supporting masses of foliage at each end, but otherwise the ground would be left in its present condition, excepting where drainage, filling or seeding are required to provide cricket pitches and playing grounds. . . . The position of the south-east entrance and the drive immediately within the park gives an excellent axial line, on each side of which are arranged children's playgrounds, bowling greens, band-tand and tennis lawns. There is also on the east side of the first bend a space large enough for an excellent hockey ground. This arrangement allows of economical working and control.

"Nothing gives a cheaper appearance to a park than a bandstand of spidery, ornamental cast iron, and I suggest that the design of this feature should be based upon a classic model, and be constructed in oak . . . or of stone and wood."

With regard to the lake the report states that its margins would be undulating, and planted with aquatic and semi-aquatic plants, and with trees and shrubs of suitable growth, to secure varied and picturesque reflections. The plantations would, as a rule, be arranged with a view to producing English woodland effects. The trees it is proposed to plant are those which are known to succeed in the district, while shrubs would be planted as a foreground to the large trees, and to form groups on the mounds round the lake. Most of these groups would consist of both deciduous and evergreen flowering varieties planted in large masses.

The walks are in every case arranged to secure variety of park vistas, and particularly the view across the lake, and they would follow easy gradients and be of ample width for a public park.

Mr. Mawson's estimate as originally submitted did not provide for the completion of the main avenue or the work of road making outside the main entrance; nor did it include for any drainage over the playing fields or the boundary fences, but a supplementary estimate is included in the report, sufficient, it is suggested, to permit of the completion of that part of the work undertaken by the parks superintendent.

	£	s.	d.
Forming new paths and roads ...	1,819	2	6
Manholes	20	0	0
Excavation of lake, puddling and formation of banks	1,363	0	8
Grading, levelling, trenching, and resoiling spaces to be planted with forest trees and shrubs ...	891	0	0
Forming bowling-greens, tennis-grounds, and flower-beds round bandstand; forming other lawns, returfing or sowing down with grass seed	940	0	0
Allow for rockwork	200	0	0
Plantations	841	12	6
Bridges	426	0	0
Boat landing and boat house ...	225	0	0
Children's playing ground, not including any fixtures	156	13	0
Two new entrances near children's playgrounds and opposite Bostocks' Farm	220	0	0
Bandstand	560	0	0
New entrance at the end of Lime-avenue, steps, piers, and wing walls only	250	16	0
Pavilion shelter in centre of avenue, in wood, with brick base as per plan	720	0	0
Allow for clock turret	100	0	0
Conveniences	80	0	0
Conveniences, in children's playgrounds	240	0	0
*Relaying 300 yds. of sewer to allow of lake	300	0	0
4,620 yds. completing and rolling existing area of avenue	519	15	0
Provisional sum for completion outside of entrances	30	0	0
Extra gravelled space in front of pavilion, and in the circle at the end of avenue	115	0	0
†14,648 yds. lm. of 3-in. and 4-in. land drains connected to existing mains laid by borough surveyor ...	549	5	9
Extra for connection to walks and lake, and for contingencies ...	80	0	0
	£10,647	5	5

In a concluding passage Mr. Mawson says: "Unlike most other work, it is not possible to design a public park with any attempt at finality. It has been said that garden making is the only art in which the fully attained result may greatly surpass the original conception. This added effect is secured not only because the design owes much to Nature's efforts to assert herself, as by the intelligent interpretation which the person in charge of the actual oversight of the work brings to bear on the designer's intentions as explained by the plans. For this reason, if my recommendations are adopted, I would like to see the work carried out under a foreman who has received his training under my direction. The benefits of such a course would be incalculable."

Bromsgrove Rural Council Summoned.—At Redditch Petty Sessions, recently, the Bromsgrove Rural District Council was summoned, upon information laid by Mr. Oliver George Goodman, of Alvechurch, for allowing part of the highway in the parish of Alvechurch to be out of repair for a space of 400 yds. Mr. H. D. Holloway (clerk) appeared on behalf of the council, and admitted that the road was not in a proper state of repair. The bench adjourned the case for a fortnight, and deputed two magistrates to visit the road in the meantime, in company with Mr. Holloway, to see that the repairing work required had been properly carried out.

* This is a provisional sum which may not be spent. It may be possible to form a concrete jacket or covering over the existing line of pipes.

† In measuring up the quantity of land drains required, the drains have been equally distributed over the site, but in carrying out the work it may be advisable to adjust them to the nature of the soil, placing the "herring-bones" closer together in some parts, and omitting them in others where the subsoil is dry.

Some Recent Publications.*

Hazell's Annual, 1913. Edited by Hammond Hall. Price 3s. 6d. nett. London: Hazell, Watson & Viney, Limited.

Our old friend Hazell's Annual turns up as usual at Christmas time to present us with a connected story of the events of the past year, and a guide to the questions likely to come to the fore in 1913. The story of the Balkan War is brought down to the armistice of Tchataldja, and is illustrated by a map which has the advantage of having been drawn after the victorious progress of the allied armies, and of showing, therefore, all the place-names mentioned in the narative. Maps illustrate also special articles on the Panama Canal, the Marconi Agreement, and the proposed Trans-Persian railway to India. Our naval and military forces and the forces of the Dominions are dealt with at length, and are lucidly compared with those of foreign countries. The points of the political, social and religious movements of the day are presented with a clearness which renders them intelligible to anyone, while the interests of scientific, artistic, literary and sporting tastes are catered for as fully as usual. Some idea of the extraordinary extent and variety of the information compressed into this indispensable volume may be conveyed by the statement that its index fills thirty-four pages and contains about 7,000 references.

The Law Relating to Highways. By H. Hampton Copnall, solicitor, clerk of the Notts County Council, author of "The Law Relating to Locomotives on Highways," "The Law Relating to Infectious Diseases and Hospitals," &c. &c. (Second Edition). Price 21s. nett. London: Charles Knight & Co., Limited.

The first edition of this work was published in 1905, since which date there have been a great number of decided cases, determining many practical points of highway law and administration. The present edition has been rearranged and much of it re-written, and the whole has been brought up to date. The breaking up of the chapters into concise paragraphs, each with its own headline, is an excellent arrangement, and adds greatly to the utility of the work. Every branch of this comprehensive subject is treated fully, and at the same time with admirable conciseness, and no practical detail is lacking. For instance, in the chapter on motor cars are given tables of maximum weights and the index marks of the various registering authorities. The appendix contains an epitome of enactments and orders relating to highway administration, commencing with a clause of Magna Charta. The book should prove indispensable to highway officials, and to all who are interested in highway matters.

Who's Who, 1913. Price 15s. nett. London: A. & C. Black.

This indispensable annual is modestly described on the title page as a biographical dictionary. Such a description, though, of course, it has the merit of mere accuracy, is far too colourless to convey any notion of the friendly feeling with which this wonderful compilation is regarded by its host of readers. The marvel is that year by year we have a repetition of the announcement that "the number of biographies included has been increased." The consequence is that this, the sixty-fifth annual issue, contains 25,000 biographies and no fewer than 2 226 pages. We know of no book of reference which exceeds this in completeness and accuracy, while it is unique in the fact that whenever it is consulted the reader is led on by sheer interest to read many pages which are not concerned with the subject of his original search. We can only say that this year's issue makes a further advance in excellence on its predecessors.

The Englishwoman's Year Book and Directory, 1913. Edited by G. E. Mitton. Price 2s. 6d. nett. London: A. & C. Black.

This annual contains a really wonderful amount of information in regard to everything which concerns the modern woman, including education, employments and professions, literature, art, music, charities, and a host of other matters. It is divided into two parts—one including education, professions and social life, and the other being mainly devoted to philanthropic work. The editor has had the assistance of many experts, and the result is a book which no woman who desires to take her part in the political, social, philanthropic or educational life of the day can afford to ignore.

Whitaker's Peerage, Baronetage, Knightage and Companionage for 1913. Price 5s. nett.

This is the seventeenth annual issue of Whitaker's Peerage, which is the cheapest work of its kind. Its alphabetical arrangement renders reference very easy—an important point in such a book. The directory proper is preceded by a very full introduction of over 100 pages, containing *inter alia* a dissertation on the peerage and its degrees, and an official glossary of the terms used in the book. It is claimed that "Whitaker" has a circulation which exceeds that of all other peerages combined, and this fact combined with its low price justifies the appellation of "Popular" which has been applied to it.

The International Whitaker. Price 2s. nett.

This is an entirely new book issued by the proprietors of Whitaker's Almanack, and containing information which may be specially interesting to Englishmen throughout the world. The book aims at providing information concerning every country in one compact, handy and inexpensive volume. It has already been well received, the first issue having been exhausted. In our view the new work has come to stay, and will rapidly establish for itself a position analogous to that which "Whitaker" has attained in the British Isles.

The January issue of *Concrete and Constructional Engineering* contains a strong indictment of the London County Council in respect of that body's neglect of London's fire dangers, and the non-administration of the ample powers the council possesses to remedy this grave menace to the safety of life and property. Attention is drawn to the fact that at the present moment there are roughly some 93,000 buildings which have now been awaiting the council's attention for the past seven years. Suggestions are put forward showing how this evil may be remedied without great expense and delay. Among other interesting articles in the issue is one dealing with recent reinforced-concrete structures in Alexandria. In addition there is an article on flat slab design, and one on the specific gravity of Portland cement.

DIARIES AND CALENDARS.

The Adamant Stone and Paving Company, Limited, of Palace Chambers, 9 Bridge-street, Westminster, S.W., and Dancing Quarries, Aberdeen, follow up their handsome gift of a pocket diary for 1913 with a Letts' patent "Business" desk-memo. calendar, which is not only a quaint metal ornament, but should be of practical daily use for recording and filing for future reference appointments, matters requiring attention, and other business memoranda. It is quite a peculiarly novel device.

Messrs. James Potts & Son, stone merchants, Millburn House, Newcastle-on-Tyne, issue for 1913 a daily calendar in the form of a block of tear-off dates, figured in bold red letters. For over sixty years their speciality had been "Caithness" natural-faced pavement of most enduring quality, but they are also well known for the excellence of their kerbs and channels and setts and cubes.

Waterlow Bros. & Layton's Architects' and Surveyors' Diary, Directory and Price Book for 1913 is, as usual, a veritable mine of information, and continues to uphold its reputation as one of the most indispensable of reference books. Procurable at either 3s. 6d. or 6s., according to binding and diary space, it is a marvel of cheapness, being none the less well-produced in every way.

The Commercial Process Company, Limited, engravers and photographers, of 8 Wine Office-court, Fleet-street, E.C.—who do a very considerable amount of work for The Surveyor, and invariably do it admirably—issue as a New Year's memento a neat calendar for standing on a desk and wall date recorder for hanging.

Messrs. Merryweather & Sons, Limited, whose name is a household word for fire-fighting engines and appliances, issue, for 1913, a wall calendar which is illustrated most tastefully in colours.

* Any of the publications reviewed, or referred to as received, will be forwarded by the St. Bride's Press, Ltd., on receipt of published price.

Assistants' and Students' Section.

Conducted by SYDNEY G. TURNER, Assoc.M.Inst.C.E.

All communications in regard to this page must be addressed to The Editor, St. Bride's House, 24 Bride-lane, Fleet-street, E.C. *Envelopes must be marked "Assistants' Section" in the top left-hand corner. Correspondents are invited to submit questions for consideration and answers to the questions which appear. For the contributions considered to be the most meritorious, one or more premiums in books will be awarded monthly. Diagrams must be drawn to scale on separate sheets, ready for reproduction.*

THE MONTHLY PREMIUM.

Mr. H. E. Lunn, of Islington, to whom the premium for November was awarded, has selected the following books:—

"Reinforced Concrete Design," by Faber & Bowie.
"Practical Road Engineering," by H. P. Boulnois.
"The Civil Engineer's Cost Book," by Coleman.

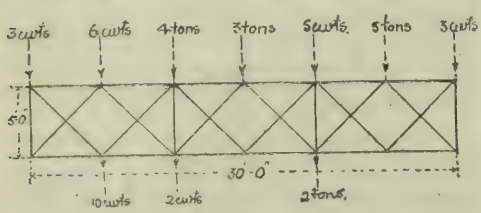
These have been duly forwarded to him.

QUESTIONS.

This week answers are invited to the following questions:—

294. Traction.—Compare the tractive force required for heavy vehicles over roads of various surfaces and grades, and show how this affects the cost of transport. (H. V. O., *West Bromwich.*)

297. Lattice Girder.—How would you obtain, graphically and by calculation, the stresses in the members



of a lattice girder braced and loaded as shown in sketch? (T. H., *Leicester.*)

299. Surveying.—Will some reader kindly give a sketch and description of Colby's Compensation Bars for the accurate measurement of base lines? (Student.)

300. Retaining Wall.—A retaining wall is required to support a roadway having no footpath, and consequently heavy vehicles such as steam rollers, &c., will seriously surcharge the wall. The height of the roadway above the adjoining ground is 8 ft., and the filling will be good clay. Design a suitable wall in mass concrete, and show calculations. (D. G. B., *Darlington.*)

301. Waterworks.—Two pumping engines deliver water at the rates respectively of 1,620 and 1,150 gallons per minute together into three pumping mains 10 in., 11 in. and 14 in. diameter. What is the velocity in and the discharge of each main? (D. G. B., *Darlington.*)

[The Editor is at all times glad to hear from readers who desire to submit questions regarding matters of general interest, points of daily practice, &c., for insertion in the "Assistants' and Students' Section." Questions which are published are taken into consideration, as well as other matter, in awarding the Monthly Premium.]

REPLIES TO QUESTIONS.

296. Tides. Please explain clearly what is meant by "H.W. of ordinary spring tides" and "L.W. of ordinary spring tides." Also state how the height of ordinary spring tides is arrived at, and over what period the observations or calculations are made. In what respect does an ordinary spring tide differ from an equinoctial spring tide? (Perplexed.)

The tides which occur on our coasts are in reality the resultant of two tidal waves, one being caused by the gravitation of the moon and the other by that of the sun. Owing to the much greater distance of the sun its tide-generating force is only $\frac{5}{11}$ths that of the moon, gravitation varying inversely as the square of the distance.

Now it is apparent that when the sun and moon lie approximately in a direct line with the earth their tide-generating forces are combined, and we get a considerable rise and fall of the tide. Such a tide is called a "spring tide," and this condition occurs at new moon and full moon. At new moon the sun and moon are on the same side of the earth and cross the meridian together, and at full moon they are approximately diametrically opposite. Hence "spring tides" occur twice in each lunar month—that is, once a fortnight.

Between these two periods the sun and moon come into opposition, till at the end of the first and third quarters the moon is causing high tide at the same point as the sun is causing low tide; therefore, the actual tide is that due to the nett difference of their forces. This tide is called a neap (nipped) tide.

If we give the numerical value of 10 to the rise and fall of the moon's tide, the relative rise and fall of the sun's tide will be $10 \times \frac{2}{5} = 4$. Therefore, when they are acting together the range of the tide will be 14, but when they are opposing each other it will be only 6.

The expression "High Water of Ordinary Spring Tides," or H.W.O.S.T., refers to the average high-water mark of spring tides, and similarly for "Low Water of Ordinary Spring Tides," or L.W.O.S.T. To determine these levels it is necessary to take observations for twelve months. Rough observations may be made on a vertical post in a harbour or creek where the effect of surface waves is reduced to a minimum. More accurate results are obtained by fitting up a recording tidal gauge, which consists essentially of a float working in a cylindrical chamber. The water in the chamber communicates with the open sea by a few small holes which allow for the slow change in level due to tide, but damp down the rapid oscillations due to surface waves.

By suitable mechanism the rise and fall of the float is recorded on a drum in the usual way.

In making a coastal survey it is necessary to show the high-water line and the low-water line of ordinary spring tides. These are best surveyed as contour lines when the high-water and low-water levels have been determined by one of the foregoing methods.

It was stated above that at new and full moon the tide-generating forces of the sun and moon are acting approximately in the same straight line, but the degree of this coincidence varies through the year. Also, whereas the earth's equatorial plane is at $23\frac{1}{2}$ deg. to the plane of the earth's ecliptic, the orbit of the moon is only at 5 deg. to it. Hence the position of the moon and sun relative to the Equator vary during the year. Now it so happens that about the time of the vernal and autumnal equinox the relative positions of the earth, moon and sun are such as to cause greater spring tides than at any other period of the year. These tides are consequently called the equinoctial spring tides.

Readers wishing to pursue this subject further are referred to the article on tides in the "Encyclopædia Britannica," or "The Tides," by G. H. Darwin. (D. G. B., *Darlington.*)

298. Gauging of Streams.—In gauging the quantities of water in small streams over a rectangular notch 3 ft. 9 in. wide (taking the velocity of the stream into consideration) is there any known connection between the velocity of the stream immediately above the gauge and the height of the water above the sill, taking no other quantities into consideration? If there is no general connection between the two is there any within certain limits, and, if so, what are the limits? (E. K., *Sutton Coldfield.*)

For discharge over a rectangular notch, neglecting end contractions, and with usual notation,

$$Q = \frac{2}{3} k \sqrt{2g}\ B.H^{\frac{3}{2}}$$

H being the total head, or, as it is usually called, the still-water head, and B the breadth.

This corresponds to the Francis formula for no end contractions, $\frac{2}{3} k \sqrt{2g}$ being taken equal to 3·33.

The limitations of the Francis formula are due to regarding this coefficient as constant. Bazin

The Surveyor
And Municipal and County Engineer.

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observed, from the results of experiments, that the coefficient is not constant, but varies with the head, and he wrote the formula

$$Q = m. \sqrt{2g}. B. H^{\frac{3}{2}}$$

m being a coefficient dependent upon the variable head. He experimentally determined m and expressed it as

$$m = 0{\cdot}405 + \frac{0{\cdot}00984}{H}$$

As the result of investigation the following method of considering the velocity of approach was adopted. If v = the velocity of approach, then

$$\text{Still water head} = H = h + \frac{av^2}{2g}$$

where a is a numerical coefficient and h is the measured head above the sill. Substituting this value of H the discharge formula becomes

$$Q = m \sqrt{2g}. B. \left(h + \frac{av^2}{2g}\right)^{\frac{3}{2}}$$

Expanding this expression, and neglecting powers of $\frac{av^2}{2g}$, since they are relatively small, and substituting $a = 1{\cdot}66$, then

$$Q = m \sqrt{2g}. B. \left(1 + 2{\cdot}5 \frac{v^2}{2g}\right) h^{\frac{3}{2}}$$

This is evidently the formula required by your correspondent, since it is an expression for the discharge which involves only the stream velocity, and the head of the water above the sill. (E. R., *Grimsby.*)

Manchester Town Planning.—The Corporation of Manchester on Wednesday last decided to make application to the Local Government Board for permission to carry out a town-planning scheme on land situated partly within the city and partly within the area of the Heaton Norris District Council

"The Surveyor" Exhibition.—In the list of members of the Consultative Council of the forthcoming SURVEYOR Exhibition which appears in the advertisement pages of this issue the address of Mr. S. A. Hill-Willis, surveyor to the Orsett Rural District Council, should be given as Tilbury. The error was noticed only after the portion of the paper in which the announcement is made had gone to press.

VENTNOR ESPLANADE EXTENSION.

Proposals for the extension of the esplanade at Ventnor, Isle of Wight, have from time to time been brought forward, only to be rejected, the chief objection being that the cliffs at the back of the proposed esplanade were not the property of the district council, and consequently to build a wall would be to protect other people's property. This objection was, however, removed a few years back, when the council purchased the whole of the cliffs referred to. These cliffs were laid out with winding paths, making easily accessible what had previously been almost useless land; unfortunately the sea had been rapidly gaining ground, and it became imperative that something should be done to prevent the cliffs from total destruction.

A scheme was prepared by the engineer and surveyor to the council, Mr. H. Hughes Oakes, and, the approval of the council and the Local Government Board having been given to this, the tender of Messrs. D. Day & Sons, Bonchurch, at £3,325. was subsequently accepted for its execution.

The wall is a very massive one, being built of local ragstone and Portland cement concrete. The average height of the wall above the foreshore is 19 ft., and the face of the wall is a segment of a circle. Over 10,000 loads of filling-in will be required between the wall and the cliffs, but fortunately this is easily obtainable from the local quarries, although the distance to which it has to be carted (practically 1 mile) makes this a somewhat expensive item. Over 1,500 cub. yds. of concrete and about 10,000 super. ft. of ragstone facing will be used.

The site of the wall is considerably below high-water mark, and this meant that in the early stages the work was covered by water at every high tide. This added very much to the difficulties of construction, and special care had to be exercised to prevent the new work from being washed away.

The completion of the extension is hoped for this month. Altogether some 500 ft. will be added to the sea-wall, and a further extension, 600 ft. in length, has been suggested.

STROUD SURVEYOR AND EXTRA SERVICES.

Stroud (Gloucestershire) Urban District Council on Tuesday considered the question of their surveyor's claim for remuneration for extra work. The council are about to expend over £10,000 in the erection of a refuse destructor and additional sewage disposal works. The Local Government Board advised the employment of a competent engineer, with a view to the preparation of a suitable scheme, and, ultimately, after correspondence with the Local Government Board, who had sanctioned the necessary loan, the work was entrusted to the council's surveyor, Mr. G. P. Milnes.

Mr. Milnes now asked to be paid for this work, which he and others considered as outside his ordinary duties as surveyor to the urban council, and the council in committee decided to offer him £350. Several meetings have been held at which certain councillors objected to any payment whatever, arguing that the salary of £260 a year paid to Mr. Milnes, who was also allowed to engage in private practice, ought to include everything.

The legality of the proposed payment was also strongly questioned, and the opinion of Mr. A. Glen, K.C., was obtained, this being that the payment could legally be made.

At Tuesday's special meeting several councillors pointed out that if an outside engineer had been engaged to do the work it would have cost the council between £500 and £600, and possibly more. Mr. Milnes admitted that he did not raise the question of payment when he was instructed to go on with the work because he thought it was apparent he would expect payment.

Upon a division it was decided, with only four dissentients, to offer the surveyor £350, of which £100 was to be paid immediately and the balance by half-yearly instalments extending over a period of two and a-half years.

Stepney Electricity Undertaking. — The Stepney Borough Council propose to borrow £13,000 from the London County Council for the purpose of extending the electric light machinery and mains.

LOCAL GOVERNMENT BOARD INQUIRIES.

The Editor invites the co-operation of Surveyor *readers with a view to making the information given under this head as complete and accurate as possible.*

INQUIRIES HELD.

Biggleswade U.D.C. (December 16th. Mr. W. H. Collins).—£4,326 for the purchase of 1 acre 1 rood 22 poles of land in Drove-road, and the erection of twenty-two workmen's houses. It was stated that the houses would be let at 4s. 6d. a week. The cost of the land would be £415. Dr. Bywater, medical officer of health, informed the inspector that overcrowding was very common, and in his opinion more working-class homes were needed for decency's sake. There had lately been fifty cases of scarlet fever in the town.

Blackpool T.C. (December 16th. Mr. M. K. North). £2,100 for public conveniences on the promenade at North Shore.—Mr. J. S. Brodie, the borough engineer and surveyor, stated that it was proposed to erect the conveniences nearly opposite the south end of Lansdowne-crescent. The roads at that point were on three levels or terraces. The roof of the conveniences would be level with the top promenade, on which stood Lansdowne-crescent, and the conveniences would be approached from the level of the middle promenade. The buildings would be in brickwork, the external walls being of the best Accrington brick, and the inside of white enamel-glazed brick. The lighting would be by electricity, with gas for the purpose of warming water and so forth. The following were the estimated items of cost: Removing present materials, £37 10s. 6d.; excavating and drainage, £101 3s. 9d.; concrete and tile, £218 15s.; brickwork, £693 3s. 11d.; masonry, £207 11s.; carpentry and joinery work, £215 3s.; plumbing and fittings, including the glazed-fireclay ware, £552 7s. 6d.; painting, £17 10s.; glazing, £20 5s.; ironfounders, £46; a total of £2,099 17s. 8d. In reply to the inspector Mr. Brodie said these figures were based on actual bills of quantities.

Lisburn R.D.C. (January 3rd. Mr. R. Pack-Beresford). £18,925 for the provision of eighty-seven dwellings under the Labourers (Ireland) Acts, 1883 to 1911.—The clerk, Mr. William Sinclair, stated that the quantity of land allocated to each cottage averaged 10 perches. It was proposed to acquire the land by absolute purchase, compulsorily. Estimating the cost of repairs to the cottages at £1 per year per cottage, the total outlay would be £1,301, and the income from rents £580, the balance falling on the rates being £721. This sum would represent a rate of about 2 1½d. in the £. The loss per cottage would be £4 5s. 10d. The actual poundage rate at present levied under the Act was 2d. in the £, and to meet the annual charge on loans, irrespective of other charges, would require a rate of 3¼d. in the £. The rent under the regulations would be twenty-eight at 5s. 6d. per week, or £309 4s. per year; fifty-nine at 4s. 3d. per week, or £191 15s. per year.

Plymouth T.C. (January 2nd. Mr. W. O. E. Meade-King). £1,169 for works of private street improvement in Athenæum-terrace-lane, Peverell Park-road-lane East, No. 7 Edgar-terrace-road, and Florence-terrace, Lower Compton.—The borough surveyor, Mr. J. Paton, explained that in the lanes it was proposed to form a foundation of clinker, and pave the surface with granite setts. There would be no footpaths, the lanes being secondary means of access.

Trowbridge U.D.C. (December 20th. Mr. R. G. Hetherington). £16,090 for the extension of the sewage works.—The estimated cost of the proposed scheme, which has been prepared by the surveyor, Mr. H. N. Lackey, is as follows: Storm sewage stand-by tanks and sludge-pumping machinery, £1,024; sedimentation tanks, £2,090; primary percolating filters, £8,032; storm-flow tanks, £853; secondary percolating filters, £3,545; drainage of sludge area, £160; out agencies, £385. Detailed evidence was given by Mr. Lackey, and there was no opposition.

West Bromwich T.C. (January 2nd. Mr. T. C. Ekin). £14,000 for the installation of vertical retorts at the corporation gas-works.—The town clerk, Mr. A. Wickham, stated that at an interview with the Local Government Board they were informed that the board would grant the loan for a period of twenty years. As a matter of fact the council asked for only twelve years, and they proposed to repay the loan in five or six years. The new works would displace the old ones, which cost £4,530, and upon which £2,500 was outstanding. Mr. H. E. Copp, borough gas engineer, gave details of the proposed installation.

APPLICATIONS FOR LOANS.

Bournemouth T.C.—£1,500 for the purpose of laying out the cliffs at Southbourne.

Caistor R.D.C. £2,000 for additional hospital buildings.

Chelmsford T.C.—£1,575 for works of road improvement.

Cockermouth R.D.C.—£3,700 for the Borrowdale-road improvement.

Deal T.C.—£8,673 for a pavilion on the sea front.

Dewsbury T.C.—£1,600 for paving works.

Fleetwood (Lancs) U.D.C.—£7,176 for extensions at the electricity works.

Kendal T.C. £850 for new roads and works of sewerage.

Salford T.C.—£14,820 for alterations and additions to the town hall buildings.

Sheffield T.C. £900 for the provision of bowling greens.

Somerset C.C. £700 for a teacher's house at Midsomer Norton.

Taunton T.C.—£1,671 for the erection of twelve workmen's dwellings.

Warmley R.D.C. £38,525 for a sewerage scheme for Siston.

Wimbledon T.C.—£4,000 for an additional ward at the isolation hospital.

Windermere U.D.C. £500 for the purchase of a portable stone-breaker.

Wolstanton U.D.C.—£3,800 for a drainage scheme.

LOANS SANCTIONED.

Bath T.C.—£4,000 for the destructor extension works, for a period of fifteen years.

Bolton U.D.C. £1,500 for the erection of workmen's dwellings.

Brierley Hill U.D.C. £5,877 for a deep sewerage scheme.

Darwen T.C.—£19,760 for street improvement works.

Driffield R.D.C.—£522 for a water supply for Nafferton.

Maidenhead T.C.—£4,902 for tar-paving works, and £280 for the improvement of St. Mark's-road.

Meriden R.D.C.—£219 for water main extensions.

Turton U.D.C.—£36,494 for road construction with granite setts.

Wednesbury T.C.—£2,750 for the extension of the municipal buildings, £5,245 for public baths, and £231 for slipper baths.

Worthing T.C.—£2,320 for wood paving in Montague-street.

FORTHCOMING INQUIRIES.

JANUARY.

		£
13.	**Wakefield.** For street and sewerage works (Mr. R. H. Bicknell)	15,372
13.	**Willesden.** For private street works (Mr. M. K. North)	2,335
14.—	**Cheadle.** For water supply purposes (Mr. T. C. Ekin)	725
14.—	**Chepping Wycombe.** For sewage disposal works (Mr. R. G. Hetherington)	38,500
14.—	**Halifax.** For works of paving (Mr. R. H. Bicknell)	11,587
14.	**Knaresborough.** In respect of the provision of council offices (Mr. R. H. Bicknell)	700
14.—	**Little Lever.** For private street works (Mr. W. O. E. Meade-King)	1,128
15.—	**Barkisland.** For water supply purposes (Mr. W. O. E. Meade-King)	3,200
15.—	**Wombwell.** For the provision of swimming baths (Mr. R. H. Bicknell) ...	7,400
16.—	**Bournemouth.** For works of surface-water drainage (Mr. F. H. Tulloch) ...	2,150
16.—	**Chadderton.** For works of sewerage (Mr. T. C. Ekin)	5,500
17.—	**Kirkham.** For private street works (Mr W. O. E. Meade-King)	600
17.—	**Middleton.** For electricity purposes (Mr. T. C. Ekin)	7,200
17.—	**Sunbury-on-Thames.** For sewage disposal works (Mr. F. O. Stanford) ...	2,500

Municipal Work In Progress and Projected.

The Editor invites the co-operation of SURVEYOR *readers with a view to making information given under this head as complete and accurate as possible.*

The following are among the more important projected works of which particulars appear below: Buildings—Barrow, £12,000, Belfast, Cardiff, Newbury, Salford £14,820, Torquay £15,000; housing and town planning—Barrow £70,000; roads and materials—Canterbury £7,008, Haltwhistle £40,000; sewerage and sewage disposal—Teddington £10,830, Tyldesley £13,500; water, gas and electricity—Darlington £30,290, Inverness £12,000, Spalding £13,673; miscellaneous—Houghton-le-Spring.—Particulars of other works projected will be found on our "Local Government Board Inquiries" page.

BUILDINGS.

Barrow T.C. The council have accepted the offer by Mr. Andrew Carnegie of £12,000 for the provision of a public library.

Belfast T.C. A branch public library is to be provided at the east end of the city, and extensive alterations are to be carried out at the police courts.

Bexhill T.C.—The council have just completed the erection of a new elementary school which is said to be a model of its kind. It has cost £14,000.

Bournemouth T.C.—At Tuesday's meeting of the council the mayor, Alderman H. S. McCalmont Hill, observed that there had been a succession of very violent storms, and on the South Coast there was hardly a town which had not suffered, but the Undercliff Drive had not lost a single stone, although it had been exposed to the south-westerly gales. The work that had been done under the guidance of their borough engineer (Mr. F. W. Lacey) had stood the test of those storms, and the greatest credit was due to him for its conception and to the contractor for the way he had carried out the work.

Cardiff T.C.—The city engineer, Mr. W. Harpur, has received instructions to prepare sketch plans of covered baths on the Canton market site and the Severn-road site, it being understood that the proposed open-air baths in Llandaff Fields will be dealt with when the plans are submitted.

Cheltenham T.C.—The borough surveyor, Mr. J. S. Pickering, at the council meeting on Monday reported that, in his opinion, none of the plans sent in for new municipal offices on the Winter Garden site could be carried out for the amount at which the council had fixed the limit of expenditure. The question had been referred to Mr. H. Vale, quantity surveyor, of Wolverhampton, who had made a similar report. The Special Committee, therefore, recommended that no award be made on the plans, but they considered some recognition should be made of the trouble and expense to which the competitors had been put in preparing the designs, and they accordingly recommended that a payment of 20 guineas each be made to the authors of the two plans respectively labelled "Efficiency and Economy" and "Palladio," which were considered the best, and that 5 guineas each be voted to the six other competitors. Notice of motion has been given to ask the Special Committee to continue their services.

Cheshire C.C.—A new school is to be erected at Willaston.

Newbury T.C.—The corporation are considering plans for a new town hall.

Norfolk C.C.—It is proposed to provide new schools at Hilgay and Hockwold.

Peterhead T.C.—A gymnasium is to be erected at the public school at a cost of £720

Redditch U.D.C.—The surveyor, Mr. A. J. Dickinson, has been instructed to prepare an estimate of the cost of the provision of a suitable permanent bridge at the part of the river Arrow known as Beoley Brook.

Rochdale T.C.—It is proposed to build a public dispensary at an estimated cost of £1,000.

Salford T.C.—It was decided at the council meeting on Wednesday last to carry out additions and alterations to the town hall buildings at an estimated cost of £14,820.

Scarborough T.C.—The council in committee have decided to proceed with the following improvements on the South Side, and are now applying to the Local Government Board for sanction to borrow the money: (1) Construction of ladies' and gentlemen's lavatories near the sands, £890; (2) construction of an additional bathing and beach shelter (subject to certain facilities being afforded by the Cliff Bridge Company), £1,450; (3) construction of shelter pavilions, the filling up of a small creek, and the necessary draining of surrounding land, £1,079; (4) drainage, £220. A scheme for the construction of lavatories, shelter, and additional footpaths and entrances from the Esplanade, at an estimated cost of £3,020, has been deferred.

Scunthorpe U.D.C.—New schools on the open-air principle were formally opened at Scunthorpe on Monday last. There are twenty classrooms, each of which will accommodate fifty children, and the rooms are grouped in a wide corridor, one side of which is fitted with sliding doors, which in suitable weather can be pushed aside, the classrooms thus being thrown open to the air. There is a large central hall for physical exercise and other grouped lessons, while the playgrounds are surrounded by the buildings. The cost has been kept down to £10 per head, or £10,000, with the additional cost of the central hall.

Sevenoaks U.D.C. The offer of Mr. E. Kraftmeire to subscribe £3,000 for public swimming baths as a memorial to King Edward has been accepted by the council.

Torquay T.C.—Plans are being prepared for new medicinal baths and a public swimming bath at an estimated cost of £15,000

HOUSING AND TOWN PLANNING.

Barrow T.C.—A proposal to carry out a housing scheme, at a cost of between £60,000 and £70,000, advocated by the Health Committee, has been referred to the General Purposes Committee.

Battle U.D.C.—The tender of Messrs. Banks & Gearing, Bexhill, at £947, has been accepted for the erection of six houses at Netherfield Hill.

Birmingham T.C.—The Town Planning Committee have appointed a Survey Sub-committee to go into the question of a town planning scheme for the newly acquired district of Handsworth.

Caistor R.D.C. A start is to be made with the housing scheme by the erection of two houses at Grasby.

Flockton U.D.C.—Twenty workmen's dwellings are to be erected at a cost of £3,830.

Hadnam R.D.C.—A commencement is to be made with the housing scheme by the erection of six cottages, at a cost of £1,050.

Manchester T.C.—The Sanitary Committee have under consideration a scheme for the utilisation of certain undeveloped land on their Blackley estate. The chairman is to confer with the city surveyor, Mr. T. de Courcy Meade, M.INST.C.E., on the subject with a view to the land being plotted out for this purpose.

Nantwich R.D.C.—The council have adopted a report presented by the Rural Housing Committee with respect to the provision of labourers' cottages. In this they expressed the opinion that the problem could be solved by the provision of cottages in pairs, and they recommended with a view of obtaining definite information as to the most suitable type of cottage and its probable cost the council issue an advertisement inviting architects and builders, or any person interested in the subject of rural housing, to submit plans and specifications of a pair of cottages to be erected on a site not exceeding ½ acre in extent and having a minimum depth of 40 yds.; each cottage to contain living room, scullery, &c., and three bedrooms, and to be provided with the usual out offices and a pig-stye.

Swansea T.C.—With respect to the contemplated building of 300 houses on the Town Hill site, the Housing Committee have agreed to ask the corporation to allow the committee to proceed at once with the building of 100 houses with an outside architect, and that 200 more be erected directly the permanent architect was appointed.

Taunton T.C.—It has been decided to build twelve workmen's dwellings, at an estimated cost of £1,671.

subject to the consent of the Local Government Board.

PARKS AND OPEN SPACES.

Birmingham T.C.—It has been decided to prepare the site purchased a few months ago at the corner of George-street West and Camden-street for the purposes of a recreation ground. The land, which covers an area of about 6,000 sq. yds., will be laid out with trees and shrubs around the pathways, and seats will also be provided. The greater part of the land will be available as a playground.

Eastbourne T.C.—The council on Monday decided to promote a Bill to acquire the undertaking of the Devonshire Park and Baths Company, Limited.

Manchester T.C.—The council have agreed to make an offer of £10,000 to the Government for the purchase of the site of the Hulme Cavalry Barracks, for the purpose of an open space.

Selkirk T.C.—An anonymous donor has presented £100 to the council for the purpose of erecting one or more shelters in Pringle Park.

ROADS AND MATERIALS.

Canterbury T.C.—The main roads are to be paved with granite, at an estimated cost of £7,008.

Cockermouth R.D.C.—The scheme for the widening of the Borrowdale-road has been agreed to. The estimated cost is £5,320, but towards this grants will be received from the county council and the Road Board, reducing the rural council's liability to £3,700.

Esher and the Dittons U.D.C.—The surveyor, Mr. H. C. Fread, has been instructed to negotiate with the owners of a strip of land adjoining the school playground, with a view to carrying out an improvement at St. Leonard's-road, Claygate, the cost of which is estimated at £282.

Folkestone T.C.—Road improvement works, estimated to cost £771, are to be carried out.

Haltwhistle R.D.C.—Plans and specifications have been completed of a partly new road between Haltwhistle and Alton, estimated to cost £40,000, and application for a grant has been made to the Road Board.

Hartismere R.D.C.—The surveyor, Mr. E. R. Ennals, has received instructions to carry out repairs on the road at Rishangles, at an estimated cost of £237, in order to put it into a fit condition to be taken over as a main road.

Hendon R.D.C.—Application is to be made to the Road Board for a grant for works of road improvement.

Merton U.D.C.—It is proposed to widen Kingston-road at an estimated cost of £340.

Midhurst R.D.C.—In reply to a question by Mr. Aman as to the cost of roads twenty years ago compared with now, the surveyor (Mr. A. G. Gibbs) stated that ten years ago the cost was about £4,000, and now it was between £6,000 and £7,000.

Newhaven R.D.C.—The surveyor, Mr. Arthur C. Groves, reported that there was considerable difficulty in obtaining stone, and the chairman of the council said it was understood that one reason for this was the high rate of freights.

Penybont R.D.C.—A scheme for the improvement of certain narrow roads, at an estimated cost of £1,700, is under consideration.

Ramsgate T.C.—The tender of Mr. George Griggs, at £1,349, has been accepted for making up the extended portion of the East Cliff Promenade.

Tavistock R.D.C.—The county council have expressed approval of the proposed improvement of the approach to Princetown.

Wandsworth B.C.—It has been agreed to contribute a sum not exceeding £3,333 towards the cost (£10,000) of widening part of High-street, which is to be carried out by the London County Council.

Westhampnett R.D.C.—The tender of Messrs. Llewellins & James, Limited, of Bristol, to supply one W. & B. patent vertical tar-spraying machine with accessories for £40 7s. 6d. has been accepted; also the tender of Messrs. Forbes, Abbott & Lennard, Limited, of Shoreham, for the supply of 14,500 gallons of tar at 4¾d. per gallon.

SEWERAGE AND SEWAGE DISPOSAL.

Barnstaple R.D.C.—A recommendation of the Sanitary Committee for the draining of Parracombe, at an estimated cost of £150, has been referred to the parish council.

Bulkington (Warwickshire) U.D.C.—The surveyor, Mr. Edward Cuthbert, has taken the preliminary levels for a sewage disposal scheme, and the council have communicated with landowners as to the price of sites for outfall works

Leyton U.D.C.—The sewers in the Cawn Hall district are to be reconstructed at a cost of £1,623.

Teddington U.D.C.—The tender of Messrs. Cunliffe & Co., at £10,830, has been accepted for the extension of the sewage disposal works.

Tyldesley U.D.C.—The main outfall sewer from the town to the sewage works is to be reconstructed at an estimated cost of £13,500.

WATER, GAS, AND ELECTRICITY.

Alloa T.C.—Plans are being prepared for the extension of the water supply.

Bulkington (Warwickshire) U.D.C.—The council have approached Mr. Newdigate, M.P., with a view to obtaining a supply of water from his Weston estate.

Chelmsford T.C.—The tender of Messrs. Davey, Paxman & Co., of Colchester, at £606, has been accepted for a suction gas engine gas plant at the waterworks. The tender of the same firm, at £654, has also been accepted for sinking a borehole at Galleywood.

Darlington T.C.—The report of the Electricity Committee has been approved providing for the installation of a new generating plant at a cost of £20,290.

Dudley T.C.—The Streets, Tramway, and Lighting Committee have considered the question of the lighting of the courts throughout the borough, and a report is being prepared by the borough surveyor (Mr. J. Gammage), assisted by the inspector of nuisances, giving the area of each court and other information for the guidance of the committee.

Inverness T.C.—Sanction is being sought for a loan to enable the council to lay new water mains and double the main supply pipe between Loch Ashie and the reservoir, and for the provision of a supplementary supply from Loch Duntalchaig to Loch Ashie. The estimated cost of the additional supply is £12,000.

Langport R.D.C.—The surveyor, Mr. J. Mathison, has received instructions to prepare a scheme or schemes of water supply for Huish.

St. Austell U.D.C.—A contract has been entered into with the St. Austell Electric Lighting Company for three and a-half years for public lighting at £212 per annum.

Scarborough R.D.C.—The tender of Messrs. W. Morley & Son, of Keighley, at £3,134, has been accepted for the provision of a water supply for the village of Snainton. In connection with the same matter another contract has been accepted, at £324, from Messrs. Crossley Brothers, of Hull, for motive power.

Spalding R.D.C.—The council have referred to a committee a statement received by Mr. E. J. Silcock, Westminster, with regard to the South Lincolnshire water undertaking acquired by the council, and the cost of completing it. The approximate cost of the first portion of the works was put at £9,574, and, in addition, proposals were made for the erection of four water towers—at Pinchbeck, Surfleet, Moulton Sea's End and Cowbit—which would bring the total expenditure to £13,673. This, it was stated, would involve a rate of 3½d. in the £ for thirty years.

York T.C.—The council on Monday last approved the promotion of the bill by which the corporation seek to acquire the undertaking of the York Gas Company, and to acquire lands in connection with their electricity undertaking, and for other purposes.

MISCELLANEOUS.

Dewsbury T.C.—Steps are to be taken with a view to the extension of the local tramways.

Houghton-le-Spring U.D.C.—It has been decided to form a local fire brigade, to purchase various fire-extinguishing appliances, and to ask the Durham and Northumberland collieries fire brigade on what terms they will agree to attend local fires when the new sub-station is erected at Houghton-le-Spring.

Kingstown (Co. Dublin) U.D.C.—A resolution has been adopted affirming the desirability of the council joining with the neighbouring townships of Blackrock, Dalkey and Killiney with a view to erecting an up-to-date fire brigade station in a central position, fully equipped with motor engine, for the use of the four townships mentioned.

PERSONAL.

Mr. H. Woodward, assistant in the Nelson borough engineer's office, has been voted an increase of salary.

Mr. S. Beal, road foreman under the corporation, has been appointed a magistrate for the City of Lincoln.

Mr. W. E. Putman, borough engineer of Morley, has resigned, and will in future devote himself to private practice.

Mr. A. L. Thomson, burgh surveyor of Leslie, has been appointed assistant sanitary inspector for the Dundee district of Forfarshire.

Mr. A. H. Leece, of Warrington, has been appointed assistant highway surveyor for the Frodsham area under the Runcorn Rural District Council.

Mr. W. C. Robson, of Fenny Compton, has been appointed highway surveyor to the Brackley and Middleton Cheney Rural District Councils.

Mr. Thomas Bull, of Sheffield, has been appointed surveyor and inspector of nuisances to the Thurnscoe Urban District Council, at a salary of £140 per annum.

Mr. Farquharson Minto, road surveyor for the Arbroath district of Forfarshire, has retired on a pension of £100 a year, after thirty-eight years' service.

Mr. J. G. Alexander, an assistant surveyor to the Westminster City Council, has resigned his position, having secured the appointment of chief surveyor at Cawnpore.

Mr. H. C. H. Shenton, of the firm of Messrs. Shenton & Easdale, civil engineers, of 28 Victoria-street, Westminster, S.W., has received instructions from the Ringwood Rural District Council to investigate and generally report upon the sanitation of the town.

Mrs. Stratten Boulnois wishes to express her deep gratitude for all the sympathy and kindness shown to her in the bereavement which she recently suffered by the death of her husband—who, as we stated last week, was the sole surviving brother of Mr. H. Percy Boulnois, M.INST.C.E.—and hopes, later on, to be able to thank individually those who have shown it so fully.

FOR OTHER ADVERTISEMENTS

See End of Paper.

BOROUGH OF SOUTHEND-ON-SEA.
REFUSE DESTRUCTOR CELLS.

The Corporation of Southend-on-Sea is prepared to receive Tenders for the construction of six refuse destructor cells.

General Conditions, Specification, Form of Tender and Drawing may be obtained on and after Saturday January 11th, on application to Mr. Ernest J. Elford, M.INST.C.E., borough engineer, Municipal Buildings, Southend-on-Sea, on payment of a deposit of Two Guineas, which will be refunded on receipt of a *bonâ-fide* Tender and the return of all documents.

Tenders, endorsed "Refuse Destructor," must be delivered not later than 9 a.m. on Saturday, February 1st. The Corporation do not bind themselves to accept the lowest or any Tender.

(By Order)
H. J. WORWOOD.
Town Clerk.

Town Clerk's Office,
Southend-on-Sea.
February 9, 1913.

ESSEX COUNTY COUNCIL HIGHWAYS COMMITTEE.

The Essex County Council are prepared to receive Tenders for the year ending 31st March, 1914, for the Supply of Stoneware Pipes, &c.

Forms of Tender, and the special envelope in which the Tenders are to be delivered, and all other information and particulars, can be obtained at the County Surveyor's Office at Chelmsford.

Tenders to be delivered on or before Saturday, the 18th day of January, 1913.

PERCY J. SHELDON, M.INST.C.E.,
County Surveyor.

Offices of the County Surveyor,
Chelmsford.
January 8, 1913.

BOROUGH OF CHELTENHAM.
YEARLY TENDERS.

Tenders are invited for the Supply of the following, for the year ending 31st March, 1914:—

Portland Cement, Forage, Stoneware Pipes, Broken Stone, Kerbs and Setts, Disinfectants, Oils, Colours, &c., Ironmongery (including Wrought-iron Tree Guards), Timber (including Wheelbarrows and Street Orderly Trucks), Indiarubber Goods, Lead (Sheet, Pipe and Tape), and Brass Fittings, Tools for Highways, &c., Wrought Iron, Steel, Files, &c., Electric Light Fittings, Household Goods, Sundries, &c. (including Cotton Waste, Bathing Drawers, Towels, Road Brooms, &c.), Lias Lime, Bricks, &c., Clothing (including Uniforms, Flannel Suits, Waterproofs, Overalls, &c.), Cast-iron Pipes (for two years).

Forms of Tender may be obtained from the undersigned, to whom sealed and endorsed Tenders are to be delivered not later than 30th January, 1913. The lowest or any Tender will not necessarily be accepted.

J. S. PICKERING,
Borough Engineer.

Municipal Offices,
Cheltenham.
January 8, 1913.

BOROUGH OF SOUTHEND-ON-SEA.

WESTERN ESPLANADE EXTENSION
(Section No. 3).

TO CONTRACTORS.

The Corporation of Southend-on-Sea is prepared to receive Tenders for the Construction of the above Esplanade Works.

Plans may be seen, Specification and Bill of Quantities and Form of Tender obtained, on application to Mr. Ernest J. Elford, M.INST.C.E., Borough Engineer, Municipal Buildings, Southend-on-Sea, on and after Thursday, the 16th inst., on payment of a deposit of Five Guineas, which will be returned on receipt of a *bonâ-fide* Tender and the return of all documents.

Sealed Tenders, endorsed "Tenders for Western Esplanade Extension, Section No. 3," to be delivered at my Office not later than 9 a.m. on Thursday, January 30th, 1913.

The Corporation do not bind themselves to accept the lowest or any Tender.

(By order)
H. J. WORWOOD,
Town Clerk.

Town Clerk's Office,
Southend-on-Sea.
January 7, 1913.

BOROUGH OF RICHMOND (SURREY).
ASSISTANT WATER ENGINEER.

Applications are invited for the appointment of Assistant Water Engineer for the Borough of Richmond (Surrey).

Salary £250 per annum, payable monthly.

Applicants must be between 25 and 30 years of age.

The person appointed must be prepared to reside in the Borough within reasonable distance of the Waterworks, and must possess a knowledge of electrical, steam and deep well pumping machinery, and general engineering work as applied to waterworks and water distribution, and have special experience in the prevention of waste. His duties, under the direction of the Water Engineer, will comprise general assistance in all the work of the Water Department.

Applications, on Forms to be obtained from the undersigned, together with copies of three recent testimonials, must reach the Town Clerk on or before Monday, the 27th day of January, 1913.

Personal canvassing is strictly prohibited.

HENRY SAGAR,
Town Clerk.

Town Hall,
Richmond (Surrey).
January 7, 1913.

PUPIL.—Westminster Consulting Engineer has vacancy for man with some knowledge of Drawing and Design, Civil and Mechanical Work. Small premium.—Write Box 126, c/o Brown's, 21 Tothill-street, Westminster.

LONDON COUNTY COUNCIL WORK DURING 1912.

In its customary New Year's review the *Times* describes as singularly eventful the work of the London County Council during the past twelve months. It points out that the King twice showed his interest in the work done at Spring Gardens, one of the occasions being when His Majesty laid the foundation-stone of the new county hall at Westminster—which, to quote his own words, is to "remove a reproach which falls upon no other capital city." In March Captain Swinton was elected chairman, but as he was soon after appointed to preside over the Delhi Town Planning Committee, Lord Cheylesmore succeeded him as chairman. The increased popularity of the motor-omnibus and a decrease of £80,000 in the council's tramway receipts gave rise to much discussion, and few meetings have passed without some debate on the traffic question, the need of an independent traffic board having been frequently urged. In February the Road Board suggested that the council should unite with the other authorities concerned in the construction of a new approach road from West Cromwell-road to Hounslow, at a cost approximately of £1,750,000, towards which the board was prepared to contribute one half of the cost; but the council was unable to fall in with the proposal, and it was resolved to approach the Road Board with the view of co-operation in other traffic improvements. The council's decision to apply for powers to construct a tramway across the new St. Paul's Bridge and to continue it in a subway under St. Paul's-churchyard to Cheapside has led the Dean and Chapter of the Cathedral to call attention to the possibility of danger to the building under their care.

Among other things, the council decided to rebuild the Sessions House at Newington, and to apply to Parliament for powers to rebuild Lambeth Bridge, though the House of Commons earlier in the year rejected the same proposal. A notable step towards the full development of Kingsway was taken when the council sold to the Commonwealth of Australia the crescent site between Aldwych and the Strand. The price paid was £379,756.

Road Upkeep in London.—According to the Local Taxation Return for the year 1910-11, the aggregate length of public roads maintained by the metropolitan borough councils in that year was 2,114 miles, the expenditure being £277 per mile.

INSTITUTION OF MUNICIPAL AND COUNTY ENGINEERS.

President—Mr. R. J. THOMAS, M.INST.C.E., County Surveyor, Buckinghamshire.

COUNCIL MEETING.

At a meeting of the council held at the offices of the institution on Saturday last there were present: Messrs. R. J. Thomas (president, in the chair), W. Harpur, H. T. Wakelam, W. T. Lancashire, W. H. Prescott, T. Moulding, J. W. Cockrill, J. S. Pickering, E. R. Matthews, C. Brownridge, G. F. Carter, E. B. Martin, E. P. Hoodey, A. D. Greatorex, W. N. Blair, O. E. Winter, J. P. Barber, R. H. Dorman, T. W. A. Hayward, Thomas Cole (secretary), and H. V. Giles (assistant secretary).

Elected as Members.—Messrs. A. C. Tipple, deputy borough engineer and surveyor, Halifax; E. W. Pullen, district surveyor to the Herts County Council; R. W. Hindhaugh, surveyor to the Ham Urban District Council; A. E. Newey, surveyor to the Foleshill Rural District Council; F. L. Burch, engineer and surveyor to the East Dereham Urban District Council; G. Riley, engineer and surveyor to the Wellington (Salop) Urban District Council; R. C. N. Newport, surveyor to the Kingsbury Urban District Council; F. Britton, surveyor to the Dore (Hereford) Rural District Council; J. M. C. Lyons, deputy county surveyor, County Louth; A. J. Lander, chief assistant to county engineer, Middlesex; G. L. Murray, surveyor to the Hexham Urban District Council; W. T. Fletcher, county surveyor, Dorset; W. Gregory, district surveyor to the Hertford County Council; A. W. Callaway, surveyor to the Nailsworth Urban District Council; F. W. Smart, chief assistant to the Bedford County Council; W. Owen, surveyor to the Menai Bridge Urban District Council; J. Storrar, road surveyor, suburban district, County of Midlothian; F. Hill, deputy surveyor and water engineer, Lancaster; P. S. Bennett, surveyor and inspector of nuisances to the Ramsay Urban District Council; R. A. Rogers, surveyor and water engineer to the Newton Abbot Rural District Council; and T. A. F. Phillips, chief assistant to county surveyor, West Sussex.

Elected as Associate Members.—Messrs. E. Pilling, assistant surveyor to the Swinton and Pendlebury Urban District Council; L. W. Peach, chief assistant surveyor to the Cannock Urban District Council; S. C. Bennett, engineering assistant to the Hertford County Council; T. Bradshaw, chief inspector's assistant, Thames Conservancy Board; S. Dean, assistant engineer to the Barnoldswick Urban District Council; C. C. Hancock, surveyor to the Warminster Rural District Council; H. M. Lawson, deputy road surveyor, Birmingham; W. R. Collins, engineering assistant to the Enfield Urban District Council; J. R. Hill, surveying assistant to Rochdale Corporation; and B. D. Tracy, assistant to city engineer, London.

Elected as Students.—Messrs. V. E. R. Bolton, articled to E. E. Ryder, Bushey Urban District Council; A. A. Harrison, articled to the borough engineer, Preston; T. W. Noblet, articled to the surveyor, Preston Rural District Council; and N. D. Preston, assistant to the surveyor to the Ulverston Rural District Council.

The council learnt, with regret, of the death of Mr. J. G. O'Sullivan.

The secretary reported that the second edition of the Specification for Concrete Flags had been printed, and copies were now obtainable, price 2s. 6d. each, from Messrs. E. & F. N. Spon, 57 Haymarket, London, S.W.

The New Offices Committee reported the approval of lease for new premises at 92 Victoria-street, and recommended the council to authorise the president to sign on behalf of the institution. This was unanimously agreed to, and steps were ordered to be taken to complete removal at an early date.

The General Purposes Committee reported the reception of a deputation from the National Federation of Building Trades Employers in support of the Federation's objection to certain exemptions contained in the draft arbitration clause, referred to in the annual report of council, 1911-12 (pp. 462, 463 and 464 of vol. 38 of the "Proceedings"). After discussion, the deputation had expressed their agreement with clauses A, B, C, D, E, G, I and M, and the committee promised to consider further the remaining paragraphs. It was resolved that the request for the reception of a deputation from the Confederation of Master Plasterers, Plumbers and Slaters with respect to sub-contractors in relation to main contractors be acceded to.

On the recommendation of the Town Planning Committee, it was resolved to issue revised conditions for the competition for the laying out of a seaside pleasure resort to be held in connection with the annual meeting in July, 1913. The paragraphs C and D requiring details of works and a bird's-eye view of the town, and the paragraph calling for tramways, sewers, &c., to be shown, to be deleted.

On the recommendation of the Constitution Committee, the affiliation of the Association of County Surveyors of Ireland with the institution was agreed to and the Articles ordered to be signed. The application of the Institution of Local Government Engineers of New Zealand was agreed to, and it was resolved to offer them affiliation on the same terms as was granted to the Irish and Scottish Surveyors' Associations. The suggestion that examinations should be held in New Zealand as in India and Africa was approved, and the secretary was instructed to complete the necessary details. The completion of the constitution of the Mutual Defence Fund was reported, and the council approved annual subscriptions to this fund as follows: Members 7s. 6d., associate members 5s., students 2s. 6d.

Mr. J. W. Cockrill was unanimously nominated for the office of president for the ensuing year, and Messrs. J. S. Pickering, T. W. A. Hayward, and H. T. Wakelam were unanimously nominated as vice-presidents. Mr. Chas. Jones and Sir James Lemon were unanimously nominated for the respective offices of honorary secretary and honorary treasurer for the ensuing year.

The secretary was instructed to send a letter of thanks to the N.A.L.G.O. for their kind assistance in the case of Mr. Jones's Colwyn Bay libel action.

Mr. G. F. Carter was nominated to represent the institution on the Engineering Standards Sub-committee on Cast-iron Pipes.

SOUTH WALES DISTRICT MEETING.

District Chairman—Mr. W. HARPUR, M.INST.C.E., Cardiff.

A meeting of the institution will be held in the South Wales District at the Guildhall, Swansea, to-morrow (Saturday).

PROGRAMME.

11.30 a.m.—Meeting of members of South Wales District at the Guildhall, Swansea, for the purpose of electing a district committee.

12 noon.—General meeting at Guildhall, Swansea, where the members will be received by the mayor. Proceed to Castle-street and inspect street widening and construction of tramways by the corporation and erection of new buildings. Thence to Hotel Cameron.

1 p.m.—Luncheon at Hotel Cameron, High-street (tickets 2s. 6d. each).

2 p.m.—Drive by way of High-street, where tramways recently constructed will be inspected, to destructor (tickets 1s. 6d. each). Inspection of the Pentre Valley, Burlais Brook culvert, the destructor and its recent improvements, the slab-making plant and the houses erected by the corporation.

4 p.m.—Return to Hotel Cameron. Light refreshments provided by the borough surveyor. Discussion on paper entitled "Swansea Tramways, Past, Present and Future," by Mr. G. Swarbrick, deputy borough surveyor (member), and the paper entitled "The Development of the Pentre Valley in Relation to the Destructor," by Mr. G. H. Bell, assistant borough surveyor (Assoc. Member). Papers will be taken as read.

H. ALEX. CLARKE,
Hon. District Secretary.

Council Offices,
Briton Ferry,

NORTH-EASTERN DISTRICT.

A meeting of the institution will be held in the North-Eastern District at Newcastle-on-Tyne on May 2nd and 3rd next.

Notice is hereby given that, under the provisions of by-law 14, nominations for the council of 1913-14 must be received by me not later than February 1, 1913.

Each member or Associate member of the institution is entitled to nominate one member or associate member for the council. Nominations must be accompanied by the consent of the nominee.

SOUTHERN DISTRICT MEETING.

A meeting of the Southern District will be held at Southampton on Saturday, February 22nd next.

THOMAS COLE,
11 Victoria-street, S.W. *Secretary.*

INSTITUTION OF MUNICIPAL ENGINEERS.

President—Mr. FRANK LATHAM, M.INST.C.E.I., F.S.E., Borough Engineer and Surveyor, Penzance.

NORTHERN DISTRICT.

The meeting fixed for Saturday, December 14th, which was postponed owing to the N.E.R. strike, will be held to-morrow (Saturday) in the town hall, Newcastle-on-Tyne, at 3 o'clock, and the Annual Dinner will follow at the Turk's Head Hotel, at 6 o'clock.

JOHN ROBINSON,
Hon. District Secretary.

Union Offices,
Darlington.

COUNCIL MEETINGS.

The next council meeting will be held at 39 Victoria-street on Wednesday, January 29th, at 6 o'clock. The following council meetings have been arranged: February 22nd, Newcastle-on-Tyne; March 26th, London; April 30th, London; May 31st, Manchester; June 28th, London; July 30th, London.

SOUTHERN DISTRICT.

A visit will be paid, by kind permission of the authorities, to the Royal Arsenal, Woolwich, on Thursday, January 30th. Members will meet at the main gates of the Arsenal, Beresford-square, at 2 o'clock sharp, and the hon. secretary, Mr. Arthur Palmer, Town Hall, Greenwich-road, Greenwich, S.E., requests that those intending to be present will notify him by the 25th inst., in order that the necessary arrangements as to guides may be made. Members of other districts of the institution are, of course, cordially invited to attend, and the opportunity to visit these colossal workshops is one that should appeal strongly to all.

WESTERN DISTRICT.

A meeting (of which full programme will be issued later) will be held at Birmingham on Saturday, February 8th or 15th.

GENERAL MEETING.

A visit will be paid to the Building Exhibition at Olympia on April 12th, by kind permission of the promoters. Full particulars will be issued later.

B. WYAND,
39 Victoria-street, S.W. *Secretary.*

APPOINTMENTS VACANT.

Official and similar advertisements received up to 4.30 p.m. on Thursdays will be inserted in the following day's issue, *but those responsible for their despatch are recommended to arrange that they shall reach* **THE SURVEYOR** *office by noon on* **Wednesdays** *to ensure their inclusion in the weekly list of summaries. Such advertisements may, in cases of emergency only, be telephoned (No. 1359 Holborn), subject to later confirmation by letter.*

SURVEYOR.—January 11th.—To take charge of construction of sewage disposal works, for the Chesterfield Rural District Council.—Mr. R. F. Hartwright, clerk.

ROAD SURVEYOR.—January 11th.—Inverness-shire County Council. £200 per annum.—Mr. W. Mackay, district clerk, 19 Union-street, Inverness.

HIGHWAY SURVEYOR.—January 17th.—Dulverton Rural District Council. £130 per annum.—Mr. R. Sowton Barrow, clerk.

BRIDGE AND ROAD SURVEYOR.—January 18th.—Devon County Council. £400 per annum.—Mr. F. Bailey, clerk, The Castle, Exeter.

CLERK OF WORKS.—January 18th.—Corporation of Banbury.—Mr. A. Stockton, town clerk.

ROAD FOREMAN.—January 20th.—Stourbridge Urban District Council. 35s. per week, with house. Mr. Fredk. Woodward, surveyor.

FOREMAN.—January 20th.—Corporation of Beeston. 28s. per week.—Mr. C. L. Hamby, borough surveyor.

SEWAGE WORKS MANAGER.—January 22nd. Harpenden Urban District Council. — Mr. C. S. Tuckey, clerk, High-street, Harpenden.

SANITARY INSPECTOR.—January 23rd.—Islington Borough Council. £148—£184.—Mr. W. F. Dewey, town clerk.

SURVEYOR'S JUNIOR ASSISTANT. — January 23rd.—Corporation of Worthing. £85—£110 per annum.—Mr. W. Verrall, town clerk.

ENGINEERING ASSISTANTS.—January 27th.—For municipal engineer's staff in a large town in the Midlands. £130—£150.—BOX 1,212, THE SURVEYOR, 24 Bride-lane, Fleet-street, London, E.C.

WORKING SUB-FOREMEN OR GANGERS. January 27th.—Hampshire County Council. 30s.—40s. per week.—Mr. W. J. Taylor, county surveyor, The Castle, Winchester.

ASSISTANT ENGINEERS. — May 1st.—Indian Public Works and State Railway Departments.—Secretary, Public Works Department, India Office, London, S.W.

ASSISTANT ENGINEER.—Public Works Department of the Federated Malay States. £360—£480, with allowances.—Messrs. Gregory, Eyles, & Waring, 12 Dean's-yard, Westminster.

DIVISIONAL ENGINEER.—Public Works Department of the Government of Jamaica. £400—£500.—Crown Agents for the Colonies, Whitehall-gardens, London, S.W. Quote M.5791 on left-hand top corner of application.

SECOND-CLASS OVERSEER.—Public Works Department of Hong Kong. £165—£225.—Crown Agents for the Colonies, 4 Whitehall-gardens, London, S.W. Quote M.5627 on left-hand top corner of application.

MUNICIPAL COMPETITIONS OPEN.

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SWAFFHAM.—January 25th.—Plans, specifications and estimates for workmen's dwellings, for the rural district council. A premium of £10 is offered to the selected plan.—Mr. Sydney Matthews, clerk.

JAMAICA.—January 31st.—Plans for municipal buildings to cost £9,000. A premium of £100 is offered. Messrs. Young, Limited, 60 Fenchurch-street, London, E.C.

HEMEL HEMPSTED.—January 31st.—Design for a housing scheme, comprising twenty-five houses, for the town council.—Mr. A. E. Usher, town clerk.

HARROGATE.—February 3rd.—Designs for a council school, for 675 children.—Mr. C. E. Rivers, ASSOC.M. INST.C.E., borough engineer.

DUBLIN.—February 6th.—Designs for municipal buildings for the corporation. The proposed expenditure is £50,000, and the author of the design placed first will be appointed to carry out the scheme on a 5 per cent basis. Premiums of £150 and £100 are offered. The assessor is Mr. Albert E. Murray, F.R.I.B.A. —The Town Clerk.

RANGOON.—March 1st.—Designs for municipal buildings. Premiums are offered of £300, £200, and £100.—The Clerk to the Rangoon Municipality.

WINNIPEG.—March 1st.—Designs for city hall. Limited to British architects in Canada. Premiums are offered of 5,000 dols., 3,000 dols., and 2,000 dols.—The Clerk.

MUNICIPAL CONTRACTS OPEN.

Official and similar advertisements received up to 4.30 p.m. on Thursdays will be inserted in the following day's issue, *but those responsible for their despatch are recommended to arrange that they shall reach* THE SURVEYOR *office by noon on* **Wednesdays** *to ensure their inclusion in the weekly list of summaries. Such advertisements may, in cases of emergency only, be telephoned (No. 1369 Holborn), subject to later confirmation by letter.*

Buildings.

CORNWALL.—January 11th.—For building a school at Tintagel, for the Education Committee.—Mr. F. R. Pascoe, secretary, County Hall, Truro.

PEMBROKE.—January 11th.—For the erection of a school, for the Education Committee.—Mr. H. E. H. Jones, clerk, County Education Offices, Haverfordwest.

ILFORD.—January 11th.—For the erection of a refuse destructor, for the urban district council.—Mr. Adam Partington.

HADLEIGH.—January 11th.—For the erection of eight cottages, for the urban district council.—Mr. C. J. Grimwade, clerk.

SOUTH MOLTON.—January 11th.—For the erection of ten cottages, for the corporation.—Mr. H. C. E. Rayner, borough surveyor.

HASTINGS.—January 12th.—For building two cottages at the waterworks, for the corporation.—Mr Ben. F. Meadows, town clerk.

BECKENHAM.—January 13th.—For the erection of a weather-boarded potting shed and office, for the urban district council.—Mr. F. Stevens, clerk.

FLINT.—January 14th.—For the erection of an elementary school, for the county council.—Mr. Sam. Evans, county surveyor, County Offices, Mold.

DURHAM.—January 14th.—For the erection of an infants' school, for the county council.—Mr. A. J. Dawson, clerk to the Education Committee, Shire Hall, Durham.

LANCASHIRE.—January 14th.—For the erection of a school, for the Education Committee.—Mr. H. Littler, county architect, 16 Ribblesdale-place, Preston.

HASTINGS.—January 14th.—For the erection of a concrete and rolled steel joist bridge, for the corporation.—Mr. Ben F. Meadows, town clerk.

KENT.—January 14th.—For building a lock-up at Hythe for the county council.—Mr. F. W. Ruck, county architect, Maidstone.

LITTLEHAMPTON.—January 14th.—For the erection of a destructor, for the urban district council.—Mr. H. A. Johnson, 15 The Exchange, Bradford.

MANCHESTER.—January 15th.—For the construction of a public library, for the corporation.—Mr. Thos. Hudson, town clerk.

KIRKCONNEL.—January 15th.—For the erection of a public school, for the School Board.—Mr. R. Wilson, clerk, Sanquhar.

SOUTHGATE.—January 16th.—For the erection of lavatory, stables, and store-room, for the urban district council.—Mr. W. M. Ellenor, clerk.

GLAMORGAN.—January 16th.—For the erection of a cottage and outbuildings, for the county council.—Mr. T. Mansel Franklen, clerk, County Hall, Cardiff.

HERTS.—January 17th.—For the erection of four cottages, for the county council.—Mr. J. Weall, surveyor, 38 High-street, Watford.

SHERINGHAM.—January 20th.—For the construction of retaining walls, promenade and shelter, for the urban district council.—Mr. Edgar C. Rolfe, clerk.

SOUTHAMPTON.—January 20th.—For extension of retaining wall, for the county council.—Mr. H. Barber, clerk, The Castle, Winchester.

CHESTER.—January 20th.—For the erection of isolation hospital, for the Committee of Visitors.—Mr. A. Hornby, clerk, Upton Asylum, Chester.

GLASGOW.—January 20th.—For the erection of bathrooms at Tradeston gasworks, for the corporation.—Mr. J. Lindsay, town clerk.

ST. HELENS.—January 21st.—For the erection of a school, for the Education Committee.—Mr. P. Sharp, secretary, 17 Cotham-street, St. Helens.

HEREFORDSHIRE.—January 21st.—For the construction of a bridge over the Sapey Brook, for the Roads and Bridges Committee.—Mr. G. H. Jack, county surveyor, Shire Hall, Hereford.

KENT.—January 21st.—For widening a bridge, for the county council.—Mr. F. W. Ruck, county architect, Maidstone.

EAST SUFFOLK.—January 22nd.—For the construction of a temporary bridge, for the county council.—Mr. H. Miller, county bridge surveyor.

WEST RIDING.—January 24th.—For alterations and additions to a school, for the Education Committee.—Mr. F. A. Darwin, County Hall, Wakefield.

HARROW-ON-THE-HILL.—January 25th.—For the erection of public offices, for the urban district council.—Mr. J. P. Bennetts, surveyor.

NORTHAMPTONSHIRE.—January 25th.—For the supply of broken granite, for the county council.—Mr. C. S. Morris, county surveyor.

IPSWICH.—January 27th.—For building concrete intake chamber and other works, for the corporation. —Mr. F. Ayton, Constantine-road.

SAFFRON WALDEN.—January 27th.—For the erection of a brick water tower, for the corporation. —Mr. A. H. Forbes, borough surveyor.

SUSSEX.—January 28th.—For the erection of a county high school for girls, for the county council.—Mr. L. Thompson, secretary, Education Committee, High-street, Worthing.

EGYPT.—February 1st.—For the erection of pumping station buildings at Kafr el Gamus, for the Public Works Ministry.—Controller-General, Main Drainage Department, Public Works Ministry, Cairo.

Iron and Steel.

CHORLEY.—January 11th.—For the supply of two gas engines and two pumps, loan of portable boiler, and laying water mains, for the rural district council. —Mr. R. E. Aspden, clerk.

WHITEHAVEN.—January 13th.—For cutting trenches and removing cast-iron pipes, and laying pipes, for the rural district council.—Mr. E. B. Croasdell, clerk.

TADCASTER.—January 18th.—For laying water main, for the rural district council.—Mr. Geo. A. Bromet, clerk.

MADRAS.—January 22nd.—For the supply of English stoneware pipes and specials, varying from 4 in. to 21 in. internal diameter, and aggregating a length of about 165 miles, for the corporation.—

Messrs. James Mansergh & Sons, agents, 5 Victoria-street, Westminster.

ELLESMERE.—January 31st. For providing and laying 9,000 yds. of 4-in. and 3-in. cast-iron mains, sluice valves, fire hydrants and air valves, for the rural district council.—Mr. H. R. Giles, clerk.

BOMBAY.—February 18. — For supplying and laying about 19 miles of 50-in. diameter steel main, for the municipality. — Mr. H. J. Trivess Smith, hydraulic engineer, Municipal Offices, Bombay.

Roads.

MIDHURST.—January 11th.—For the supply of granite and tar-macadam, for the rural district council.—Mr. A. G. Gibbs, surveyor.

ANTRIM.—January 11th.—For tar treatment and steam rolling in certain roads, for the county council. —Mr. Alexander Millar, deputy-secretary, County Courthouse, Belfast.

BOURNE.—January 11th.—For the supply of granite and slag, for the rural district council.—Mr. T. Lake, district surveyor.

MEATH.—January 11th.—For the hire of a traction engine, for the county council.—Mr. Hugh J. Cullen, secretary, Navan.

GLOUCESTER.—January 13th.—For the supply of road stone, for the county council.—Mr. S. E. Sinnott, county surveyor, Shire Hall, Gloucester.

MERIDEN.—January 13th. — For carrying out various works in Coleshill-road, for the rural district council.—Mr. A. W. Liggins, clerk.

WOODSTOCK.—January 13th.—For the supply of hand-picked unbroken stone, best broken stone (2-in. gauge), best double-screened nuts (1¼-in. gauge), best double-screened coarse chippings and binding chippings, and best rubble, for the rural district council. —Mr. A. G. Higgs, clerk.

HENDON.—January 13th.—For making up certain roads, for the urban district council.—Mr. S. S. Grimley, engineer.

HUNSLET.—January 13th.—For carrying out private street works, for the rural district council.—Mr. W. B. Pindar, clerk.

LEEDS.—January 13th.—For works of paving and flagging, for the corporation.—Town Clerk.

GRANTHAM.—January 15th.—For the supply of granite and slag, for the rural district council.—Mr. Aubrey H. Malim, clerk.

GLAMORGAN.—January 15th.—For the improvement of main road, for the county council.—Mr. T. Mansel Franklen, clerk.

WORKSOP.—January 15th.—For the supply of slag, for the urban district council. — Mr. G. H. Featherstone, clerk.

DEWSBURY.—January 15th.—For works of paving and flagging, for the corporation.—Mr. H. Ellis, town clerk.

AXMINSTER.—January 15th.—For the supply of clean, unbroken, surface flints, for the rural district council.—Mr. Cecil Forward, clerk.

HESTON.—January 15th.—For the supply of tar and Tarvia, for the urban district council.—Mr. H. J. Baker, clerk, Council House, Hounslow.

CHELMSFORD.—January 16th.—For carrying out street work, for the corporation.—Mr. G. Melvin, town clerk.

SPILSBY.—January 17th.—For the supply of 5,000 tons of broken granite, 9,500 tons of broken slag, and 450 tons of slag chippings.—Mr. G. Beaumont Walker. clerk.

CARLISLE.—January 17th.—For diverting, widening, strengthening, altering gradient, and metalling Blackwell-road, and other work, for the rural district council.—Mr. H. B. Lonsdale, clerk.

WIRRAL.—January 17th.—For making up work, for the rural district council.—Mr. W. H. Churton, clerk to the Highways Committee.

CUCKFIELD, —January 17th.—For the supply of 7,000 tons of broken granite, tarred material, and flints, for the rural district council.—Mr. C. H. Waugh, clerk.

HALIFAX.—January 18th.—For private street works, for the corporation.—Mr. J. Lord, borough engineer.

NORFOLK.—January 18th.—For the supply of road-men's tools and implements, for the county council.— Mr. T. H. B. Heslop, county surveyor.

NORFOLK.—January 18th. For the supply of granite, for the county council.—Mr. T. H. B. Heslop, county surveyor.

HAILSHAM.—January 18th.—For the supply of granite, stone, flints, beach, and cartage, for the rural district council.—Mr. Edmund Catt, clerk.

ESSEX.—January 18th.—For the supply of broken granite, for the county council.—Mr. Percy J. Sheldon, county surveyor, Chelmsford.

FLINT.—January 18th.—For the supply of road material, tar macadam and cartage, for the county council.—Mr. Sam Evans, county surveyor, Mold.

BANBURY.—January 20th.—For the supply of Hartshill stone, for the corporation.—Borough Surveyor.

ROMFORD.—January 20th.—For the supply of blue Guernsey hand-broken granite, for the urban district council.—Mr. T. Turvey, surveyor.

HEBDEN BRIDGE.—January 21st.—For works of paving, for the urban district council.—Mr. T. Waddingham, surveyor.

SALOP.—January 21st.—For the formation of a new road, for the county council.—Mr. F. Crowte, clerk.

SURREY.—January 21st.—For the supply of high-class granites, basalts, limestone, slag, tar-macadam, bitumen, pitch, tar, and tar oils, for the county council.—Mr. A. Dryland, county surveyor.

WORTHING.—January 22nd.—For laying wood paving, for the corporation.—Mr. F. Roberts, borough surveyor.

RHONDDA.—January 23rd.—For the supply of granite or basalt macadam and limestone macadam, for the urban district council.—Mr. W. J. Jones, engineer and surveyor.

ESSEX.—January 25th.—For the supply of Norway granite kerb and setts, for the county council.—Mr. P. J. Sheldon, county surveyor, Chelmsford.

WANDSWORTH.—January 25th.—For the purchase from the council of a Leyland patent steam motor wagon fitted with interchangeable tipping body and 1,000-gallon tank.—Mr. P. Dodd, borough engineer.

SCUNTHORPE.—January 29th.—For making up a certain street, for the urban district council.—Mr. W. M. Hett, clerk.

DOWNHAM.—January 31st.—For the supply of road materials, for the rural district council.—Mr. H. R. B. Wayman, clerk.

WORCESTERSHIRE.—January 31st.—For the supply of 50,000 tons of granite and 10,000 tons of tar macadam, for the county council.—Mr. C. E. Gettings, county road surveyor.

WATFORD.—February 4th.—For the supply of distilled tar, for the urban district council.—Mr. D. Waterhouse, engineer.

MIDDLESEX.—February 5th.—For the supply of 12,000 tons of hand-broken basalt, for the county council.—Mr. H. T. Wakelam, county engineer, 63 Victoria-street, Westminster, S.W.

HERTFORDSHIRE.—February 5th.—For the supply of broken granite and slag, for the county council.—Mr. Urban A. Smith, county engineer.

Sanitary.

EASTBOURNE.—January 11th.—For additions to sanatorium, for the corporation.—Mr. W. C. Field, borough architect.

NANTWICH.—January 13th.—For laying sewer and manholes, for the urban district council.—Mr. J. A. Cowley, clerk.

PONTEFRACT. — January 13th. — For work of scavenging, for the rural district council.—Mr. A. M. Storr, assistant overseer.

CHORLEY.—January 13th.—For scavenging work, for the rural district council.—Mr. R. E. Aspden, clerk.

GRIMSBY.—January 13th.—For the conversion of premises into a public convenience, for the corporation.—Mr. H. Gilbert Whyatt, borough engineer and surveyor.

BERMONDSEY.—January 14th.—For the erection of a public convenience, for the borough council.—Mr. F. Ryall, town clerk.

MALDENS AND COOMBE.—January 14th.—For supplying and fixing 50 B.H.P. Diesel oil engine, new skylights, engine foundation, general builder's work, 8-in. centrifugal pump, feed pump, shafting and pulleys, belting, and repairs to existing pump at sewage works, for the urban district council.—Mr. James W. Johnson, clerk.

LITTLEHAMPTON.—January 14th.—For sewerage alterations, for the urban district council.—Mr. H. Howard, surveyor.

MARKET BOSWORTH.—January 15th.—For laying socket-pipe sewer, for the rural district council.—Mr. F. Bouskell, clerk.

WELLINGTON.—January 15th.—For the construction of a sewer, for the rural district council.—Mr. W. Sydney Price, clerk.

CLEETHORPES-WITH-THRUNSCOE. — January 16th.—For the construction of an underground convenience.—Mr. C. H. Waithman, engineer and surveyor.

HAMBLEDON.—January 18th.—For work of scavenging, for the rural district council.—Mr. F. Smallpiece, clerk, 138 High-street, Guildford.

GRIMSBY.—January 18th.—For the construction of ½ mile of surface-water sewerage, for the rural district council.—Mr. Albert Hobson, engineer.

DURBAN (Natal).—January 20th.—For the supply of stoneware sewage pipes, junctions and bends, for the corporation.—Messrs. Webster, Steel & Co., agents to the Durban Corporation, 5 East India-avenue, Leadenhall-street, London, E.C.

LUTON.—January 20th.—For the removal of house refuse, for the rural district council.—Mr. W. Austin, clerk.

MANCHESTER.—January 20th.—For the construction of main drainage work (new outfall sewer), for the Rivers Committee.—Mr. Thomas Hudson, town clerk.

LONDON.—January 21st.—For the construction of public conveniences, for the county council.—Sir Maurice Fitzmaurice, County Hall, Spring-gardens.

MADRAS.—January 22nd.—For the supply of English stoneware pipes and specials, for the corporation.—Messrs. J. Mansergh & Sons, agents to the corporation, 5 Victoria-street, Westminster, S.W.

ISLE OF WIGHT.—January 22nd.—For work in connection with an 18-in. sewer outfall pipe, for the rural district council.—Mr. H. Eldridge Stratton, clerk.

HOVE.—January 24th.—For the removal of house refuse, for the corporation.—Mr. H. Endacott, town clerk.

CANNOCK.—January 24th.—For the supply and laying of 8,000 yds. of 12-in., 9-in. and 6-in. stoneware pipe sewers, and construction of manholes and flushing chambers, for the rural district council.—Mr. A. W. Carver, clerk.

STOCKTON.—January 25th.—For the execution of a scheme of sewerage, for the rural district council.—Mr. T. H. Faber.

ROMFORD.—January 27th.—For the construction of sewerage works, for the rural district council.—Mr. W. J. Grant, surveyor.

ILKESTON.—February 1st.—For laying and jointing cast-iron pipe sewers, concrete tube sewers, stoneware pipe sewers, construction of manholes and flushing chambers, and construction of engine-house, for the corporation.—Mr. S. F. James, town clerk.

AMBLESIDE.—February 11th.—For the construction of sewage disposal works, for the urban district council.—Mr. G. Gatey, clerk.

PORT SAID.—March 1st.—For the construction of drainage works, for the municipality.—Mr. A. L. Webb, C.M.G., Queen Anne's Chambers, Broadway, Westminster.

Stores.

ST. PANCRAS.—January 13th.—For the removal of road sweepings and gulley soil, horsing water vans, horsing road-sweeping and other machines, cartage, supply of timber and joinery materials, creosoted deal blocks, jarrah wood blocks, barrows, truckles, handles, paints, oils, candles, smiths' and founders' works, ironmongery, tools, Yorkshire stone and artificial paving slabs, granite kerbs, paving setts, broken granite, Kentish rag, gravel, bass brooms, tarpaulins, paints and rubber goods, pitch, tar, creosote oil, carbolic powder and coke, for the borough council.—Mr. C. H. F. Barrett, town clerk.

CHISWICK.—January 15th.—For the supply of horses and drivers, oils, motor spirit, drysaltery, ironmongery, disinfectants, cement, Kentish flints, Guernsey granite, granite kerb, channel and setts, York paving, tarred granite and limestone paving, for the urban district council.—Mr. E. Willis, surveyor.

LAMBETH.—January 16th.—For the supply of materials and services, for the borough council.—Mr. H. Edwards, borough engineer.

PLYMOUTH.—January 18th.—For the supply of paints, varnish, ironwork, petroleum oil, broomheads, household brushes, iron, steel, carbolic powder, Portland cement, lubricating oils, tar, pitch, painters' brushes, explosives, soap, wood blocks, creosote, road metal, disinfectant fluid, granite kerbs, setts, white lead, refilling machine revolving brooms, benzoline and motor spirit, tools, india-rubber goods, hose, ship chandlers' goods, for the corporation.—Mr. James Paton, borough engineer and surveyor.

MIDDLESBROUGH.—January 20th.—For the supply of annealed scoriæ (broken rough blocks and blocks), bricks, castings, concrete flags and kerbs, Portland cement, pitch and tar, sanitary pipes, gullies, junctions, slag, tarred whinstone, limestone, granite, timber, granite setts, brushes, bolts, nuts, screws, disinfectants, general stores, glass, hardware, india-rubber goods, iron, steel, leather beltings, oils, paints, varnishes, packings, picks, shovels, shafts, polishes, cleaning materials and ropes, for the corporation.—Mr. S. E. Burgess, borough engineer.

CAMBERWELL.—January 20th.—For the supply of timber, harness, varnishes, brooms, shovels, hire of horses, harness, ragstone, broken granite and asphalt paving work, for the borough council.—Mr. W. Oxtoby, borough engineer.

ACTON.—January 21st.—For the supply of Portland cement, ground blue lias lime, stoneware pipes, shoeing horses, manhole covers, granite kerb and channel, artificial stone paving, York stone, cycle repairs, paints, oils, team labour, horses for fire brigade, brooms, disinfectants, wood blocks, tar-paving materials, coke, coke breeze, tools and plant, plumbing, iron, steel, ironmongery and wheelwrights' work, for the urban district council.—Mr. W. Hodson, clerk.

WEST HAM.—January 24th.—For the supply of paving materials, broken granite and chippings, road flints, sand, tar and pitch, ironmongery, iron castings, lime, plaster, Portland cement, rope and tarpaulins, hardwood, lead, zinc, solder, oils, colours, stoneware pipes, brooms, brushes, boots, sanitary articles, disinfectants, domestic articles, clothing, engine-room stores, and chemicals, for the corporation.—Mr. Fred. E. Hilleary, town clerk.

BIRMINGHAM.—January 25th.—For the supply of lias lime, Portland cement, drain pipes, gullies, gulley pans, brown bricks, timber, drysaltery, castings, iron, steel, lamp glass, enamelling, brooms, hose pipe, rubber goods, incandescent mantles, uniform clothing, granite kerbs, setts, crossing stones, chippings, flags, paving bricks, wood blocks, ragstone, limestone gravel, tarred limestone, gravel, sand and slag, for the corporation.—Mr. Henry E. Stilgoe, city engineer and surveyor.

HUDDERSFIELD.—February 5th.—For the supply of granite setts, gritstone and Lonkey setts and macadam, furnace slag, broken or unbroken, granite, slag, limestone tar-macadam, flags, landings, kerbs, pitch and creosote oil, cast-iron materials, Portland cement, bricks, lime, river sand, hay, straw, scavenging machine brushes and brooms, earthenware pipes, junctions, bends, coal, team labour, shoeing horses, and oils, for the corporation.—Mr. J. Henry Field, town clerk.

BLACKBURN.—February 8th.—For the supply of miscellaneous materials and labour, for the corporation.—Mr. William Stubbs, borough and water engineer.

Miscellaneous.

POPLAR.—January 20th.—For the supply of iron castings for sewerage and drainage works, stoneware sewer and drain pipes, scavengers' brooms, rotary machine sweeping brushes, paints and varnishes, for the borough council.—Mr. Leonard Potts, town clerk.

TENDERS FOR MUNICIPAL WORKS OR SUPPLIES.

The Editor invites the co-operation of SURVEYOR *readers with a view to making the information given under this head as complete and accurate as possible.*

* Accepted. † Recommended for acceptance.

BARNSTAPLE.—For work of drainage, for the corporation.—Mr. E. Y. Saunders, borough surveyor:—

J. Barwick, Barnstaple	£21
J. Essery, Barnstaple	18
W. Slee & Son, Barnstaple*	17

CHELMSFORD.—For sinking a borehole, for the corporation:—

W. Brown & Son, Tottenham	£2,145
J. Henderson & Son, Glasgow	1,970
Munro & Co., Glasgow	1,560
C. Isler & Co., London	1,360
G. Y. Murray, London	1,348
Oilwell Engineering Company, London	1,302
T. Tilley & Sons, London	1,295
Artesian Well Boring Company, London	1,243
C. Chapman & Sons, Salford	1,221
A. C. Potter & Co., London	1,046
New England Boring Company, Peterborough	931
J. Sheldrake & Son, Yorks	896
Perkins, Macintosh, Petroleum Tool & Boring Co.	839
F. Smith & Son, Grimsby*	654

GUILDFORD.—For the construction of surface-water drain, manholes, gullies and connections, for the corporation:—

A. H. Ball & Co., Farnham	£928
H. M. Blaker, Leatherhead	927
H. Harrow, Loughborough	920
W. H. Wheeler & Co., London	909
May & Son, Ashtead	876
E. Miles (sen.), Croydon	868
S. Johnson, Son & Marsh, London	838
Streeter & Co., Shalford	763
Hardy & Co., Woking*	704

HADHAM.—For the erection of six cottages, for the rural district council:—

A. Long, Puckeridge	£1,170
C. Barker, Albury	1,140
C. Martin's Exors., Bishop's Stortford	1,119
C. Chapman, Standon	1,090
J. Day & Son, Bishop's Stortford	1,065
D. Robinson, Stansted	1,063
J. L. Glasscock & Son's Successors, Bishop's Stortford*	1,050

HARROGATE.—For the erection of entrance lodge and conveniences, and additions to baths, for the corporation.—Mr. C. E. Rivers, borough engineer and surveyor:—

CONVENIENCES.

Masons.

Dawson & Son	£110
Kershaw & Hill	100
C. A. Nettleton	98
A. Hymas	97
T. Godfrey*	95

Plasterers.

	s. d.
J. Barker	19 8
A. Calverly*	14 0

Plumbers.

H. Proctor	£53
Richmond & Co.	48
Braithwaite & Co.	46
H. Hannan	46
J. Hewson*	43

Joiners.

J. Allen & Sons	£27
H. Rudd	27
T. Archer	26
E. Thomas	26
A. E. Baines	25
G. H. Carrick	24
J. W. Taylor*	22
W. Watson	22
G. W. Ledger	21
F. Harvey	15

Slaters.

T. Rayner	£11
J. Laty	10
Wright Brothers*	10

Painters.

Broadbank & Co.	£3
Decorative Supply Company	3
H. Eshelby	3
Jessop & Cosgrove	2
Noddings & Son	2
J. Morley*	2

ENTRANCE LODGE.

Masons.

Kershaw & Hill	£323
Dawson & Son	322
C. A. Nettleton	311
A. Hymas	298
T. Godfrey*	296

Plasterers.

J. Barker	£31
A. Calverly*	28

Plumbers.

H. Procter	£116
H. Hannam	103
Richmond & Co.	103
Braithwaite & Co.	98
J. Hewson*	89

Joiners.

E. Thomas	£209
H. Rudd	205
F. Harvey	200
J. Allen & Sons	191
T. Archer	186
G. H. Carrick	180
G. W. Ledger	178
W. Watson	173
J. W. Taylor*	173
A. E. Baines	160

Slaters.

J. Laty	£88
T. Rayner	88
Wright Brothers*	87

Painters.

Broadbank & Co.	£27
Decorative Supply Company	25
H. Eshelby	25
Noddings & Son	24
Jessop & Cosgrove	22
J. Morley*	21

STAINBECK BATHS.

Masons.

Lawson & Son	£712
T. Godfrey	562
C. A. Nettleton	546
Kershaw & Hill	532
A. Hymas*	523

Joiners.

F. Harvey	£210
W. Watson	205
J. Archer	203
E. Thomas	201
G. H. Carrick	195
H. Rudd	191
L. W. Ledger	188
J. Allen & Sons	183
J. W. Taylor*	175

Slaters.

T. Rayner	£63
Wright Brothers	63
J. Laty*	62

Painters.

Broadbank & Co.	£54
J. Brown	52
Jessop & Cosgrove	51
Decorative Supply Company	49
Noddings & Son	45
H. Eshelby	44
J. Morley*	43

Plasterers.

J. Barker	£50
A. Calverly*	48

Plumbers.

H. Procter	£115
Richmond & Co.	109
H. Hannam	93
H. Hawson	93
Braithwaite & Co.*	93

Furnisher.

Morrison & Co.	£71

All the Tenderers reside in Harrogate.

LLANTRISANT AND LLANTWIT FARDRE.—For laying stoneware sewers, for the rural district council:—

GILFACH SEWER.

W. Cox, Llandaff	£344
P. J. Davies & Co., Penarth	321
Johnson Brothers, Gloucester	292
Barnes, Chaplin & Co., Cardiff	269
G. Jones, Bridgend	266
John & West, Llantrisant*	230

MISKIN SEWERAGE.

G. Jones, Bridgend	84
P. J. Davies & Co., Penarth	81
W. Cox, Llantrisant	77
Johnson Brothers, Gloucester	71
Barnes, Chaplin & Co., Cardiff	67
W. Thomas & Sons, Llantrisant	66
D. W. Hughes, Church Village	63
John & West, Llantrisant*	49

READING.—For making-up Highmoor-road, for the corporation.—Mr. J. Bowen, borough engineer:—

Knight & Allen, Caversham	£846
F. T. Robinson, Caversham	816
E. Free & Sons, Maidenhead	781
McC. E Fitt, Reading*	780

WILTS.—For work at Conigre Infants' School, Trowbridge, for the county council.—Mr. J. George Powell, county surveyor:—

Moody & Barsted, Chippenham	£160
E. Linzey & Sons, Trowbridge	138
W. Hussey, Trowbridge	130
H. Isley & Co., Trowbridge	104
W. G. Brewer, Trowbridge	97

WORTHING.—For the supply of broken granite, for the corporation:—

	Broken granite.	¾ in. chips.	Dust.
	s. d.	s. d.	s. d.
Johnston Brothers, London	11 11	9 11	9 11
The Enderby & Stoney Stanton Granite Company, Limited, London	12 0	10 3	9 3
H. L. Cooper & Co., London	12 2	11 2	—
The Croft Granite Company, Leicester	12 8	—	—
Penlee Stone Quarries, Limited, Bristol	12 8	11 8	11 8
The Dosthill Granite Quarry Company, Limited, London	14 6	12 10	11 9
The London Granite Company, Limited, London	*11 6	14 6	13 0
J. Mowlem, Limited, London	14 8	12 3	9 2
A. & F. Manuelle, Limited, London	14 11	*11 11	*8 11
The Enderby & Stoney Stanton Granite Company, London	15 0	13 0	11 6
W. Griffiths & Co., Limited, London	15 1	12 3	9 3
Rowe & Mitchell, London	15 2	12 4	9 6
The Road Maintenance Stone Supply Company, Gravesend	15 5	14 11	14 11
British Macadams, Limited, Gravesend	15 5	14 11	14 11

LEYTON.—For laying stoneware sewers, for the urban district council.—Mr. E. H. Essex, Town Hall:—

G. J. Anderson, Poplar, E.	£2,602
J. Ford, Willesden Junction, N.W.	2,564
J. C. Bills, Forest Gate, E.	2,256
S. Jackson, Son & Marsh, London	2,185
W. Manders & Co., Leyton	2,098
O. T. Gibbons, Leytonstone	1,919
T. W. Pedrette, Enfield	1,858
W. & C. French, Buckhurst Hill	1,697
F. J. Cowhead, Leytonstone*	1,623
T. Farley, Worcestershire	1,012

MEETINGS.

Secretaries and others will oblige by sending early notice of dates of forthcoming meetings.

JANUARY.

11.—Institution of Municipal and County Engineers: Meeting at Swansea.

11.—Institution of Municipal Engineers: Northern District Meetin and Annual Dinner, Newcastle-on-Tyne.

14.—Illuminating Engineering Society: Mr. C. Hoddle on "Acetylene Lighting;" Mr. E. Scott Snell on "Petrol Air Gas Lighting," Royal Society of Arts, John-street, Adelphi 8 p.m.

23.—Institution of Municipal and County Engineers: West Midland District Meeting at Birmingham.

29.—Institution of Municipal Engineers: Council Meeting, 39 Victoria-street, S.W. 6 p.m.

30.—Institution of Municipal Engineers: Visit to Woolwich Arsenal.

FEBRUARY.

3.—Royal Institute of British Architects: President's address to students; presentation of prizes.

8.—Institution of Municipal and County Engineers: East Midland District Meeting at Newark.

3.—Institute of Sanitary Engineers: Annual Dinner, Holborn Restaurant. 7 p.m.

22.—Institution of Municipal and County Engineers: Meeting at Southampton.

APPOINTMENTS OPEN.

Official and similar advertisements received up to 4.30 p.m. on Thursdays will be inserted in the following day's issue, *but those responsible for their despatch are recommended to arrange that they shall reach* THE SURVEYOR *office by noon on* **Wednesdays** *to ensure their inclusion in the weekly list of summaries. Such advertisements may, in cases of emergency only, be telephoned* (*No.* 1359 *Holborn*), *subject to later confirmation by letter.*

BOROUGH OF WORTHING.
SURVEYOR'S JUNIOR ASSISTANT.

Applications are invited for the post of Junior Assistant in the Borough Surveyor's Office. Salary £85 per annum, rising, on satisfactory service, by annual increments of £5 to a maximum of £110 per annum.

Candidates must have had Municipal experience, and must not be more than 24 years of age.

Applications, on Forms which must be obtained from the Borough Surveyor, endorsed "Surveyor's Junior Assistant," to be sent in to me not later than 12 noon on Thursday, January 23rd, 1913.

Canvassing, in any form, will be considered a disqualification.

(By order)

W. VERRALL,
Town Clerk.

Municipal Offices,
Worthing.
January 7, 1913.

HAMPSHIRE COUNTY COUNCIL.
MAIN ROADS.

The County Council are about to engage six Working Sub-foremen or Gangers, to take charge of general Road Repairs, Steam Rolling and Surface Tarring. Applications are invited from persons who have had a sound practical experience in road making and maintenance, and the control of workmen. Age not to exceed 35 years. The Sub-foremen will be required to reside where directed in the county, and be prepared to take up their duties within one month on being appointed. Wages 30s., rising to 40s. per week, to include the provision and upkeep of a bicycle. Applications, in candidate's own handwriting, stating age, &c., and accompanied by copies of three recent testimonials (which will not be returned) to be sent to me on or before January 27th, 1913, endorsed "Road Foreman."

W. J. TAYLOR,
County Surveyor.

The Castle, Winchester
January, 1913.

DULVERTON RURAL DISTRICT COUNCIL.
APPOINTMENT OF HIGHWAY SURVEYOR.

The Council invite applications for the post of Highway Surveyor for their district. Estimated mileage of roads 220 miles.

The person appointed will be required to devote the whole of his time to the duties of the office, to keep his own books, to reside where the Council require him, and to give security through an approved Guarantee Society in the sum of £100. The officer must be a competent Road Surveyor, able to prepare plans and specifications, estimates and bills of quantities. He should also have had experience in the preparation of detailed estimates for the maintenance and improvement of roads, and working and management of steam rollers and scarifiers, and the supervision of workmen, whether under contract system or by direct labour.

Canvassing, either directly or indirectly, by or on behalf of any candidate is strictly prohibited, and will disqualify.

The appointment will be made subject to the approval of the Somerset County Council.

The salary will be £130 per annum, to include all travelling expenses.

Three months' notice on either side must be given to terminate the appointment.

Applications (upon Forms which will be supplied by the Clerk to the Council), in candidate's own handwriting, stating age (not more than 35), qualifications and previous experience, accompanied by copies of not more than three recent testimonials (which should be written on foolscap paper, and which will not be returned), to be sent to me on or before Friday, the 17th day of January, 1913, endorsed "Surveyor."

Notices will be sent to selected candidates, whose personal attendance is required on the day of election, and third-class railway fare will be paid.

Duties to commence at once.

(By order of the Council)

R. SOWTON BARROW,
Clerk to the Council.

Dulverton.
January 1, 1913.

DIVISIONAL ENGINEER required by the Government of Jamaica for the Public Works Department. Engagement permanent after one year's satisfactory probation. Age between 25 and 40, preferably unmarried. Strict medical examination and vaccination if necessary. Salary £400 a year, rising to £500 by annual increments of £25. Free first-class passage out. Half salary on voyage out, full salary from date of arrival in the Colony.

Candidates should be Corporate Members (by examination) of the Institute of Civil Engineers, and should have had previous experience in similar positions in England or abroad, preferably in a British Colony. They should be able to take charge of and supervise a staff of assistants, and possess a capacity for administration.

Application by letter (no special form required), stating age, whether married or single, giving full particulars of experience, accompanied by copies of testimonials (not originals), with names and addresses of referees of whom inquiries can be made as to capabilities and character, should be sent at once to the Crown Agents for the Colonies, Whitehall-gardens, London, S.W.

Quote M/5791 on left-hand top corner of application.

ENGINEERING ASSISTANTS.—Required on a Municipal Engineer's staff in a large town in the Midlands, two Engineering Assistants, who must have good general engineering experience and a knowledge of bridge work (steel and masonry construction), and who must be good draughtsmen and expert levellers. Salary commencing at £130, and rising by £10 per annum to £150 per annum. Applications, stating age, qualifications, and experience, together with copies of at least three recent testimonials, to be sent not later than Monday, 27th January, 1913, addressed Box 1,212, office of THE SURVEYOR, 24 Bride-lane, Fleet-street, London, E.C.

PUPIL.—The Borough and Waterworks Engineer of Leamington (A.M.I.C.E.) has a vacancy in his office for a Pupil.—Address, Town Hall.

EX-PUPILS AND ASSISTANTS.

EX-PUPIL (22), Assoc.R.San.I., Stud.Inst.Mun. and Cy.E., requires Appointment. Excellent experience in surveying, private street works, and general municipal work in a large Borough. Would prove a reliable assistant to a municipal engineer. Excellent testimonials.—Cato, office of THE SURVEYOR, 24 Bride-lane, Fleet-street, E.C.

(Continued on p. xxviii.*)*

ROAD-MAKING MATERIAL.

URBAN DISTRICT COUNCIL OF DARTFORD.

CLINKER FOR ROAD MAKING, &c.

Clinker for Road Making, and for other purposes, may be obtained free of charge at the Refuse Destructor, Priory-road, Dartford, which is situate about ¼ mile from Wharves on Dartford Creek, and about ½ mile from Dartford Station (S.E. and C.R.).

Apply to Mr. J. D. Pember, Electricity Works, Dartford.

W. KAY,
Clerk to the Council.

Council Offices,
Dartford.
January 6, 1913.

TENDERS WANTED.

CITY OF BIRMINGHAM.

The Public Works Committee are prepared to receive Tenders for the Supply of Stores for one year, ending March 31st, 1914—viz.: Lias Lime, Portland Cement, Drain Pipes, Gullies, Gully Pans, Brown Bricks, Timber, Drysaltery, Castings, Iron and Steel Ware, Lamps, Glass, Enamelling, Brooms, Hose Pipe, Rubber Goods, Incandescent Mantles, and Miscellaneous Stores.

Samples and Patterns may be seen on application to the Storekeeper at the Lamp Department, Cambridge-street, and the Corporation Wharf, Sheepcote-street. Forms of Tender, Copies of Conditions, and Specifications may be obtained, on and after the 6th inst., at the City Surveyor's Office, Council House, Birmingham, on payment of £1 for each copy, which will be returned on the receipt of a *bonâ-fide* Tender for the whole or any portion of the Stores required. Samples of Goods tendered for must be sent, carriage paid, to the undersigned; the samples of Portland Cement, 4 lb. in weight, to be delivered by the 20th of January. Tenders must be made out on the Forms provided, and delivered at the undermentioned Offices on the 25th day of January, 1913, endorsed "Tender for Stores," and addressed to the City Surveyor, Council House, Birmingham. The person whose Tender may be accepted will be required to conform with the provisions of the Trade Board's Act, 1909. The Committee do not pledge themselves to accept the lowest or any Tender, and reserve the right to accept portions only of a Tender.

HENRY E. STILGOE,
City Engineer and Surveyor.

The Council House,
Birmingham.
January 6, 1913.

CITY OF BIRMINGHAM.

The Public Works Committee are prepared to receive Tenders for the Supply of Uniform Clothing for one year ending 31st March, 1914.

Samples and patterns may be seen on application to the Storekeeper at the Lamp Department, Cambridge-street, and the Corporation Wharf, Sheepcote-street. Forms of Tender, Copies of Conditions, and Specification may be obtained, on and after the 6th inst., at the City Surveyor's Office, Council House, Birmingham, on payment of £1 for each copy, which will be returned on the receipt of a *bonâ-fide* Tender for the whole or any portion of the Clothing required.

Persons tendering must, at the time of tendering, and at all times during the execution of the works, be paying all their workpeople not less than the Trade Union or standard rate of wages in the districts where such workpeople are actually engaged in the execution of the work, and must be observing the hours and conditions of labour recognised by the Association of Employers and the local organised bodies of workers in the various trades in such district.

The Tender of any person not paying the Trade Union or standard rate of wages, or not observing such hours and conditions of labour in his ordinary business, will not be accepted. The Contractor will be held responsible for the observance of these conditions by any sub-contractor employed by him.

Persons tendering will also be required to comply with the requirements of the Trade Board's Act, 1909.

Tenders must be made out on the Forms provided, and delivered at the undermentioned Offices on the 25th day of January, 1913, endorsed "Tenders for Uniform Clothing," and addressed to the City Surveyor, Council House, Birmingham.

The Committee do not pledge themselves to accept the lowest or any Tender, and reserve the right to accept portions only of a Tender.

HENRY E. STILGOE,
City Engineer and Surveyor.

The Council House,
Birmingham.
January 6, 1913.

CITY OF BIRMINGHAM.

The Public Works Committee are prepared to receive Tenders for the Supply of Materials for one year, ending March 31st, 1914—viz.: Granite Kerbs, Setts, Crossing Stones, Chippings, Flags, Paving Bricks, Wood Paving Blocks, Ragstone, Limestone Gravel, Tarred Limestone, Gravel, Sand, and Slag.

Forms of Tender, Copies of Conditions, and Specifications may be obtained, on and after the 8th inst., at the City Surveyor's Office, Council House, Birmingham, on payment of £1 for each copy, which will be returned on the receipt of a *bonâ-fide* Tender for the whole or any portion of the Materials required. Samples of Materials tendered for must be sent, carriage paid, to the undersigned. Tenders must be made out on the Forms provided, and delivered at the undermentioned Offices, on the 25th day of January, 1913, endorsed "Tender for Stone, &c.," and addressed to the City Surveyor, Council House, Birmingham. The person whose Tender may be accepted will be required to conform with the provisions of the Trade Board's Act, 1909, and to provide approved sureties in sums of £300 each for the due performance of the Contract. The Committee do not pledge themselves to accept the lowest or any Tender, and reserve the right to accept portions only of a Tender.

HENRY E. STILGOE,
City Engineer and Surveyor.

The Council House,
Birmingham.
January 6, 1913.

CANNOCK RURAL DISTRICT COUNCIL.

GREAT WYRLEY SEWERAGE.

The above Council invite Tenders for the Supply and Laying of about 8,000 yds. of 12-in., 9-in., and 6-in. Stoneware Pipe Sewers, together with the Construction of Manholes, Flushing Chambers, &c.; also for the Construction of additional Liquefying Tanks, Storm-water Tanks, Bacteria Beds, and Appurtenances, at the Littlewood Sewage Outfall Works.

Plans may be seen, and Specification, Bill of Quantities, and Form of Tender may be obtained, on application to the Engineer to the Council, Mr. Herbert M. Whitehead, Engineer's Office, Penkridge, Stafford, on and after Monday, January 13th next, upon payment of a Five Pound Bank of England Note, which will be refunded on receipt of a *bonâ-fide* Tender and return of all documents.

Sealed Tenders, on Forms supplied, endorsed "Great Wyrley Sewerage," must be delivered at my Office not later than 9 a.m. on Friday, January 24th, 1913.

The Council do not bind themselves to accept the lowest or any Tender.

(By order)
A. W. CARVER,
Clerk to the Council.

Union Offices, Cannock.
January 4, 1913.

NORTHAMPTONSHIRE COUNTY COUNCIL.

MAIN ROADS.

SUPPLY OF GRANITE.

The Roads and Bridges Committee invite Tenders for the Supply of Broken Granite, delivered at various Stations and Wharves in the County.

Tenders to be sent in not later than January 25th next to the undersigned, from whom Forms of Tender and other particulars may be obtained.

C. S. MORRIS,
County Surveyor.

County Hall,
Northampton.
January 6, 1913.

METROPOLITAN BOROUGH OF WANDSWORTH.

Tenders are invited for the purchase of a Leyland Patent Steam Motor Wagon, fitted with interchangeable tipping body and 1,000-gallon tank, for street watering.

The Wagon can be seen on application at Ashlone-road Wharf, Putney, any day between the hours of 10 a.m and 4 p.m. (Saturdays 10 a.m. to 1 p.m.).

Tenders to be sent to the undersigned not later than Saturday, January 25th next.

The Council does not bind itself to accept the highest or any Tender.

P. DODD, M.INST.C.E.,
Borough Engineer.

Borough Engineer's Office,
215 Balham High-road, S.W.
January 6, 1913.

COUNTY BOROUGH OF WEST HAM.

TENDERS FOR SUPPLIES, &c.

The Council hereby invite Tenders for the Supply of—

Paving Materials,
Broken Granite and Chippings,
Road Flints,
Sand for Tramways,
Tar and Pitch,
Ironmongery, &c.,
Iron Castings,
Lime, Plaster, &c.,
Portland Cement,
Rope and Tarpaulins, &c.,
Hardwood,
Lead, Zinc and Solder,
Oils and Colours, &c.,
Stoneware Pipes, &c.,
Brooms and Brushes,
Boots,
Sanitary Articles and Disinfectants,
Domestic Articles,
Clothing,
Soaps.

Forms of Tender and further particulars may be obtained at the Borough Engineer's Office, Town Hall, West Ham, E. (where the Standard Samples may also be seen).

For the Supply of—

Newspapers and Periodicals,
New Books, and for
Bookbinding

for the Public Libraries and Technical Institute.

Forms of Tender and further particulars may be obtained at the Central Public Library, Water-lane, Stratford, or at the Central Public Library, Barking-road, Canning Town, E.

For the Supply of—

Meat,
Fish,
Ice,
Bread and Flour,
Druggist's Sundries,
Groceries,
Tea and Coffee,
Linen,
Drapery, Boots and Slippers,

for use in the Council's Hospitals.

For the Supply of—

Bread and Flour,
Meat,

to the Council's Convalescent Home, The Grange, Harold Wood, Essex.

Forms of Tender and further particulars may be obtained of the Medical Superintendent, at the Hospital, Samson-street, Plaistow.

For the Supply of—

Engine-room Stores,
Chemicals,
A.C. House Service Wattmeters.

Forms of Tender and further particulars may be obtained of the Electrical Engineer, 84 Romford-road, Stratford, E.

A deposit of £1 will be required in respect of each Form of Tender, which will be returned on receipt of a *bonâ-fide* Tender.

NOTE.—No Tender will be considered unless the same is delivered at the office of the Town Clerk, Town Hall, West Ham, E., in the envelope supplied, by registered post, not later than 12 o'clock noon on Friday, January 24th, 1913.

The Tenders will be opened at the Town Hall, West Ham, on Friday, January 24th, at 6.30 p.m., and persons tendering may be present if they so desire, but no guarantee is given that any information, beyond the names of persons tendering, will be read out.

The Council do not bind themselves to accept the lowest or any Tender. The Contractor will be required to enter into a bond, with sureties, for the due performance of the Contract, and no goods, materials, &c., will be ordered under the Contract until such bond has been duly executed.

The Contractor whose Tender is accepted, and with whom a contract is entered into, will be required to pay to the whole of his workmen such rate of wages and observe such hours of labour as are recognised by the Workmen's Trade Unions, and in force at the time of signing the Contract. In the event of any breach of such agreement, the Council will enforce the penalty clause in its entirety.

(By order of the Council)

FRED. E. HILLEARY,
Town Clerk.

Town Hall,
West Ham, E.
January, 1913.

COUNTY BOROUGH OF HUDDERSFIELD.

TO CONTRACTORS.

The Corporation of Huddersfield invite Tenders for the Supply and Delivery of the following Materials, for a period of 12 months ending March 31st, 1914—namely:—

HIGHWAY MATERIALS.

Form No.

1.—Granite Setts, Gritstone and Lonkey Setts and Macadam.
2.—Furnace Slag (Broken and Unbroken) for Highway Purposes.
3.—Granite, Slag, and Limestone Tar-macadam.
4.—Flags, Landings, Kerbs, &c.
5.—Pitch and Creosote Oil.
6.—Cast-iron Materials.
7.—Portland Cement.
8.—Bricks, Lime, and River Sand.
9.—Hay, Straw and Provender.
10.—Scavenging Machine Brushes and Brooms.
11.—Earthenware Pipes, Junctions, Bends, &c.
12.—House Coal for Highways Department.
13.—Team Work (for all Districts).
14.—Shoeing Horses.
15.—Oils (Engine, Cylinder, Gas Engine, Heavy Bearing and Petroleum).

The successful Tenderer will be required to execute a Contract, the draft of which may be inspected at the Town Clerk's Office, Town Hall, between 10 and 4 o'clock (except Saturdays).

Specification and Forms of Tender may be obtained on application at the Offices of Mr. K. F. Campbell, M.INST.C.E., M.I.E.E., Borough Engineer and Surveyor, 1 Peel-street.

Please state the number of Tender Form required.

Sealed Tenders, endorsed "Tender for Granite Setts," or as the case may be, signed in the handwriting of the Tenderer or his Agent, and addressed Town Clerk, Town Hall, Huddersfield, must reach him not later than Wednesday, 5th February, 1913.

The Corporation do not bind themselves to accept the lowest or any Tender.

J. HENRY FIELD,
Town Clerk.

Town Hall, Huddersfield.
January 7, 1913.

The Surveyor

And Municipal and County Engineer.

Vol. XLIII. JANUARY 17, 1913. No. 1,096.

Then and Now, 1892—1913.

"*This is my birthday. . . . Give me thy hand.*"—JULIUS CÆSAR, Act v., Scene i.

THE SURVEYOR AND MUNICIPAL AND COUNTY ENGINEER has with this issue accomplished its first twenty-one years of existence, and in commemoration of the occasion we have made the chief contents of a special character, taking the opportunity to compare matters within our scope as they are to-day with the stage they had reached some two decades ago. Contrasted with the venerable antiquity of some newspaper enterprises our life has not been a long one, but as part of the span of the average man's years anything approaching a quarter of a century is a fair record of service, and it is with a paramount feeling of thankfulness that we remind our readers that we are now "of age," and that we who gave birth to THE SURVEYOR, and have steered it for so long with some measure of success, are still spared to continue its guidance with absolutely unabated enthusiasm. What we have done in the past has, in the main, been possible through the unvarying help and encouragement we have received from municipal engineers themselves, and we take the opportunity of expressing to them our heartfelt appreciation and most cordial thanks. That with the aid of this co-operation we have made some growth is shown by one or two typical details which could be quoted. For instance, our first half-yearly volume (January 21—June 30, 1892) included 378 literary pages; our last volume (July—December, 1912) had grown to 912 pages. This increase in bulk was made possible by an even greater increase in circulation—by which we mean *paid* circulation. This—according to the certificate of Messrs. Leake & Co., the eminent chartered accountants—showed an increase of nearly 200 per cent during the ten years 1896-1905, and the expansion has continued since the latter date.

From its inception THE SURVEYOR has devoted itself solely to the interests of municipal engineers and municipal engineering, and we can fairly claim that for many years it has been to a peculiar degree the organ of the profession. It would be impossible within the compass of this introductory article to trace adequately the great changes which have taken place since the year 1892 in the administrative machinery of local government, the development of municipal engineering science, and the raising of the status of municipal engineers. The occasion is appropriate, however, for some such review, however imperfect, and a record of what has been accomplished in these directions will accordingly be found in the several articles which follow, each specially prepared by the most highly qualified specialist available.

It is interesting to observe that THE SURVEYOR made its appearance at a time when the reorganisation of local government in this country which resulted in the creation of the modern authorities was not yet completed; moreover, it was a time of great engineering activity, most of the important work, however, being carried out under the supervision of engineers in private practice. It will be remembered that prior to 1888 the county council as an administrative local governing body did not exist. Such county business as had to be transacted under the then existing law was entrusted to the justices sitting in quarter sessions. By the Local Government Act of that year county councils were created, and many of the powers hitherto exercised by the justices were transferred to them. By the same Act the powers and duties of the somewhat discredited Metropolitan Board of Works were handed over to the newly constituted London County Council. In 1894—*i.e.*, two years after THE SURVEYOR made its first appearance—the second great Local Government Act was passed. By this, urban district councils and rural district councils, as we now know them, were created; and the ancient vestry meetings in rural parishes were superseded by parish councils and parish meetings. Finally, there was passed the London Government Act of 1899, which effected large reforms in the constitution of the local authorities of the Metropolis. It will thus be seen that during the period of THE SURVEYOR's existence an end has been made of the old chaos into which the local government administration had been allowed to fall, and we venture to think that we can fairly claim that through all this time of change we have done our best to secure that the interests of municipal engineers should not be allowed to suffer.

Turning now to the developments which have taken place in engineering science, we are amazed as we look back at the complete revolutions in idea and method which have taken place in various directions. It must not be imagined from this, however, that the engineer of twenty-one years ago was not able to carry out with success many wonderful works. We may mention, for example, the Forth Bridge, which was designed by Sir John Fowler and Sir Benjamin Baker, commenced in 1883, opened in 1890, and cost £3,000,000; the Manchester Ship Canal, 35½ miles in length, which was opened in 1893, and cost £15,500,000; and the Tower Bridge, which was opened in 1894. These works, and many others, are standing monuments to the courage and skill of the engineers of twenty-one years ago. In other branches of engineering, however, conditions

have so changed during that time that it may be said that The Surveyor, in the course of its comparatively brief career, has witnessed both the inception and development of modern practice. An example of this is afforded by the case of sewage dispcsal. It was in 1892, the year of our birth, that the first bacterial installation was laid down at the Northern outfall works of the London County Council. In the same year, at the Sanitary Congress held at Portsmouth, a paper was read with the object of showing the failure of land treatment; and from that day to this the bacterial treatment of sewage has shown a continual and rapid development. It may here be observed that the improvements in sewage disposal and sanitary administration generally are reflected in a very striking decrease in the death-rate for England and Wales, which has fallen from 19·01 per 1,000 in 1892 to 14·60 per 1,000 in 1911.

As regards water supply, the outstanding administrative measure of the period under review was the creation in 1905 of the Metropolitan Water Board. This body has not escaped criticism, but it can point to many big achievements in reservoir construction and other matters, and also to the fact that the anxiety as to the adequacy of the supply in certain districts during periods of drought has now gone.

Another important branch of engineering whose development has been practically contemporaneous with the life of The Surveyor is the supply of electricity. In 1891, we believe, there was only one municipal electrical undertaking in existence —that at Bradford—whereas the number of such undertakings to-day is legion. This amazing development of electrical industry has been accompanied by a corresponding decrease in the price at which that commodity is sold to the consumer, so that it is now only about one-sixth of what it was in the early 'nineties.

If we look now for a moment at the progress which has been made in regard to tramways, we find once more that there has been an almost complete change of practice during the period under review. It was not until 1891 that steel girder rails of modern type were brought into general use; and prior to 1893 the use of electricity as the motive power was only to be found in a few isolated cases. In that year, however, the advantages of the trolley wire system were fully appreciated, and there was at once a great expansion of municipal tramway enterprise, which has continued unabated until the present day. The latest innovation is the trolley omnibus, about which, however, it would not yet be appropriate to say much in a retrospective article.

In highway matters the constant aim of The Surveyor has been to head the march of events with a literary searchlight. Close attention has been paid to proceedings at congresses, conferences, and professional meetings, and our readers have been kept in touch with the subject generally by means of weekly comment, annual summaries, and special articles. No small proportion of the subject-matter in connection with roads has been derived from the annual reports of surveyors, or contributed by them in the form of articles, notes, and correspondence. Besides taking an active part in promoting conferences of surveyors and other persons interested in roads, we have organised the roads section of the biennial exhibition at Olympia and the conferences in connection therewith, have procured the services of specially qualified writers on road subjects, and have taken part in the publication of books treating of highway matters from various points of view. The growth of motor traffic has been carefully watched and studied, and it would, we think, be difficult to find in any journal not directly interested in the motor vehicle industry any now justified expression of opinion as to their development so early and so definite as that which appeared in our annual issue in January, 1905, or those which may be found in issues of that year and the next. We never accepted the findings of the Commission on London Traffic, but recognised, on the contrary, the probability of a rapid development of motor-omnibus services. As regards street lighting, we early recognised the soundness of the view of one of our special contributors—namely, that a defect of street lamps is that their glare greatly reduces the value of their illuminating effects, a matter which is now, after some five years, attracting the attention of lighting authorities. Another matter now coming forward, the possibility of making considerable use of self-contained street and road lamps, was foreshadowed in an editorial article in December, 1904.

The range of The Surveyor has extended as its size has increased, and matters pertaining to Scottish and Irish roads now receive a larger share of our attention than formerly, while the more important features of foreign practice and administration are critically considered. A number of matters affecting road maintenance, which receive but scant attention in the literature of the subject, have furnished material for comment or study in our pages. We have, for instance, attempted to trace the effects of climate and of local geology upon roads, and the important influence which roadside conditions have upon maintenance, and we have encouraged the study of the properties of local road-making materials. As regards the planting and care of city trees, and the influence of roadside conditions upon maintenance, we have favoured a policy of discriminating study rather than the acceptance of vague generalities.

The red-letter years of the period of our life in relation to highway engineering are 1895-6, when the Legislature recognised the distinction between a motor car and a traction engine, and so opened wide the gates for the speedy revolution in the character of road traffic, and, as a corollary, to great strides in the practice of road engineering; and 1909, the year which witnessed the creation of the Road Board. It is not unfair to say that the then attitude of highway surveyors was to welcome State aid in relief of local outlay on roads, but rather to resent any measure of State control. We were not in the zenith of our popularity when we ventured to urge that one hinged upon the other, but we think we were right in our plea that the inevitable should not be fought, but that surveyors should bring to bear all their influence to confine control to a well-defined, even narrow, channel. We took steps to bring road makers and road users into touch, and have no reason to regret the course. The Road Board, we consider, is one of the most open-minded of our Government Departments. It has wisely sought the counsel of our highway engineers, and has notoriously laid itself out to work in sympathy with them. This was the policy we fought for, and if it is pursued we see no limit to the magnificent work the board may still do to further the scientific and economical improvement and expansion of our highways.

As a conclusion, we would say a few words as to the status and professional interests of municipal engineers. A glance through the pages of past issues of The Surveyor shows that we have not only advocated any proposal which we have deemed to be in the best interests of our readers, but that we have also consistently criticised in the most outspoken way any person or body, public or private, acting in a manner which was unjust or unfair to our readers as a body or individuals. We have recognised to the full that the position of the municipal engineer is not an enviable one, inasmuch as his duties are not unlikely to bring him into conflict with the personal interests of individual members of the authority which he serves. That our efforts have been successful to some ex-

tent we may reasonably hope; unfortunately, too many of the abuses which we have exposed from time to time are still rampant. For example, the advertising of an appointment with a miserably and ridiculously low salary, or with a "local candidate" in view, are matters which are still with us. Curiously enough, in our very first issue we had occasion to call attention to a case of each type, and from 1892 to the present time similar cases have arisen. These evils, together with others—such as the absence of any security of tenure of office—would be minimised by some measure of Government protection. We believe that both this much-needed reform and the right to superannuation are nearer than they were, and we are confident that the general status of the municipal engineering profession has been considerably raised. We are bold enough to say that it would be still more efficiently protected if there were unity where there is now dissension. In 1908 there was formed a second association for municipal engineers and surveyors, and it cannot be said impartially that it is not now firmly established, and that it has not done, and is not doing, excellent work for its members, and consequently for the profession generally. But we still cherish the hope that it and the older body may still join forces, and as a united institution establish the right of municipal engineering to be considered as a definite and distinct branch of civil engineering, fostered by a representative organisation strong enough to right wrongs and to make possible the doing of even better work for the public welfare.

Before closing this brief review we may perhaps be permitted to say a word as to the Widows and Orphans' Fund in connection with the Institution of Municipal and County Engineers. This fund, which was instituted in 1899, has been instrumental in relieving many cases of distress and in bringing cheer and comfort into many a home from which the breadwinner had been removed by death. We may be pardoned a certain feeling of satisfaction that we were privileged to take no small part in its inauguration, and that our columns have always been open to plead on its behalf. In our issue of March 31, 1899, a letter appeared from Mr. John Bourne, the surveyor to the Neston and Parkgate Urban District Council, in which the idea of a benevolent fund was mooted, and the next week we published a "Minute" advocating the inauguration of a scheme, and pointing out that the idea was one which had been in our mind for some years. Our issue of April 14th contained a special supplement devoted to the furtherance of the proposal, giving details of a practical scheme, and particulars of several similar funds which had been established by other bodies. The fund was ultimately inaugurated at the annual meeting of the institution held at Cardiff in the same year, and, as stated above, it has since then accomplished much beneficent work. It is a pleasing recollection that we, after an unofficial start of the fund, were able to hand over to the institution sufficient capital, and promises of future support, to warrant the fund being accepted as a fact accomplished.

ELECTRICITY SUPPLY.

Twenty-one years—as it represents the lifetime of this journal, so it also covers, very nearly, the whole existence of electricity supply in this country; at any rate, the birth of the municipal supply of electrical energy was almost contemporaneous with the establishment of THE SURVEYOR, for, practically speaking, there was but one example of it in operation at the beginning of the year 1891. The enterprising authority which had so early embarked upon the troubled waters of municipal trading was that of Bradford, which in September, 1889, commenced supply with about 1,000 8-c.p. lamps connected, and at the beginning of 1891 had increased its *clientèle* so far that some 15,000 lamps derived their radiance from the city mains. To suggest, however, that the supply of electricity had not even at that date come into vogue would be to give a very wrong impression, for a considerable number of undertakings in private ownership had made substantial progress, and had familiarised the public with the idea that electricity as a means of illumination was well within the field of practical politics, though few of them were more than two years old (the Electric Lighting Act of 1888 having largely removed the blighting effects of the Act of 1882). Statistics relating to those early days are scanty, and probably of somewhat doubtful reliability; but we shall not be far wrong when we place the total number of supply undertakings in operation on our first birthday at twenty-four, with an aggregate connection of rather more than 300,000 lamps of 8 c.p., the standard adopted in those days and still largely employed, though its significance has become very dubious under the changed conditions. The prices charged then, as now, were almost as variable as the systems employed; they ranged from 10d. to 4½d. per Board of Trade unit, the most usual price being about 8d. It is interesting to observe that the lowest price obtained at Newcastle, the district where in modern times the supply and utilisation of electrical energy have been most fully developed.

PROVISIONAL ORDERS.

But while little had been actually accomplished by the local authorities, and hardly any of the larger cities had taken definite action, we must not overlook the fact that many of them had acquired Provisional Orders for the supply of electricity. In the year 1890 seventy applications for orders or licences were filed, of which thirty-six were made by municipal bodies. In view of subsequent events, it cannot be denied that there was reasonable ground for the reproach that many of these applications were lodged purely with a view to the protection of the existing interests of municipalities in connection with their gas supply undertakings. We need not here discuss the merits of this policy; but it seems plausible to suggest that in no small measure it contributed eventually to the remarkable development of municipal electricity supply in this country, for the authorities which had secured orders with the intention of "sitting on them" soon found that the pressure of public opinion, which demanded a supply of electricity, compelled them either to exercise their dormant powers or to stand aside and permit private "undertakers" to satisfy the demand. The impression that large profits were to be made out of the business, combined with a natural reluctance to allow the streets to be broken up for the purpose of laying mains by private hands, was no doubt largely responsible for the popular insistence on the former course, with the result that at the present day the vast majority of the undertakings in this country are in the hands of public bodies.

A COMPARISON WITH THE UNITED STATES.

Returning to the question of the degree of development which had been attained at the time when our first number appeared, it is interesting to observe that in the United States a totally different régime obtained. Unembarrassed by competition with gas, which had by no means occupied the ground, the promoters of electric-lighting systems there were in most cases the first in the field, and were able to develop their undertakings on a comparatively large scale; moreover, they were free from the restrictions which the British Parliament had imposed upon similar ventures in this country, and from the regulations of the Board of Trade, and were at liberty to string their cables in festoons above the streets of their large towns in a fashion which led to frequent loss of life

and ultimately to drastic action on the part of the municipal authorities. Public and private lighting with arc lamps on the series system attained to vast proportions—at St. Louis, for example, there was a generating station feeding 7,000 arc lamps. Nevertheless, while the Americans had greatly outpaced us in this direction, they were far behind in other respects. In conformity with our national reputation for the solidity and durability of our work, our pioneers adopted underground mains almost from the first, with few exceptions; and Professor Forbes, lecturing on the development of electrical distribution in January, 1892, was able to say that he knew of no town in the world where such enormous progress, designed for permanency, had been made as in London. The cost of electricity there, according to his estimate, was about double that of gas when derived from a central station, but about equal when it was generated in a private plant. In central station practice as well as in the methods of distribution we were also in advance of the United States, and, indeed, of the rest of the world; the Willans high-speed engine had been developed for driving electric generators, and with it the system of coupling each dynamo directly to the engine, which has since become universal practice, whereas in the big American station to which we have referred there were no fewer than fifty-three small dynamos, driven by as many belts from six steam engines. In 1891 the Vestry of St. Pancras—the first of the London authorities to take this step—commenced public electricity supply with a works capacity of 10,000 lamps, which was taken up within a month or two; and the generating plant consisted wholly of direct-coupled engines and generators, forming, for the period, a model station.

THE DEVELOPMENT OF LAMPS.

At that time the whole of the incandescent lamp manufacture was in the hands of the Edison-Swan Company, who by combining the master patents had established a complete monopoly; however, they made a good lamp, with a useful life of about 1,000 hours, giving an efficiency at the start of 3½ watts per candle-power, and an average efficiency throughout its life of a little over 4 watts per candle—figures which were but little improved upon until the recent advent of the tungsten filament lamp. About 200,000 of these lamps were in use in London at the beginning of 1891. The design of arc lamps was passing through the early stages of development; few classes of electrical apparatus have undergone a more laborious course of evolution, or have been more enthralling (and, as a rule, unprofitable) to the inventor than the arc lamp, and although such vast numbers were in use even then in the United States, there is a wide gap between the types which were then popular and those which are employed at the present day.

ELECTRICITY FOR POWER.

The feasibility of the use of electricity for the supply of power was well understood in 1891, and its vast possibilities were somewhat vaguely foreseen: but this department was quite in its infancy, owing mainly, no doubt, to the high cost of electrical energy. Good motors were obtainable—indeed, British dynamos and motors were fully equal, and generally much superior, to any that could be obtained elsewhere, and importations of foreign electrical plant of this class, except for arc lighting, were practically unknown. The machines were very small compared with the giant generators to which we are accustomed nowadays; a 200-kilowatt dynamo was reckoned a large one, whereas now units of 25,000 kilowatts are under construction. But their behaviour was excellent, and their efficiency and durability had attained to a high standard. The great majority were of the continuous-current type, which had been developed to a much higher degree of evolution than the alternating-current generator. The latter indeed was efficient and practical, but it differed radically from the machines of the present day, and in most cases was mechanically much inferior not only to the latter, but also to its contemporary rival. The alternating-current induction motor was only just beginning to be known, and polyphase alternating currents were still of recent introduction—in fact, the development of the polyphase system was one of the most noteworthy features of the year 1891. It was in that year that the first long-distance transmission scheme was carried out—namely, from the waterfalls at Lauffen to the Frankfort Exhibition, a distance of 112 miles—and the use of three-phase currents for this purpose, at a pressure of 30,000 volts, constituted a most interesting innovation which gave a great impetus to the development of this system. The first three-phase distribution system for public supply was carried out early in the following year, at Heilbronn. No attempt had yet been made to utilise the power of the Falls of Niagara, but it is interesting to call to mind that in 1892 a Mr. Dorman suggested the possibility of transmitting power from Niagara to Chicago at a pressure of 1,000,000 volts on the direct-current series system—truly a magnificent idea!—and that Herr Dobrowolsky, one of the leading exponents of the three-phase system, seriously outlined a project for accomplishing the same purpose at 50,000 volts, the distance being 500 miles. How far ahead of their times were these engineers may be gathered from the fact that it is only within the last few years that transmission of power at 50,000 volts has become a practical reality, and that the three-phase system has been employed as proposed by Dobrowolsky; the distances traversed have exceeded 300 miles, and the pressures have recently been raised to 130,000 volts, but 500 miles have not yet been covered.

ELECTRICITY FOR DOMESTIC PURPOSES.

As regards the methods of utilisation of electricity for domestic purposes, we have already referred to the high qualities of the carbon-filament lamps then used; electric heating and cooking were practically unknown, though of course the fact that electricity could be applied to these functions—at a price—was well understood, and electric furnaces for obtaining very high temperatures had been constructed long before. Indoor wiring was carried out almost entirely with wood casing, the wires being insulated with vulcanised indiarubber, and, to the credit of the wiremen of those days, a great deal of it is in use to this hour; indeed, the virtues of this system still give it a high place among the many rival systems which have been developed. Conduit wiring was only beginning to be used, except on board ship and in other special positions. The switches employed were mainly of the "turn" type, of which innumerable designs were invented, but these have been practically superseded by the convenient tumbler-switch, though the Americans have adhered to the turn switch, and developed it out of all knowledge. The design of fuses left very much to be desired, and there is still much room for improvement in this accessory. But the usual voltage was only 100 volts, and methods which would not stand the searching test of modern pressures (200 to 250 volts) then proved very satisfactory.

COST OF ELECTRIC LIGHTING.

The cost of electric lighting in 1891 was six or eight times as much as it is to-day, in terms of candle-power; but it must be remembered that the gas lamp with which it had to compete was the old flat-flame burner as a rule, the incandescent gas mantle having made but little progress. According to data published at the time, there was little to choose between the rival illuminants in point of cost for light, but the incidental economies effected by electric lighting—saving in the cost of decorations, absence of injury to pictures and the leather bindings of books, and safety from fire—were fully realised, and rendered electricity the premier light-

ing agent wherever the cost of installation could be faced. By a curious sequence of events, the popularising of the incandescent gas mantle was followed by the introduction of the tungsten filament lamp, while the cost of electrical energy was also reduced, so that a very similar state of things obtains to-day; the two lights are practically equal in cost per candle-power, but the hygienic qualities and the economies mentioned above still turn the scale in favour of electricity, which, moreover, is still handicapped, though not to the same extent, by the cost of installation.

DISTRIBUTION.

Up to the time of which we speak the system of distribution usually employed with continuous current was the simple two-wire or three-wire system, and with alternating current, transformers on the consumers' premises; it was already realised, however, that the latter was not satisfactory, and even at that date there was outlined the method which has now become universal in the case of all large undertakings—namely, distribution by feeders at high pressure from the generating station to sub-stations, and further distribution after transformation to a lower pressure (with or without conversion to continuous current) from the sub stations to the consumers. The use of batteries in sub-stations, to provide storage at the point where it was most needed, and to equalise the load on the generators and feeders, was also practised; in recent years this practice has received a considerable impetus, after having languished somewhat in the interim.

THE ROTARY ENGINE.

It is not without interest to remark that the commercial career of the Parsons turbine, which has revolutionised central-station practice, is practically contemporaneous with our own. It was in 1890 that the Newcastle and District Electric Lighting Company commenced supply with Parsons' steam turbines, which were then in an early stage of development; in 1891 the first condensing turbine was tested with very satisfactory results by Professor Ewing, and we are now about to see the magnificent reciprocating engines of the London County Council at Greenwich turned out to make way for steam turbines of three times their power, after less than seven years' service, thus marking the victory of the rotary engine which for some years has been exclusively adopted for all large new power stations.

ELECTRICITY TO-DAY—

So far we have mainly considered the conditions which obtained when THE SURVEYOR first saw the light, believing that our readers will need little exposition of those which now rule. We must not close, however, without a brief consideration of the latter, so far as we have not already touched upon them in passing. So multitudinous are the present-day applications of electricity that it has become an absolute necessity to modern industry, and our municipalities, which control by far the greater part of it, have developed their undertakings to an extraordinary degree. Manchester, for instance, has invested nearly three millions sterling in its electrical system, and the limit is still far distant. As we predicted years ago, the supply of electricity for motive-power has grown to vast dimensions; no one would think of erecting a large factory without employing electric power to drive the machinery. Even in the case of textile mills, and the huge rolling-mills in steel works, which were amongst the last to yield to the new system, the electric motor is asserting its pre-eminent advantages. The sudden check to the output of energy for lighting which was caused by the adoption of the highly efficient tungsten lamp accentuated the importance of the power load, which in many areas is already far more important than lighting, though the latter was greatly stimulated by the same event, and by the development of the flame arc lamp. The great reduction in the cost of electricity, due to a variety of causes, has accelerated its adoption, and thereby further lowered its cost, so that in many towns it can now be purchased even for lighting at 3d. per Board of Trade unit, and for power at less than a penny. Moreover, the cheapness of the supply has opened up new opportunities for its extension to fulfil new functions: cooking by electricity is now commercially on an equal footing with gas or coal, and electric heating, though admittedly more expensive than its rivals, is rapidly extending, owing to the extreme convenience of the electric radiator. Traction and street lighting, though of great importance, need only be mentioned here, as they form the subjects of other articles. The great improvements which have been effected in oil engines of the Diesel type have enabled almost the same economies to be realised in small stations as in large ones, thus placing cheap electricity at the disposal of the residents in small towns, and the tendency is always downwards in price.

In this connection we may quote the costs of electricity supply at three stages in the existence of, say, the Glasgow Corporation undertaking, which commenced by purchasing a private concern in 1892, and has expended nearly two millions to date on capital account:—

	1893-4.	1901-2.	1911-12.
Generation (fuel, oil, wages, &c.) ...	2·01d.	0·73d.	0·3273d.
Distribution ...	0·38	0·23	0·0739
Management ...	0·43	0·16	0·0707
Capital charges, &c.	2·05	1·20	0·6895
Depreciation, &c. ...	1·50	0·37	0·2957
Total cost per unit sold	6·37	2·69	1·4571
Receipts per unit sold...	6·16	2·69	1·4923
Balance for year ...	−£697	—	+£6,524

AND IN THE NEAR FUTURE.

These striking figures speak for themselves. At Stalybridge, however, with a capital of a quarter of a million, the costs of production were even lower, the total cost per unit sold being only 0·574d., with a surplus of £1,285. (As the conditions differ, we do not suggest that the Glasgow and Stalybridge costs should be compared without due allowance being made.) Again, at Loughborough, a small undertaking, with a capital of £35,329, the total cost per unit last year was 1·8d. It will be seen, therefore, that immense progress has been made, and that the era foreshadowed by Dr. Ferranti two years ago, when electricity will be used for everything—lighting, heating, cooking, traction, power, agriculture, &c.—at a price of ½d. per unit, may not be so far off; perhaps, indeed, we may be able to record its advent before another twenty-one years have passed over our heads.

HIGHWAYS.

A retrospective article on a particular subject is like a map specially prepared to convey particular information. It may often be said of such a map that while the thing shown is clearly depicted the rest of the information conveyed by the map is so scanty, so vague, or so much reduced in scale and crowded together that the map is, in effect, merely a diagram. On the other hand, the thing shown upon the map may be so involved in a mass of detail that its significance cannot readily be grasped. In order to avoid the literary counterparts of these two errors in the present article, it is necessary to keep clear of attempts to summarise either the progress of road engineering or the conditions affecting the development of highways during the period covered by the publication of the unbroken series

of issues of The Surveyor, twenty one years of important developments. It will be better to give some definite idea as to what was the nature of the road system which was handed over to county and district management by the Acts of 1888 and 1893. This can best be done by considering four periods, and suggesting rather than describing what were some of the main features of road maintenance in each of those periods. First we will take the period from about the beginning of the century to the year 1870, indicating, by reference to a few typical counties, what was the state of affairs in the days of the turnpike trusts, when the roads were still traversed by regular services of coaches. This period saw, later on, the changes brought about by the introduction of rail ways, conditions having attained a definite character by about 1870, when all the more important railways were completed. Next, the twenty years from 1870 to 1890 will be considered, when the changes brought about by the railways had taken effect and the work of road maintenance under the overseers was in full swing, the turnpikes disappearing in the earlier part of this period. Thirdly, the fifteen years from 1890 to 1905 will claim attention, years of steady improvement under county and district council management, in which important systems of main roads were developed in a number of counties and a general improvement in the condition of minor roads took place. Lastly, the period from 1905 to the present day will be separately reviewed as that in which motor traffic developed to the proportions which now make it, in its various forms, so important an element of traction and transit on our highways. This development has greatly altered the state of affairs as regards certain details of highway construction and maintenance, but has not, be it noted, altered any of the principles of road engineering, though it has forced some of them out of the shade of neglect into the light of day.

TURNPIKE ROADS IN THE 'THIRTIES.

In order to gain some idea of the state of affairs in the old turnpike days let us turn to some of the county records, taking a few counties which have each a definite character and are situated, some near the metropolis, and others at various distances to the north-east, the north, and the south-west. Of the counties near London, Surrey and Hertfordshire, the former abutting London and including a part of the Thames Valley, the latter separated from London by marshy and heathy lands, presented marked contrasts as regards their highways and the services which those roads performed. The topography and geology of Surrey led then, as they do now, to heavy expenditure, while in Hertfordshire they were, and are, favourable factors in road maintenance. In 1831 the population of Surrey was growing rapidly, while in Hertfordshire the increase was less than the average for England. The density of population in the southern county was 640 to the square mile, against 228 for Hertfordshire; but, owing to the hilly nature of the county and the large size of the valleys, the mileage of turnpike roads in Surrey was much less in proportion to its density of population, being 289 against 170 for Hertfordshire, though the smaller county had less than a third the population of the larger. It is therefore not surprising to find that the annual cost of maintaining the turnpike roads in Surrey was about £220 per mile, and in Hertfordshire £157. The way in which the population was distributed was more favourable than in Surrey, for in the former case nearly all the common fields had been enclosed by the early "thirties," while in Surrey large areas of common lands have been left unenclosed to the present day. Out of a population of 143,000, or 29,000 families, in the former county some 8,000 families were employed in trade, manufactures, and handicrafts and 13,000 in agriculture, while in Surrey the proportions were more than reversed, out of a population of 486,000, or 109,000 families, 15,000 being engaged in agriculture and 50,000 in industrial pursuits. In view of the fact that important main roads, including the Great North Road, traversed the county of Hertford, it is not surprising to find that the cost of maintenance of turnpike roads was as much as £157 per mile. Another comparison—between Surrey and Staffordshire—may be made with regard to roads other than turnpike roads. The mileage of these roads for the 759 square miles of the former county was about 1,500, and the cost about £22 a mile; while in Staffordshire, where a large proportion of the minor roads was situated on favourable soils, some 2,400 miles of these roads cost about £9 a mile, the area of the county being 1,184 square miles. These comparisons show in a striking manner that the conditions affecting road maintenance are to a large extent permanent, and suggest the consideration that the application of Imperial funds to highway maintenance cannot properly be made on a mileage basis until an investigation has been made into these matters by specially qualified engineers.

LINCOLNSHIRE.

Turning now to areas beyond the immediate influence of the metropolis, let us take, first, as a characteristic county of the East Coast, Lincolnshire, which has a sufficiently varied topography and geology for the purpose of reasonable comparison with other areas, for, out of a total of 1,848,000 acres, some 777,000 were at that time fenland, 235,000 wolds, loamy and heathy tracts covering some 118,000 acres, and loams and sands of moderate richness for agricultural purposes about 718,000 acres. The area of 2,611 square miles had, at the census of 1831, a population of 317,000, or 66,000 families, 36,000 of these families being engaged in agriculture and 17,000 in trades and manufactures. The density of population was 122 to the square mile, and the length of turnpike roads 538 miles. This is, roughly, a mile to every 5 square miles against a little more than a mile to every 4 square miles in Hertfordshire. The mileage in proportion to population was, however, higher than in the latter county, and the cost of maintenance was only £61 per square mile. Of the total revenue for one year of the turnpike trusts, £35,000, about £28,000 was derived from tolls and the rest from statute labour and its commuted equivalent in money. Surveyors will be interested to learn that in 1835 the salary of the surveyor to the trusts was £1,673 19s. and that of the clerk £473; but the finances of the turnpike trustees in Lincolnshire were in a better condition than those in other counties. Indeed, taking England as a whole, the proportion of debts for the year 1836 was about four and a half years' income, and the proportion of unpaid interest 12 per cent, while in Lincolnshire the income in the previous year had exceeded the expenditure by several thousand pounds.

CUMBERLAND.

A county of a very different character, and, geologically and climatically, in an area presenting a marked contrast with Lincolnshire, may now be considered—namely, Cumberland. The 975,000 acres of this county included, in the early "thirties," some 470,000 acres of old enclosed land, about 150,000 acres of commons, or land only recently enclosed, and 342,000 acres of a mountainous character. The population of about 170,000 was about equally divided as regards occupation, some 11,000 families being engaged in agricultural pursuits and 12,000 in industries and trades. The area of 1,523 square miles had a population of 111 per square mile, somewhat less than that in Lincolnshire, and distributed, it may be assumed, less evenly over the whole county. There were 215 miles of turnpike roads, costing about £84 a mile.

STAFFORDSHIRE.

Very different were the conditions in the Midland county of Staffordshire, with a population which

was increasing very rapidly, and amounted at the census of 1831 to 143,000. Out of 84,000 families nearly 44,000 were engaged in trades and industries and only 18,000 in agriculture. The number of families per square mile engaged in agriculture was, however, greater than in Lincolnshire, and about the same as in Dorset, so that it is no matter of surprise to find that the cost per mile of the turnpike roads was about £98. Since the average density of population per square mile was 347, the cost of turnpike roads would have been higher but for the facts that there were no less than 601 miles of such roads in the county, and that a considerable part of the population used the roads but little and manufactured articles near the borders of the county for sale outside it. These considerations, relating to the days before railways had developed, are more to the point as regards the conditions of to-day than any that relate to the remainder of the nineteenth century, when, for a time, the railways dominated the traffic of the country. In the case of Staffordshire 601 miles of turnpike roads cost, in the 'thirties, about £98 per mile, and 605 miles of county main roads cost in 1911-12 £74 a mile. The remainder of the Staffordshire roads, of course, have greatly developed since, in the "thirties," when, with a mileage of about 2,650, they cost some £9 a year per mile for maintenance; but this figure does not take account of work done by private persons, and possibly worth a considerable annual sum. The income of the Staffordshire turnpike trusts was £58,000, of which £55,000 was derived from tolls. It is worthy of note that the expenditure on bridges in a period of about five years was some £23,000.

DORSET.

The county of Dorset may be taken as representative of Wessex, but without including any large proportion of wild moorland or downland. In the early "thirties" the population was about 159,000, on an area of 1,006 square miles, or 158 persons to the square mile, considerably more than in Lincolnshire or Cumberland. Out of 34,000 families 15,000 were engaged in agriculture, and 10,000 in trade and industries. There were 359 miles of turnpike roads, costing about £68 per mile. Out of 504,000 acres, classified, 161,000 were chalk, 145,000 classed as sands and gravels, 50,000 loams and mixed soils, and 117,000 clay.

TRAFFIC ON THE ROADS BEFORE 1870.

The period up to 1870, counting from about the beginning of the century, saw the stage-coach services in full operation, and their gradual suppression and extinction. There was, in several other respects, notably as regards posting, an alteration rather than a suppression of the traffic, which became, towards the end of the period, supplementary to the railways and local in character. The stage-coaches inflicted a large amount of wear and tear upon the roads, since they carried very heavy loads in proportion to the widths of the tyres. Their disappearance marked the beginning of a period of rest, as regards main roads, while there was, at the same time, a steady development of local roads, due to the influence of the railways, but seldom effective except where a considerable network of roads already existed. Some very good work was done by special efforts in various parts of the country, and towards the end of the period there was some development of skill in detail management of local roads, but the highways generally were very inferior to those of the present day. Hauling for farm purposes, the removal of timber from where it was felled, and some other kinds of hauling work were largely carried out in fine weather or when the roads were frozen—this being of course to a considerable extent the practice of to-day. A good deal of work had to be done, however, by main force over bad roads, vehicles with light loads being pulled by strong teams of horses or oxen through deep mud. A type of road which was developed under these circumstances was that with deep ruts, which were filled with water and soft mud, through which the wheels could be dragged without much difficulty, or, in other cases, were from time to time filled up with any hard material which happened to be available.

In addition to the turnpike roads, of which there were usually some hundreds of miles in a county, a considerable mileage of minor roads received attention during this period, towards the end of which the need for good roads to railway stations prepared the way for the idea now embodied in the phrase "secondary roads." The principles recognised and acted upon by the few great road-makers, whose work during this period was of great importance, gradually spread; drainage received more and more attention, the importance of rapidly compacting the road-crust was more widely recognised, and a considerable amount of earthwork was done in some parts of the country where primitive tracks were converted into roads which were passable in almost any weather. No special reference need be made to the more important organised works carried out during this period, accounts of which are given in several books dealing with the history of road-making in England. It may be mentioned, however, that a large amount of work was done in India, a complete system of trunk roads being created, intended to give the military authorities full control of the country, and now again available under the altered conditions of transport as an alternative and supplementary system to the railway network.

In England a considerable amount of work in road improvement was carried out by "village tyrants" and other public-spirited persons. One Sussex landowner, for instance, created, out of deeply-mired cart-tracks, a network of roads which to-day form an important part of the road system of the Weald. In other cases the Enclosure Acts created roads which were easily made serviceable, and were afterwards maintained at low cost with local materials, because the lands dealt with were on gravelly or sandy tracts the relative poverty of which for farming purposes was the reason for their late enclosure. Generally the lands not included in the earlier enclosures had been left as common lands, as wastes, or under timber, because they were either too light or too heavy for successful farming until a better knowledge of manuring increased the value of the former class, and better implements made it possible to get good crops from the stiffer soils. The distinction is important because in the case of the gravels, conglomerates, and sandy soils a system of paths and lanes usually existed, the soils being favourable to the making of such tracks wherever they were needed, and greatly facilitating their conversion into good roads, while on hard clays and on marls so stiff that they were not cultivated till last century there were, and still are, large areas with very few roads, the use of any particular track making it, for wheeled vehicles, worse rather than better than the turf in wet weather. Compare, for instance, the commons in the sandy and gravelly country to the south-west of London with the Holmwood commons, which are on stiff clay. This soil, however, is much more favourable for the making of tracks and roads than retentive marls such as those of the Blyth valley in Staffordshire, which were recently heavily wooded with oaks. This area, again, with its great dairy farms, is in sharp contrast with the moorland region of the more northern part of Staffordshire, where numerous springs of good water led to the growth of many small hamlets, and the gravel and sandstone strata made communication between them very easy, and led to the formation of a network of lanes. Similarly we may compare the area occupied by the lighter Eocene strata of Essex, and served by a network of roads, with the area to the north-west of London, which has only recently been made habitable by the extension to it of water from large supply systems. All these considera-

tions have an intimate association with the matter of road maintenance and of road construction to-day, and vitally affect the position as regards incidence of cost and the distribution of grants from general funds. Districts which are on soils which are at once receptive and retentive of water, and, in a less degree, districts on stiff, impermeable soils, cannot be expected to exhibit records of achievement which will compare with those of districts situated on favourable strata, having a legacy of naturally formed roads and of material for road repair situated by the roadside. If we are to know which are "deserving cases" we must study the topography and geology of the districts, and the dates of enclosure of commons or opening up of forest areas.

THE PERIOD FROM 1870 TO 1890.

This period saw steady development in many districts, and more attention was now paid to roads of a secondary class. Sometimes the road metal was spread over the whole width of the carriage-way for short lengths to be worked in by the traffic, and in other cases somewhat longer stretches were covered for half the width, to be very slowly consolidated, while the old half of the road received an undue share of traffic, and was often much worn before the newly-metalled portion offered better going. More and more attention was paid to providing outlets for surface water, and the value of by-roads as routes was in some cases increased by work on a few of the worst places, and the provision of culverts in the dips. A notable feature of this period was, in many districts, the gradual raising of the banks of narrow roads and of the margins of wider roads by the constant application of road scrapings, the value of which as fertilisers greatly facilitated their rapid incorporation into the turf or the solid banks, and gave the roads more and more of the character of sunken lanes. There were sharp contrasts between districts managed by zealous overseers and those managed badly, but the contrasts due to natural and economic conditions still predominated. Very marked improvement was sometimes effected by a wise choice of a surveyor. In a particular case, by the appointment of a jobmaster as surveyor of roads and the rivalry between this surveyor and the farmer who had charge of a neighbouring district, marked improvement in the roads resulted. The growth of local traffic is strikingly illustrated by the case of this jobmaster. A vicar appointed to a parish in the neighbourhood in 1875 suggested to this man that a hansom cab would be useful in the locality, no vehicle of any kind being available for hire in the village, except, possibly, a dogcart. In the course of the next twenty years the vehicles owned by this jobmaster and others in the village included, besides the hansom, a brougham, a dogcart, a large wagonette, two small wagonettes, and three or four large brakes, and the mails were taken nine miles by road instead of 2½ miles to the railway station. Developments such as these were partly due to the railways, but were to no small extent brought about by the gradual improvement in the roads. It must also be noted that certain kinds of fodder, especially grain foods, were very cheap during this period. Where a small industry had led to the congregation of a fairly prosperous community the Saturday excursion to distances of 15 miles or so sometimes became an ordinary feature of country life; football and cricket teams were taken to their "fixtures" in brakes, holiday excursions were started from public-houses on the outskirts of large towns, and "outings" in which vehicles figured prominently began to be looked upon as an ordinary feature of the activities of various clubs and other organisations. In many parts of the country local fairs and markets became less and less important, and this led to a greater use of the roads by farmers and others connected with stock-breeding and agricultural industries.

Constant small repair became in many districts a feature of road maintenance during this period, and another matter of prime importance was the steady extension of steam rolling, and the carrying out of general repairs and the making up of road-crusts on a larger scale than formerly. In some cases, where main roads ran for considerable distances through sparsely peopled districts, they were neglected, having no longer the importance which they had in the coaching days, but elsewhere these roads, being of considerable local value, gained by the reduction in through traffic, and as general traffic developed they were maintained efficiently. Many roads, unfortunately, suffered from the encroachments of greedy landowners, the cost of future maintenance being, in some cases, materially increased by the narrowing of these roads. A fallacy which vitiated much of the work done during this period was the idea of the dominant importance of evaporation as a factor in road maintenance, and in many cases efforts were made to increase the rate of drying by evaporation where the quantity of water to be dealt with was greatly in excess of that which could be controlled by that means. In a good many places the efforts made in this direction, while they produced very dry and dusty roads in dry weather in the summer, made the roads wetter and much muddier than they had previously been during the winter months. Excessive camber was often given to the crust, and on stretches with little or no gradient the two ruts, filled with water or developed into strings of puddles, were a familiar feature of many districts. Another vital defect of road maintenance, but one which was by no means general, was the lack of an appreciation of the importance of labour in proportion to the expenditure on materials. This applied, more particularly, to the work done when materials were put down and immediately afterwards. Another source of expense in road maintenance was the failure to grasp the fact that narrow tyres cause much damage and wear. When favourable weather followed the spreading of stone the narrow tyres made a very dense road crust, but when the weather was wet or very dry the materials were to a large extent wasted, and did not consolidate properly except where wide-tyred farm vehicles formed a large proportion of the total amount of traffic. Another feature of road maintenance during this period was the serious damage done to weak main roads by occasional very heavy loads. It is not generally recognised that the spread of population during this period was, in the absence of any convenient procedure as regards the making of new roads, to a large extent hampered by the absence of roads on soils naturally unfavourable to their formation by gradual development. In a few cases, however, the natural difficulties led to the construction of roads of an enduring character, since nothing less than good work was sufficient for the purpose. The growth of population was accompanied by the rise of a well-to-do middle class, the distribution of which near large industrial centres was beginning to have an effect upon the demand for serviceable roads of a secondary character, and was directing attention to the value of by-roads. The distinction between country folks and town folks was now less sharp than it had hitherto been, and a kind of rhythmic movement between town and country began, towards the end of this period, to add to the importance of roads generally, and of secondary and by-roads in particular.

THE PERIOD FROM 1890 TO 1905.

We have now briefly sketched the position of affairs before the introduction of railways; we have noted some of the direct and indirect effects of railway development upon the road system, and have shown how certain natural conditions of permanent importance exert a continuous influence upon highway development, not only directly, but also by their profound effects upon the distribution of population and the use which can be made of the

land. The mere growth of industrial populations, though, of course, of great importance locally, had but little influence upon the highway system generally during the first period; but we have seen how, during the twenty years from 1870 to 1890, industrial and commercial progress was beginning to be felt in various ways as a factor in road maintenance, while it is taken for granted that the reader realises how some industries added considerably to the amount and severity of traffic upon roads radiating from their seats of activity, while others were served mainly or wholly by the railways and by ships. At the same time highway work had a vitality of its own, and certain developments were rather native to the art than the result of the adaptation of the roads to meet the conditions of national life. This brings us to the year 1890, the date being chosen as intermediate between the passing of the Act constituting county councils and that which created district and parish councils, and we will first consider some of the main features of the period from that date to 1905, during which THE SURVEYOR collected week by week the more important records of highway work, discussed from time to time various features of technical developments, formed a rallying-ground for the profession of highway engineering in the British Empire, and provided an extended debating hall for the discussion of matters pertaining to the interests of highway surveyors in the British Isles.

Most unfortunately, this period was all too short for the successful development of its activities; the highway system of this country would have been better both administratively and technically if the local authorities had been created earlier, giving a longer run to the developments which were in part checked and in part confused by the advent of the motor-car. The construction of water-bound crusts of a high order of merit was, however, a feature of this period, and has left to the present day a legacy of great value. In some counties the surveyors, during these years, developed main road systems important in extent and so made that they not only greatly improved the chief communications of the counties concerned, but also set an example which has had an important effect upon the secondary systems for which the district surveyors are responsible. The public generally, and notably certain groups of wealthy and influential road users, have failed to appreciate the value of some of our main road systems as they stood in 1905, and do not realise to how great an extent and with how little alteration they meet the requirements of to-day in many parts of these islands. Unfortunately many counties did not appoint surveyors, or did so only towards the end of the period, or adopted a weak and hesitating policy at a time when it was of the utmost importance to lose not one of the precious years preceding the advent of the motor-car. Generally the work done in this period produced widely different results in different parts of the country, the local developments being in some cases suited to the needs of the area, but in other cases quite inadequate. We may find a single county, or a group of counties, in which main roads have been developed and the secondary system neglected. In other areas the secondary system was developed, often to an important extent, but the main roads were starved, and were found wanting as traffic developed. There are yet other areas, usually on "favourable" strata, which are served by a fairly good network of roads regarded as a whole, but with no part of the network developed as a secondary system, and with only a few overworked and therefore uneconomical main roads.

On the groundwork of general policy certain districts stand out, or groups of districts, in which the roads have been well managed by highly qualified and, in some cases, suitably paid district surveyors, supplied with funds sufficient for the economical management of the roads in their charge. Elsewhere local apathy growls and grates beneath the wheels of passing vehicles. Many towns, large and small, greatly improved their roads and streets during these fifteen years, and in some cases these improvements are important as parts of the development of the highway system generally.

Engineering features of importance marked the progress of road work during this period. The steam roller came into use more and more, and was employed not only on main roads, but in making up the crusts of secondary and even by roads. In Scotland the introduction of the steam roller was rapid, when once the reluctance to make the change had been overcome, and the effect in keeping down the cost of maintenance of roads in that country has been important. In Ireland, on the other hand, opposition to the steam roller was effective in preventing its adoption except to a very small extent in a few counties. More attention was now paid to the best kinds of road stone, and, in using them, the method of general rolled renewals to a great extent superseded the method of short-length repairs and large patching, which were characteristics of the previous period. The value of small, constant repair was, on the other hand, undervalued, especially on main roads. Where this principle was not neglected, however, good results were obtained by adopting or continuing it, in conjunction with periodical general renewals. An important advance was the change from scraping to sweeping, which, in more ways than one, has prolonged the life and increased the practical usefulness of the roads. The delicate nature of the road surface was recognised, careful and competent roadmen were employed, reckless cutting of the turf and laying bare of raw and easily denuded subsoil gave way to careful trimming of the edges and the proper maintenance of turf margins. Bridges now received more attention, and in some cases the county councils took over the responsibility for their maintenance and for the construction of new bridges, including some on district roads. While the purely general character of this sketch precludes personal references, the joint work of three investigators into the nature and properties of road stones towards the end of the period will be in the recollection of the reader as a matter of first importance.

As regards traffic, an important feature of the period was the enormous increase in the number of bicycles, introducing a demand for smoother surfaces, and for the removal of hedge clippings, emphasising the value of hard, igneous rocks, and reducing the relative importance of flints. At the beginning of the period the bicycle was a touring and pleasure vehicle, but in the last five years or so it had become an ordinary possession for daily use, and a more powerful factor in the demand for roads with less mud. The increasing number of traction engines was in some localities a serious matter, but when they were used for hauling building materials—building in places distant from main roads being a feature of this period—it was often possible to recover the cost of the repairs made necessary by their use of particular roads. The amount of general traffic was steadily increasing; there were more "carriage people" than before, motor-cars began to run timidly about the roads, and heavy motor-wagons entered the field, partly as new traffic, and partly as competitors with traction engines. The motor-wagons of this period, some of which are still in use, imposed heavier axle-loads than those allowed with vehicles built since the passing of the Heavy Motor-car Regulations of 1905. This led to a study of the strength of crusts, but little was done in the direction of practical improvement in this respect. The growth of population was increasing rateable values, but not in proportion to the increased use of the roads. The growing wealth of all but a few classes, increasing restlessness, the appreciation of beautiful scenery and of the charms of country districts generally, all tended to add to the amount of traffic on the roads, and a good deal of it in the somewhat severe form of heavily-laden wagonettes and brakes. The tradesman's boy with

his basket gave way in many cases to the smart delivery cart, and large stores extended the area of their road delivery. The use of the bicycle for touring led to an appreciation of the charm of the road itself, a new idea which had no counterpart in previous periods, and was partly due to the period of rest, when main roads, relieved of their traffic by the railways, provided safe and pleasant routes for the seeker after health and pleasure.

The Period from 1905 to 1913.

There were, then, important developments preceding the invasion of the roads by motor-cars, and in the period now to be considered these factors have continued to increase in importance, and have led to a demand for road widening in places where the traffic of a considerable network of roads is, for a short distance, concentrated on a few routes or on a single road. The great feature of the period now being considered is, however, the development of the motor vehicle, at first in its two chief forms, the ordinary motor-car and the heavy lorry, and more recently through a greater range of vehicles, the most important of which, in many districts, is the motor delivery-van with rubber tyres, allowed to travel at 12 miles an hour, and often going a good deal faster. Another factor of importance is the use of large and heavy motor-cars which meet trains and convey passengers and luggage to private houses, and are used more and more for trips to the seaside with considerable quantities of luggage, and for travelling generally, instead of the railways. The demand for more even road surfaces, which was a feature of the first few years of this period, gradually lost force as the suspension of motor vehicles was improved. On the other hand, increase in speeds and in wheel loads led to a demand for tougher surfaces. The use of harder stone and, in some cases, successive coatings of tar have led to a change from smooth but somewhat friable surfaces to tougher upper layers, which, being less susceptible to the smoothing effects of weather and traffic, have developed a surface with a small scale joltiness which is unpleasant to the cyclist, and, on account of the numerous small puddles, to the pedestrian, but is satisfactory to the drivers of motor-cars and other vehicles. The softer kind of crust which used to provide excellent going on secondary roads is, on the other hand, liable to be beaten into pot-holes, chiefly by the hydraulic effect of the wheels of motor-cars descending suddenly into slight depressions which are filled with water. There are two ways of dealing with this—the waterproofing of the surface and its maintenance to true shape, and the provision of means of rapid drainage through and from the crust. The former is rendered difficult by the fact that water will collect on muddy surfaces, however true to shape, and in slight depressions; the latter by the difficulty of preventing local puddling effects, however good the drainage through and from the crust. Small constant repair is one general precaution, and another is a general thickening of the crust, the settlements in which are mainly due to heavy wheel-loads.

An unpleasant feature of many main roads with much fast motor traffic is the driving of mud and dust towards the margins, the mud being, in some states of the weather, a danger to cyclists, who are also driven towards the edges by the motor-cars. To some extent, however, the difficulty provides its own remedy by reducing the amount of labour needed to remove the mud or dust. Surface tarring is the most striking and important feature of the development in road maintenance in this period. The range of gradients on which it can be used is in any case greater than that to which tar-macadam can be applied, and when the seasonal method is adopted, and the tar is mostly worn out by the winter, the range of gradients on which tarring can safely be used is still further extended. Surface tarring greatly reduces the dust nuisance and provides roads which are sometimes clean when untarred roads are muddy; it reduces the crunching noise made by iron-tyred wheels, and, in warm weather, the noise of hoof-beats. In some cases it has reduced the cost of scavenging in urban areas, and the same factor may be of some importance on country roads. On the other hand, the dust from tarred roads is, in some respects, worse than a large quantity of ordinary dust; the tarred road is sometimes wet and sloppy, or greasy with mud when other roads are in very good condition, and the mud brought from tarred roads into houses is ten times worse than ordinary mud. The usefulness of tarred roads will probably be increased by an extension of the practice of sweeping, by leaving untarred those stretches of road which are subjected to the action of seepage water or are in otherwise damp situations, and by making it an almost purely seasonal operation where the roads are on clay soils. Generally, a review of surface tarring would show the importance of the nature of the soil, and the greater value of the process in sandy districts compared with areas in which clay, which works up into a slime with tar, is brought on to the roads in considerable quantities.

The period from 1905 to 1913 has seen some renewal of attention to the matter of small constant repair, and quite recently the importance of simple patching with materials exactly the same as those of the crust has been realised in some places where its neglect had led to needless damage being inflicted upon the roads. Road stones which may be classed as secondary are also receiving more attention, since it is realised that their apparent failure has been in some cases due to matters which demand separate attention. Drainage as a part of road engineering is taking the place of drainage as a cult, and the importance of taking geological factors into consideration is more generally recognised than it was a few years ago. The idea that a few "clever ones," not necessarily trained engineers, can put their heads together and think out a "solution of the road problem" is giving way to the common-sense view that maintenance and reconstruction work on roads is a part of road engineering, which is itself a part of the great profession of civil engineering, and subject to the same primary laws. The great advance of this period of eight years is indeed mental rather than actual. It is realised that what is necessary now is to bring our roads as far as possible into the form which would be given them if new roads were made on the untouched ground.

To-day the country possesses all the elements needed for an efficient organisation of the highway system. In spite of the criticisms which are made so freely with regard to the condition of our roads and the cost of their maintenance, it yet remains to be shown that the roads of any country are more generally efficient and better suited to their purpose, or less costly in proportion to the population served, the area covered, the number of wheels passing per day, the tonnage passing, or the rateable value of the country. Yet our road surveyors have not the advantages possessed by men who have charge of deliberately planned highways. The amount of heavy engineering work which has been done in making and reconstructing our roads is, it is true, far greater than is generally supposed; but we have to care for a large mileage of roads which have been handed down to us as the result of natural facilities freely made use of, as a legacy from enclosure Acts made piecemeal and without reference to a general planning of highways, and as the results of individual acts of conscience or unconscious "dedication," often welcome, but frequently leading to the creation of responsibilities which can with difficulty be reconciled with the economic development of a road system. All difficulties can be overcome, however, if the proper means are taken to overcome them, and the chief of these means is the organisation of the surveyors and the development of an administrative system which will both enable and encourage them to do their best.

THE ROAD BOARD.

The most important development of this period was, of course, the creation of the Road Board. In the present connection it is not the situation as it is to-day that claims attention, but the essential constitution of this sub-department of State, and the developments to which its creation seems to point. It is not necessary to distinguish between what the board was meant to do and what it is found desirable that the board should do. Its two chief functions are—first, to act as a central information office for the compilation of statistics, the keeping of permanent records, and the encouragement of original research and of useful reports on the practice of different localities; secondly, to acquire land for highway purposes. The distribution of grants is quite a secondary matter, and it can hardly be supposed that, in its present form, this will be a permanent practice. The money can be spent to better purpose in a different way. As a central intelligence department the board will be able to take into consideration those local conditions which must be studied in order that practice in different localities may be interpreted for the use of highway engineers over the country generally, and to make it possible to separate the elements of general principle from those of only local importance. It will be possible to compile statistics in a form accessible to surveyors generally, and to make records of costs of maintenance under different conditions, which will furnish valuable studies, and tend to important economics. As regards the purchase of land, the powers of the board are ample, and the roads made under these powers will be more than ordinary highways, not only because the highway authority will be owner of the soil of the highway itself, but also for the reason that the same authority will be able to control a strip of land on each side of the highway, the board's powers to "sell, lease, or manage" providing for control of such strips of land without preventing it from being used economically for agricultural purposes. The present positions of the highway authority and the owner of the soil may, in fact, be exactly reversed.

The practical result will be that, without invoking the assistance of the board otherwise than in the completion of the necessary formalities, or as a last resource when owners prove difficult to deal with, the local authority will be able to buy land outright, or to buy the soil of the road and easements over strips on each side of it. The clumsy method of improvement by grants will give way to a reasonable departmental procedure, in which the highway organisation will function as a whole. All proposals for improvements costing less than some small limit will, it may be suggested, be submitted with lump estimates and sketch plans, will pass through the county engineer's office with a time-limit for remarks, and will be dealt with at the Road Board's office by an engineer specially charged with this duty. Proposals for works costing less than some larger limit will be dealt with in a similar but more leisurely fashion, will be accompanied by detailed estimates and scale plans, and will receive the attention of another Road Board engineer, and some actuarial scrutiny. Proposals of importance, involving joint action by the county and district authorities, and, usually, the acquisition of land, would be settled after a local conference between a Road Board engineer and the county and district surveyors, plans and estimates having been previously submitted to the board. Local responsibility will be developed, not superseded. Further taxes will be allotted to the Road Board's fund, which will, at the same time, be made available for maintenance as well as improvement. Eventually an organisation will, it may be hoped, be formed—and the present conditions almost permit of it—such that, while local authorities will have a large measure of control over their roads, they will not be allowed to appoint incompetent surveyors, while a simple machinery for the transference and promotion of surveyors will meet the convenience of both parties when relations become strained.

Control of highways by magistrates and private associations must cease.

It is the experience of almost all countries or the tendency is apparent—that responsibility for highways must be threefold; and the best work is done where there is an organisation corresponding to a State department working with county and district authorities, an important fact in this connection being that the area occupied by the State is often considerably smaller than a whole country such as France or the United Kingdom. The threefold system, properly developed, is what is wanted in this country, and the creation of the Road Board has made it not only possible of attainment, but has brought it within the range of immediately practical achievement.

MUNICIPAL AND PUBLIC BUILDINGS.

Although a period of twenty-one years is but about half the total length of the average person's professional experience, a comparison between the municipal building work of to-day and that of the early 'nineties shows a remarkable contrast. Twenty-one years ago the movement known in architecture as the Gothic revival had barely spent its force. It was still considered a reasonable thing when designing such a building as a school to try and arrange the required accommodation between the walls of a structure which externally presented the appearance of being a poor relation of a Gothic abbey. The architects of that day, in their just admiration of mediæval buildings, never seemed to realise that characteristics which rendered a building suitable for a certain purpose in the thirteenth century would, in the majority of cases, be quite undesirable in a building erected for a different use in the nineteenth century. Also those designers who had broken away from the mid-Victorian fashion in building were very far from allowing themselves a free hand. It was then a recognised law throughout all architectural work that every building of any pretentions at all must be designed in strict accordance with one or other of the principal architectural styles. So we got Romanesque dust destructors, Italian Renaissance electric generating stations, and Greek hospitals. Now, to a great extent, we have broken free from these unnecessary restrictions, and a large number of buildings are designed with principal regard to the practical uses to which they are required to be put. Except in the case of such buildings as town halls, municipal offices, and large public libraries, where a monumental appearance on classic lines is still considered necessary, it is now the general practice to avoid the close following of any particular style. Buildings are designed, as regards their planning and general construction, to fulfil certain purposes, and the features required for practical purposes are so treated as to produce a pleasing appearance both externally and internally. The fact is now recognised that good architecture consists not so much in the provision of moulded and carved ornament as in correct proportioning of the several parts of a building, and in the use of materials which are pleasant to look at, and in keeping with their surroundings.

IMPORTANT PUBLIC BUILDINGS.

One of the features of the past two decades is the construction of large public buildings by our principal municipalities. By far the greater proportion of our chief corporate bodies have recently either so enlarged and extended their existing town halls or municipal offices as to change their character very considerably, or have erected entirely new buildings. In some cases buildings have been thus constructed which will compare most favourably

with the best historic buildings in this country. Among the smaller new town halls that of Colchester occupies a prominent place, and among the larger buildings the city halls of Belfast and Cardiff, particularly the latter, represent very fine architectural achievements. As nearly all the buildings of this type have been the result of open architectural competitions, it will be of interest to consider how this method of obtaining the design of a building compares, when judged by its results, with other methods. It will doubtless be conceded by every one that in the majority of cases an open architectural competition results in the obtaining of a very good plan. If the particulars as to the accommodation required are clearly framed it can hardly happen but that some one of the fifty or more persons entering for the competition will hit upon a satisfactory plan. In other respects, however, there is a tendency for a building which is the result of an open competition to fall a little short of the standard of possible excellence. It will usually be designed by a person who is not very familiar with the locality. Also the designer, by reason of the great trouble expended by him in obtaining a good plan, will not usually care to give a great deal of time to the conception of the exterior portion of his design. He will tend rather to follow the line of least resistance, and to produce a design of stereotyped pattern, which would be just as appropriate if built in any one town as in any other town. Yet surely a town hall, of all buildings, should be characteristic of the locality in which it is erected. Where there are suitable local building materials, and, as is sometimes the case, characteristic local methods of construction, such materials should, where possible, be employed in the local manner. Important municipal buildings should not have the appearance, as is now unfortunately to some extent the case, of having been turned out of the same designing factory.

Alternatives to an Open Competition.

Two reasonable alternatives to the holding of an open competition appear to suggest themselves. The first is the holding of a competition limited to a few experienced architects, each of whom should receive remuneration for his trouble. The second is that of instructing a single architect of high standing to prepare designs, possibly in conjunction with the local borough engineer. In a limited competition where each competitor may be entitled to think he has a quite possible chance of success, more care will be taken by the competitors to study the conditions on the spot, particularly if the unsuccessful ones are assured of receiving some remuneration for the thought and labour expended. In this way a more suitable building will probably result than that which would be obtained from an open competition. As regards the second method of instructing a single architect to prepare designs, everything depends on the personal equation. If the architect chosen possesses the fullest attainments for carrying out the work concerned, it is almost certain that, working in close touch with his employers, he will produce a better building than the raw product of a competition, in which the competitors cannot but be in the dark in regard to numerous detailed requirements. In proof of this is the fact that the accepted design in a competition is often modified very considerably when the winner of the competition comes into direct contact with the responsible committee, and realises many requirements of which he was previously in ignorance. But there is the great risk, if an architect is appointed without the holding of a competition, that the work may not be entrusted to the most suitable man.

Monumental Structures.

Although probably the large town halls and similar municipal buildings that have been erected of late years will constitute the principal enduring records of the past quarter of a century, there are other structures which rank as monumental architecture. London has seen the erection of two magnificent buildings in the Roman Catholic Cathedral and the new Wesleyan Hall, both of which are situated in the same district of Westminster. At Liverpool there is in course of erection a great Cathedral which, when completed, will vie with the wonderful religious structures of the Middle Ages. But it is not merely in the large towns that our present age is leaving its mark. Throughout the whole country there has been a most noticeable movement in regard to the erection of public monuments. The sacrifices made in the South African war have been fittingly and artistically commemorated, not only in the big cities, but in many a small country town. Also, celebrities of national fame who for several hundred years have received no public mark of respect in the localities in which they lived and died have recently been given their long-delayed recognition. Fortunately, this increased public appreciation of the use of commemorative statuary occurs at a time when, in the opinion of the best judges, English sculpture has reached a level of excellence considerably above that of the work of the past two hundred years. It may therefore be confidently anticipated that the public monuments of the present day will hold their own when judged with those of past or future generations.

Buildings for Educational Purposes.

Education and yet more education is the cry of the age, and this feature of our modern life has been well emphasised in the buildings recently erected. During the past few years there has been a veritable mushroom growth of school buildings, and, as ordinary buildings for educational purposes are now under the control of the various local authorities, the officials of such authorities have in many cases been given considerably increased work, without the additional remuneration which, in all fairness, should be theirs. If a local authority requires its engineer to undertake work which was quite outside the scope of his duties when his appointment was made, he ought obviously to receive special remuneration in addition to his ordinary salary. And this is particularly so when, as in the case of the design and erection of buildings for educational purposes, the work concerned is one which is of a special nature demanding considerable thought and study. The recognised ideals to be followed in the design of school buildings have altered so frequently during the course of the last twenty years that the designer of successful buildings of this nature is practically required to anticipate future changes in public opinion. It will hardly be sufficient for him to comply with all regulations that are in existence at the present; it is necessary in addition, if his buildings are to be considered satisfactory for many years, that he shall bear in mind the general trend of opinion in regard to educational matters. Two features are here noteworthy—viz., the increased attention given to physical culture and the growing advocacy of fresh air. The first consideration suggests the provision of ample accommodation for drill, as, for instance, the wide "marching corridors" now provided in many schools. The second suggests the placing of as little reliance as may be possible on mechanical means of ventilation and the provision of ample window spaces so fitted that it is possible in the summer time to obtain almost an open-air school. It is of interest to note how the change in ideas on matters of hygiene has affected the placing of the "central halls" which are necessary in most schools. Till recently large rooms of this description were planned with class-rooms all round them, and thus the only ventilation possible was by windows in the walls carried up above the ceiling level of the class-rooms. Now it is considered that, to obtain effective ventilation, one side of the room must have windows opening at ordinary levels of 3 ft. or 4 ft. above the floor, a wall which is an external wall for practically the

whole of its height being thus required. It on this account follows that in most modern plans the "central hall" is situated at the side of the school.

HIGHER EDUCATION.

While the bulk of schools recently erected have, of course, been for the purpose of elementary education, the requirements of secondary and technical education have received very considerable attention during the past ten years. Now that the great majority of secondary schools are, if not under the control of local authorities, at least to a great extent supported out of the public funds, the standard of attainment has been greatly raised, and the old accommodation has been found to be insufficient. Many secondary schools have, therefore, been enlarged, and not a few have been rebuilt entirely. Technical education has for long been a matter for local authorities, and the increasing demands in this direction have been very well met. Indeed, there is hardly an important town in the United Kingdom where a person desirous of learning some particular technical subject will not be able to do so at the expense of the rates.

A branch of constructional work which is at root very closely connected with that of the erection of educational structures is the building of free libraries. Thanks to the generosity of Mr. Carnegie, almost every important centre is now well equipped with libraries. In this work, as in the erection of school buildings, new problems have arisen for solution. The fact that these have been overcome, and that there have been erected numerous buildings which admirably fulfil their purpose as resorts for literary recreation and study and as depots for the storage and distribution of books, is conclusive evidence that modern architecture is well able to fulfil modern needs.

HOSPITAL WORK.

The last few years seem to have shown if anything a falling-off in the number of hospitals erected by local authorities in pursuance of their duties of providing for cases of infectious disease. Serious outbreaks of diseases of this kind are now of very infrequent occurrence, and many authorities who have taken care to have ample accommodation for an epidemic of such a disease as small-pox have had practically no use for their buildings. The great advances that have been made in sanitary science are having their effect, and it can hardly be anticipated that in the future there will be any great need for the erection of many new hospitals for infectious diseases. Although hospitals for general cases are at present maintained by private subscriptions, it is a debatable question whether before thirty or forty years are past they will not to some extent have become one of the many responsibilities of local authorities. Local officials, who are expected to know almost everything, whether within the scope of their present duties or not, may perhaps therefore give a little attention to general hospital construction. One of the features of to-day is the gradual removal of old hospitals from congested surroundings in the centres of towns, and their establishment on the outskirts, where the double advantages of fresh air and cheap land are available. King's College Hospital in London is an important instance of this kind. For many years fine new buildings have been in course of construction for this hospital at Denmark-hill in South London; this work is now nearing completion, and the existing hospital premises in the neighbourhood of the Strand have recently been advertised for sale.

HOUSING OF THE WORKING CLASSES.

Some ten years ago the lack of satisfactory housing accommodation in the large towns was a very serious question, and the erection of working-class dwellings was undertaken on a fairly big scale by most of the important local authorities. At first enterprise in this direction was principally restricted to the erection of large blocks of tenement dwellings in the inner districts, but in some cases it was found that, despite the admitted lack of houses for the worst-paid classes, these tenement dwellings were difficult to let. Consequently a new departure was made, and cottages were erected in the outer suburbs. These have been found to be much more appreciated, and at the present time, although the erection of tenement dwellings has not by any means been discontinued, the general tendency is to erect cottages. While the housing problem in rural districts still remains to be solved, and year by year becomes more acute, it would seem that in the towns the factors of supply and demand in regard to housing are becoming more nearly adjusted to one another. The erection of municipal working-class dwellings on a fairly extensive scale has, of course, been one of the important features in this partial solution of the urban housing problem, but possibly a still greater one is the increased transit facilities which have been created by both public and private enterprise. By this means the workers in the central districts are able to reach the extreme outer suburbs, where, owing to the cheapness of the land, it is still possible for the local speculative builder to erect cottages that are let at rents within the reach of ordinary workmen.

The solution of the rural housing problem still appears to be a matter of great difficulty. It seems an incontrovertible fact that it is not possible for either private owners or local authorities to erect in ordinary agricultural districts cottages which will return any reasonable percentage on the money expended. Either the agricultural labourer must be paid a higher wage to enable him to meet a rent of about double that to which he at present is accustomed, or the problem of rural housing must be dealt with as it has been in Ireland by means of a large money grant from the Exchequer.

MISCELLANEOUS BUILDINGS.

Municipal enterprise is nowadays displayed in so many directions that the classes of buildings already dealt with represent only the principal ones that come within the scope of local activity. All kinds of other buildings may be, and often are, required, and if the whole municipal output of the last twenty years were to be summarised and classified it would make an interesting list. There are of course—to use what appears to be an American term—the "public utility" buildings of each local authority, such as the electric generating station, the tramway sheds, the dust-destructor, the fire station, the public baths, the depot, the buildings at the sewage works and at the waterworks. Sea-coast towns have also their concert pavilions, shelters, and piers. A very great proportion of all these buildings and structures have been erected within the past twenty years. Progress is still more rapid than ever, and it may be anticipated that in the course of a very few years municipalities will be the owners of buildings and landing-stages for aeroplanes and other aircraft.

IMPROVEMENTS IN CONSTRUCTION.

We have lately seen most striking departures in construction. Although the American sky-scraper is not yet a feature in this country, and, it is to be hoped, never will be, the American practice of steel frame construction is becoming very general, and is now recognised by Act of Parliament in London. In the development of reinforced concrete is seen an entirely new form of construction which is tending to monopolise certain branches of work. The erection of such a structure as a large retaining wall or a grain silo in any other material is now admittedly a wilful disregard of the resources of modern science, and it may not be very long before the timber pile is entirely superseded by its reinforced concrete rival. Whether or not these new forms of construction will ever take the place of brick or stone work for buildings of ordinary character, it is certain that they will be increasingly used in those branches of building construction which are most closely allied to engineering.

REFUSE DISPOSAL.

In this, the coming-of-age number of The Surveyor, it is proposed to review the ground traversed in the above branch of engineering since twenty years ago.

At that time the writer was on the engineering staff of a municipal engineer in the Midlands. It was the proud boast of that staff that their sewage disposal works were, so far as was known, the first to be lighted with electricity generated therein, and they claimed to be pioneers in other progressive movements; but at least 80 per cent. of the inhabited houses of this county borough were provided with privies, the contents of which were deported daily and nightly to a "depôt" by an expensive team department, there to be mixed with ashpit contents and disposed of under the title of agricultural manure.

No doubt instances may be cited where this apparently innocent and rational operation is proceeding to-day in small communal districts—districts separated from other populated centres by greenfields and open spaces—but the county borough in question had a population of 80,000, and was closely hemmed in by other thickly-populated urban districts in all directions.

And if at any time an objection were raised to the existence of the depôt, and the installation of a refuse destructor was advocated in the interests of both health and decency, the objector was always silenced upon it being pointed out that in the absence of a thorough water-closet system the handling of privy and ash-pit contents was bound to continue.

WATER-CARRIAGE SYSTEM OF SEWERAGE.

It is probably not more than twenty years ago since the water-carriage system of sewerage was accepted and began to be adopted by all sanitary authorities as the most cleanly and satisfactory method, in spite of the old opposition on the ground of expense from both property owners and "low rate" representatives on the councils.

But with a gradual and complete adoption of this system by all authorities, even down to those of only 2,000 population—ashpit refuse became isolated from privy refuse, and has to be considered on its own merits or shortcomings.

True, a certain amount of progress had been made before this date with regard to the incineration of ashpit refuse, inasmuch as certain residential towns had adopted the water-carriage system already, and were confronted with the disposal of ashpit refuse only.

The authorities of such towns, however, were not long in discovering that refuse heaps, whether covered over with a few inches of soil or not, whether hidden away in areas of low rateable value or not, whether the inhabitants of contiguous dwellings were intimidated or not, yea, even whether the cavities to be filled would enhance the value of land actually belonging to the local member of Parliament or not—refuse heaps were a danger, a menace, in neighbourhoods where human beings crowded together and lived under circumstances quite foreign to animals naturally.

Among the

EARLIEST WORKERS IN REFUSE DESTRUCTION

at this time, one of the most prominent was the late Mr. Alfred Fryer, of Messrs. Manlove, Alliot and Fryer, Nottingham, who, in collaboration with the late Mr. Angus Smith, made very valuable investigations concerning both the desirability of refuse incineration and the effects of incinerating by such appliances as were then extant.

To-day it appears strange to read the following quotation from the *Daily Chronicle* of August 8th, 1885:—"A lecture on 'Dust Bins and Cholera' was delivered last night at the Royal Aquarium by Mr. Wm. Warner, A.M.I.C.E., of Nottingham, Dr. de Lacey Evans in the chair. . . . At the close of the lecture Dr. Daniell moved that in the opinion of this meeting it is desirable that house refuse from dust bins should be cremated as a preventive to disease. Captain Molesworth, R.N., seconded the motion. The resolution was carried with two dissentients."

In 1888 Mr. Warner, in a paper read at Bradford before the Yorkshire Association of Sanitary Inspectors, after referring to the early work of Messrs. A. Fryer and Chas. Jones, of Ealing, as well as the researches of the late Mr. Thos. Codrington, M.I.C.E., on behalf of the Local Government Board, said: "The development of this burning method has been no easy matter, and at the present time it has to fight many severe battles. Sometimes our advanced sanitarians are met and defeated by their fellow councillors in the council chamber; often they are opposed and defeated by the action of meetings said to be gathered together to prevent inquiry by the inhabitants; but more probably there is some political element in the background. Again, they are defeated by old clauses in the Public Health Act which are supposed to infer that no refuse furnace shall be built in a neighbour's district without consent, no matter whether to his advantage from a sanitary or a financial point of view. Further, the destruction of refuse by fire has been defeated by our greatest legislators in the House of Commons, though approved by a Select Committee of that House."

Referring to the many furnaces invented and patented after Fryer's, Mr. Warner said one of the first to try his ingenuity was Pickard, at one time a workman at Armley-road destructor, Leeds, who called his furnace the "Gommand." Its principle was similar to that of the Gommand regenerative furnace, which consisted of a large cavern-furnace with one opening to several sets of clinkering doors and two small fires in the main flue. Wilkinson, of Birmingham, came next with a large grate, open charging hopper and a perforated wall at the back, similar to that tried by Pease and Lupton. Young, of Glasgow, made a similar furnace, and had the assistance of a fan blast. Healy, of Brighouse, devised several furnaces, and had no less than five patents. The one erected in Bradford had flues which conducted the hot gases over a hollow reverberatory arch, where it was said they would burn and the fumes become odourless.

Heard, of Paddington, had one consisting of two cells with flat fire-bars fed through a kind of water-tank, which formed the fire-arch. Burton, of London, made a continuous-supply furnace with a long, inclined hearth and back fire-grate, the material being pulled through by a chain. Stafford and Pearson patented two furnaces in the form of bee-hives, which were tried at Bradford, Batley, Richmond, Leicester, and Birkenhead.

From among the chaos of furnaces the Fryer type emerged and held precedence for some years. Its essential features were a number of cells each independent of the other, but all passing their products of combustion into a common chamber; each cell had a feeding-hopper at the back, clinkering doors in front, and a reverberatory arch common to both fire-bars and drying-hearth, the fire-bridge and feeding-hopper being formed side by side at the back of each furnace.

Mr. Charles Jones, of Ealing, was the first to add a "fume cremator" to a destructor, and this was owing to difficulty experienced in the burning of house-refuse together with sewage sludge.

The Horsfall destructor followed, with features generally on the lines of the Fryer, but having differences in detail, and then came (though on points of actual priority we do not concern ourselves here) the Warner "Perfectus," with special dampers (worked in the front of each cell) which are used to shut off any single cell during feeding and clinkering.

The use of cremators was continued for some time, and was undoubtedly of value in decomposing low-temperature gases.

The advantages of a *permanent* higher temperature, however, were so patent that various expedients were resorted to by many makers to achieve this end, but without the trouble and expense involved in a "fume cremator."

A common combustion chamber at a very high temperature was resorted to for some time; but this resulted in banishment of boilers and a soft clinker. What was required was something which would bring about a high temperature on the bars, giving a hard clinker and no empyreumatic matter entering the combustion chamber at all.

The "side-by-side" grate accomplished this, a form of furnace arrangement with which we believe Messrs. Beaman & Deas were prominently identified so far as its introduction was concerned.

To-day the arrangement is almost universal, ensuring as it does the passing of "green" gases or distillation products over at least one grate in a state of incandescence.

THE MODERN TYPE,

therefore, may be described as a destructor having side-by-side grates or cells, the products from which lead to a common combustion chamber, forced draught under the bars by means of steam jets or fans, such draught having previously been heated by means of regenerative appliances.

True, all makers will not admit this contention, some still adhering to single cell or independent furnace installations; but the cost of such installations is generally higher than side-by-side grate arrangements.

FUTURE DEVELOPMENTS.

One of the most common subjects of conversation in the drawing offices and among the technical advisers of destructor-makers is now the question of "regenerated air feed."

The tendency is to consider the advantage thereof much exaggerated, and we are disposed to think it is.

Looking firstly at the matter theoretically, we are bound to consider that the CO_2 content of destructor furnaces is invariably high. While most of the continuous CO_2 recording appliances in electrical or other power stations on coal-fed boilers show an average of 9 to 10 per cent CO_2, the minimum often falling to 8 per cent, the average figure for a destructor is 12½, and 15 per cent is common.

The reason for this of course is the great depth of fire on the bars of a destructor furnace as compared with a coal-fired boiler.

Now, such being the case, it can be assumed that no more than 20lb. air per pound of fuel (combustible) are fed into the furnace—that is to say, excess air to the extent of about 60 per cent over the minimum.

Now if this air be heated by means of regenerators to the usual temperature of 250 deg. Fahr. net, the total heat units fed in with the hot draught per pound of fuel combustible will be

$$250 \times 20 \times 0{\cdot}238 = 1{,}190 —$$

equivalent to a saving of about one-twelfth the heat value of the refuse.

But from this value must be deducted the steam required to drive fans used for propelling the air through regenerators, and when this has been done the balance is certainly small, for one firm of makers actually advertises that the energy absorbed for driving fans is 8·5 per cent of the total in the refuse.

Two important facts are worthy of observation here.

First, no published tests of destructor practice show the economies effected *with* and *without* regenerators, and this is not because such have not been made by destructor contractors within the writer's knowledge.

Secondly, the air feed can be pre-heated to an appreciable extent without regenerators at all by means of jackets or cavities arranged structurally in the brickwork.

This has been done very successfully at a destructor recently inspected by the writer—the advantage being twofold, inasmuch as there is a very decided coolness on the top of the furnaces.

A very important point in this connection, too, is the saving of the fire bars ensured by steam jets which are absent where fans are in vogue.

BACK VERSUS FRONT FEED.

Twenty years ago back feed and drying hearths were deemed essential parts of all destructors, and these were accompanied by a certain amount of preliminary sorting which has since become to be regarded as unnecessary and objectionable. The tub feed invented by Messrs. Horsfall is undoubtedly a very clever and ingenious arrangement, but the complicated mechanisms lead sooner or later to trouble, and, after all, the dumping of refuse in quantities of hundredweights or more in one place on the fire-bars tends to stop the active progress of combustion. The fires are virtually "banked up" for the time being.

Consequently for the past five years hand-feeding from the front has been advocated pretty generally. But recently a return has been made to hand-firing under modified conditions.

A furnace now in very successful operation is one made on the lines of Messrs. Meldrum's side-by-side grates, but with the grates sloping towards the front with a fall of a few inches; openings are provided at the back for feeding, with a short hearth of quick descent as a sort of fire-plate, the clinkering being done at the front only. The advantages of this arrangement are very decided. The stoker has his feed and clinker in two separate places, he has all the advantages of a hand-fired furnace, the draught is always inwards as he feeds, and as the feeding floor is set higher than the clinkering floor there is a fall towards the latter, and clinkering as well as the manipulation of the fire is facilitated. The result is really a back-fired, hand-fed furnace with side-by-side grates at a low cost.

TALL CHIMNEYS.

The controversy with regard to tall chimneys is by no means yet settled, many authorities still insisting on stacks at least 200 ft. or more in height. A little consideration will show that however much these may have been defended twenty years ago, to-day they are quite unnecessary when practically every plant is provided with forced draught.

Forced draught is regulated according to the closeness of the fire-bars, thickness of fires, and character or texture of material to be incinerated. Excess of "draught" means an outrush of flame on the furnace doors being opened, liability to a "blow through" in case of defective brickwork, and, most important of all, the deportation of unburnt material to the dust catcher.

A fact often lost sight of is the very salient one that the character of the "flue-dust" varies with the intensity of the forced draught; indeed, a maker once observed to the writer that he could "burn" anything from 50 lb. to 100 lb. of refuse per square foot of grate area according to the forced draught allowed. It would have been more to the point had he said he could "shift" rather than "burn."

But, given the required pressure for overcoming the resistance of bars and fire thickness, the heat generated in the furnace is then devoted to maintaining the chimney draught (bar loss due to economisers or heat otherwise utilised) and the degree of this is determined by resistance of superheaters, economisers, and flues, or passages.

It is evident, therefore, in comparing a destructor with a Lancashire boiler without forced draught, that for a given exit temperature at the chimney base the draught ought to be better in the case

of a destructor, inasmuch as the resistance of the bars and fire thickness is more than counterbalanced mechanically ; and, further, the excess of air over the normal twelve pounds of "fuel" is less also, which conduces to a higher temperature generally.

The extra height, therefore, can only be required to ensure the distant distribution of noxious fumes which in an efficient plant do not exist.

Illustrative of this contention a case may be cited of a town in Lancashire where, within the last few years, a destructor plant was decided upon, after much opposition at the Local Government Board inquiry on the part of the inhabitants afraid of dust and fumes, the chimney to be 240 ft. in height.

The destructor and chimney were placed separately in the hands of two contracting firms to be finished about the same time. Owing to the failure of the contractor for the chimney the destructor was finished and ready for starting up before the chimney had been run up 50 ft., and what was more, the borough engineer was anxious to put the plant into operation for electrical power purposes. To get out of the difficulty, and as a temporary expedient, an iron chimney, 80 ft. in height, and only 3 ft. 6 in. diameter, was rigged up, and was used most satisfactorily for several months. The adoption of this expedient was kept from the knowledge of the public, and no complaint was made with regard to either fumes or dust until the 240 ft. chimney was completed and known to be in operation.

The real remedy for dust is not a tall chimney but a dust catcher, that is assuming dust to be carried over from the fire bars. At the same time the best practice now appears to advocate such a judicious adjustment of the blast as will lead to practically no dust being carried over. Of course this entails a reduction in the amount "consumed per square foot of grate," but possibly even this as a criterion may go. Fashions alter from year to year ; what is law and gospel one day becomes antiquated history the next.

Whenever the "experts" in the past have been called upon to lay down laws, or make pronouncements on variations in practice, they have so hedged round their statements with qualifications, limitations, and saving clauses about there being "no finality to these things," that whatever happens they can meet at a dinner and congratulate themselves on having been true prophets.

They just propose toasts to each other and sing—

> "For I am right, and you are right,
> And all is right as right can be."

And so the thing goes merrily on ; the bricklayers and stokers are getting very near to what is really required—more power to them !

SEWERAGE AND SEWAGE DISPOSAL.

The perusal of the back numbers of magazines and journals often provides much interest and enjoyment, and this is intensified when the reader, as in the case of the present writer, has been acquainted with a particular journal from its birth, and, in addition, has had a special interest in one particular subject which has been dealt with weekly in its pages. In the case of the progress in sewerage and sewage disposal during the period covered by the first twenty-one years of the life of this journal it is extremely interesting to notice opinions held twenty-one years ago which still hold good to-day ; predictions which have been fulfilled or, more often, falsified in the course of time ; or new ideas introduced, some of which very quickly proved altogether impracticable, while others have stood the test of time and are now in general use. During the period under review enormous developments have taken place in many directions, and while this applies to sewer construction chiefly in regard to the amount of work carried out, in the case of sewage disposal it includes a complete change in the methods in vogue at the commencement of that period, as will be seen in the latter part of this article.

SEWERAGE.

If it were possible to ascertain the total sum of money expended by local authorities during the last twenty-one years upon works of sewer construction, it would be found to amount to an enormous figure, which would give some idea of the work done during that period. These figures are not available ; but it is possible to compare the death rates at the beginning and end of that period. The death rate for England and Wales in 1892 was 19·01 per 1,000, and in 1911 it was 14·60 per 1,000—a reduction of 4·4 per 1,000. While it is impossible to ascribe a reduction of the death rate to sewerage alone, there is very little doubt that the great extension of sewerage systems, partly in itself and partly by means of improved methods of sanitation which are made possible by the construction of sewers, does, directly and indirectly, influence the death rate. This is particularly noticeable in the case of London. In 1865 the bulk of the main drainage works were in operation, and the death rate for the ten years 1861-1870 was 24·4 per 1,000. For the year 1911 it was 15·0 per 1,000, so that since the main drainage of London was put into operation the death rate has been reduced by 9·4 per 1,000—a splendid achievement. To understand fully what this means it should be noted that at least 120,000 people in England and Wales who are living to-day would have died during the past year if the death rate had been the same as it was in the year when THE SURVEYOR was first published.

THE INTERCEPTING TRAP.

Methods of construction have not changed to any great extent, but in matters of detail various modifications have been adopted. In view of the prominence recently given to the question of the use of the intercepting trap on house drains by the publication of the report of the Departmental Committee of the Local Government Board, and by the prolonged discussions of this report and its conclusions, it is interesting to note a statement made by Mr. H. P. Boulnois, M.INST.C.E., at that time city engineer of Liverpool, on the occasion of delivering a lecture on house drainage and sanitary appliances. He then stated (October, 1892) that he was of opinion that isolation of a house from the sewer was of greater importance than either the construction or ventilation of that sewer, and that if a house was isolated in the manner he described in detail, it would be as safe to live in as if it were erected on the top of Snowdon. Again, in a report made by Mr. T. de Courcy Meade, M.INST.C.E. (at that time engineer and surveyor to the Hornsey Local Board and now city engineer at Manchester), to his board in the following year, upon the advisability or otherwise of making the use of the intercepting trap compulsory, Mr. de Courcy Meade himself was in favour of making it compulsory, and he quoted a number of surveyors whose opinions coincided with his own, and only one, out of a number to whom inquiries were sent, who was against the use of the intercepting trap except in cases where the drains were laid under houses.

On the other hand, we find, even at that time, a reference to the case of East Grinstead. In a paper on "Sanitary Ventilation" by the late Mr. E. Tidman, read at a meeting of the Surveyors' Institution in December, 1892, he pointed out that at East Grinstead no builder was allowed to insert a trap in a house drain, and, if any trap were inserted, the builder was compelled to add a 4-in. vent-pipe on the sewer side of the trap. In spite of this (or was it because of this ?) the average death rate for the previous three years was only 10·1 per 1,000. It should be borne in mind that the average death rate for London during the ten years

in which the above three years are included was 1·1 per 1,000. Mr. Tidman expressed the opinion that "most probably the East Grinstead plan of every householder doing his share of the ventilation of the town sewers is the proper one, and that most likely to be adopted more generally in the future, as by this means, and this means only, can the sewers be made harmless." It is obvious that if Mr. Tidman were alive at the present time he would be a strong supporter of the conclusions arrived at by the Local Government Board Committee.

The vagaries of the fresh-air inlet were also causing anxiety at that period. Dr. H. R. Kenwood, in a paper he read at the Sanitary Congress at Portsmouth in the autumn of 1892, described some experiments he had made, in which he found evidences of frequent back currents at fresh-air inlets when the mica flaps were removed. He also noticed that the movements of the mica flaps were not influenced either by the height of the exit opening at the top of the soil-pipe or vent-pipe, or by the number and nature of the bends in such pipes. Dr. Kenwood was naturally anxious to remedy this defect, and he suggested that a coil of piping from the hot-water circulating system should be fitted round the soil-pipe outside the building in order to induce a permanent up-draft of air in the soil-pipe! The recent recommendation of the Local Government Board Committee to abolish the fresh-air inlet altogether is probably the proper remedy, especially as it has taken twenty years after Dr. Kenwood's experiments to arrive at this conclusion.

SEWAGE DISPOSAL.

It is a curious coincidence that the life-history of THE SURVEYOR corresponds to that of present-day methods of sewage disposal, so that the story of the latter is contained in the pages of the former. From this it would be anticipated that the columns of our first two or three volumes contain some interesting paragraphs, and this is actually the case. It is true that the first suggestions as to the connection between the lower forms of life and the purification of sewage were made somewhat earlier. Thus in 1883 Dr. Sorby, in his evidence before Lord Bramwell's Commission, stated: "It therefore appears to me an obvious conclusion that a very large portion of the detritus of fæces thus manifestly lost in the river is not lost by decomposition, but utilised by countless thousands of living creatures." In 1886 Dr. Dupré, during a discussion following a paper read by the late Dr. Tidy at the Society of Arts, suggested that "it would be a very good thing to cultivate the low organisms on a larger scale, and to discharge them with the effluent into the river, as the power which these low organisms had was remarkable." In January, 1887, Mr. W. J. Dibdin, in a paper before the Institution of Civil Engineers, stated that he had "not the slightest doubt that the future treatment of sewage will be a combined chemical and biological one, as suggested elsewhere by Dr. Dupré." The well-known experimental work of the Massachusetts State Board of Health was commenced in 1888, and continued during the following years, and the original bacterial installation on working lines was started at the northern outfall works of the London County Council in 1892, under the direction of Mr. W. J. Dibdin, at that time the council's official chemist. It is generally recognised that the last mentioned experiments, together with the one-acre bacteria bed at Barking constructed in 1893, and the smaller beds at Sutton, constructed in 1894, in both cases on the recommendation of Mr. Dibdin, were the original precursors of the whole of the present system of biological purification of sewage in filters. About the same time Mr. Donald Cameron, then city surveyor of Exeter, was working his original septic tank, which was the first of the many methods of providing preliminary treatment of sewage in tanks under anærobic conditions. Subsequently excellent work was done by Mr. Scott Moncrieff in his Ashtead experiments, and by the late Colonel Ducat with his special type of filter, which was the forerunner of all the present types of percolating or trickling filters.

STATE OF AFFAIRS IN 1892.

Before proceeding to deal with the developments which followed the first introduction of biological methods it is interesting to note the state of affairs with regard to sewage disposal at that time. The following extracts are taken from the pages of Vols. I. and II. of THE SURVEYOR, which appeared during the course of the year 1892.

In the first place there were many complaints of land treatment. Mr. Albert Wollheim in a paper referred to these and recommended preliminary treatment by chemical precipitation. He suggested that storm-water overflows should be adopted and arranged to come into operation when the sewage was diluted with a maximum of twice its own volume of stormwater, and he considered sludge-pressing plant a necessity. In a subsequent issue reference is made to the problem of sludge accumulation and to the value of sludge as manure, and it was estimated that one ton of sludge was equal to a quarter of a ton of artificial manure. About the same time (April, 1892) a very interesting article consists of a paper on the Berlin Sewage Farms, by Mr. H. A. Roechling, who has had the fortunate experience of reading another paper on the same subject almost exactly twenty years afterwards. Again, later in the same year, Mr. Burghardt considered that land treatment of crude sewage was unsuitable and dangerous, even when supplemented by the settlement of suspended matters, and that intermittent downward filtration was quite impossible for large towns. The most striking evidence of the failure of land treatment was, however, contained in a paper read by Mr. A. Angell, public analyst of Southampton, at the Sanitary Congress held at Portsmouth in the autumn of 1892. He gave a list of ten places treating their sewage by broad irrigation in connection with which complaints were made in the public press, and to-day at least eight of those have adopted biological purification by artificial methods in one form or another.

Mr. Angell's paper makes extremely interesting reading to-day, especially the following paragraph dealing with the results of the Massachusetts experiments and the controversy of nitrification in filters by the vital action of organisms *versus* oxidation by the direct chemical method. The author stated that "we must not be carried away into the biologist's dreamland by the results of the very admirable and very exhaustive, but, at the same time, very impracticable Massachusetts experiments.' He added that "he believed that Dr. Dupré was the first to suggest the possibility of treating sewage by innoculation with nitrifying germs, and he *well remembered the guffaw with which this suggestion was received by a strong meeting of sewage experts, and yet the idea was pregnant with good sense.*" It appeared to him, however, that "*the bacteriological treatment of sewage is not yet within a measurable distance of practical or applied science.*" To-day the bacteriological treatment of sewage has been adopted, and is in general use in all parts of the world, and it is Mr. Angell's warnings and predictions which are received with the "guffaw" with which the first suggestions of Dr. Dupré were treated.

On the other hand, only a few weeks before Mr. Angell read his paper the opposite opinion was expressed by Dr. Adeney at the Dublin Congress of the British Institute of Public Health. In the report in our columns of September 1st, 1892, we read that Dr. Adeney "showed that organisms naturally present in water and fresh sewage were capable of completely oxidising the organic matters in the sewage into carbonic acid, nitric acid, and certain colouring matters allied in properties to the colouring matter to be found in peaty matter, but that these organisms could only effect such

oxidation when precautions were taken to maintain a constant supply of oxygen to these during their life processes; otherwise they give rise to secondary changes in the sewage, known under the name of putrefaction, which they had been led by experiment to regard as dangerous to public health." The valuable work done by Dr. Adeney since that time in connection with the investigation of the effects of the discharge of sewage into tidal waters is well known to those who have perused our columns and studied the reports of the Royal Commission on Sewage Disposal.

Among the curious methods of treating sewage described in the pages of our first two volumes, the two following deserve mention. At the Sanitary Congress at Portsmouth a suggestion was made for purifying trade wastes by concentration and evaporation followed by condensation as "the latest, best, and most scientific and successful solution to the problem of economically dealing with manufacturing liquid refuse." This system is, of course, possible, and may be scientific and successful, but it would certainly be far from economical. At the same meeting a proposition was made to treat sewage by mixing oxygen with it, and a drawing was given showing an apparatus for the purpose, but it was proposed to deal in this way with the liquid portion only, "all solids being removed by filtration through sand or any other suitable medium."

STATE OF AFFAIRS IN 1913.

It is impossible in the space at disposal to describe all that has taken place within a period of twenty-one years, especially as a complete change in the methods of sewage treatment took place during the particular period under review. Apart from the very large number of articles dealing with the subject which has appeared in our own columns, the articles, papers, and books which have been written in many different languages would fill a large library. To refer to the names of authors and titles of books and articles alone would take many columns of THE SURVEYOR. It is, however, impossible to omit some reference to the Royal Commission on Sewage Disposal, which was appointed in 1898 and is still in existence. Although it has been at work for fourteen years and has issued eight reports and published a mass of evidence and results of investigations, it is proposed to issue a ninth report before completing its labours. These facts afford some idea of the complexity of the problem of sewage treatment. Partly on account of the many difficulties involved, partly owing to the great variety of conditions encountered in different places, and partly by reason of the inventive ingenuity of various investigators and manufacturers of appliances, there are in existence to-day a host of different "systems," processes, and appliances all designed for the one purpose of purifying sewage by biological methods. This is not the time or place to discriminate between the many systems, but it is interesting to note the following observation in the Fifth Report of the Royal Commission: "The circumstances of different places are of endless variety, and there are many varieties of treatment, any one of which will be successful if properly carried out." The opinions of experts, such as engineers, chemists, bacteriologists, and others engaged in the work of sewage treatment are also of endless variety. Some of these still maintain that land treatment is the only proper method. Some prefer preliminary treatment in one of the many types of tanks, while others consider that preliminary treatment involving putrefaction is not desirable or necessary. Some adopt coarse, some fine, and some medium grade material for filters. There is no end to the differences of opinion among experts upon matters of detail, and we think that this will continue, for the reason that, in spite of the enormous progress which has taken place in the past, there is still room for improvement in several directions. On the other hand it is practically certain that future developments will be confined to further improvements of biological systems, as it is now recognised that this is the method which obtains in Nature, and may thus be accepted as the most efficient and most satisfactory. In this connection it is interesting to note the following extracts from the conclusions in the Fifth Report of the Royal Commission on Sewage Disposal:—

(*a*) "That it is practicable to purify the sewage of towns to any degree required either by land treatment or by artificial filters."

(*b*) "That there is no essential difference between the two processes, for in each case the purification, so far as it is not mechanical, is chiefly affected by means of micro-organisms."

The most important problem which remains to be solved is that of sludge disposal. We recently (THE SURVEYOR, December 20, 1912) drew attention to the fact that a very large proportion of the energy devoted to the improvement of biological methods of sewage treatment in the past has been spent upon efforts made to remove the matters in suspension in order to render the sewage suitable for further treatment in filters. The reports of the Royal Commission contain elaborate figures as to the extent to which the suspended solids should be removed from sewage before it is filtered. It is obvious that the greater the removal of the suspended solids in tanks the larger the amount of sludge produced, and consequently the solution of the problem of dealing with the sludge is rendered increasingly more difficult. We then suggested that it might be advisable to direct future investigations towards making the filters suit the sewage instead of making the sewage suit the filters as heretofore, and if this idea should be taken up it will probably assist materially in solving the problem of sludge disposal.

Reference has already been made to a proposal brought forward in 1892 for purifying sewage by means of oxygen, and it is curious to note that practically the same idea has been tried in recent years by at least two methods. The electrolytic treatment of sewage, which is in actual operation in several places in the United States of America, and the sterilisation of crude sewage by hypochlorite solutions, which has also been attempted in the United States of America, both rely upon oxygen as the actual purifying agent. The original proposer of 1892 was, however, better informed, or more fortunate in his suggestions, than the latest experimenters, as he stipulated that all solids must be removed by filtration before the oxygen is applied. In fact this is exactly the process which has been adopted during the last few years in a large number of cases, but chiefly in America, not only for the treatment of sewage effluents, but for the purification of drinking water, and is known as "disinfection," or "sterilisation." Various chemical compounds are used in this process, but the actual effective agent in all is chlorine, which acts in several different ways, but chiefly as an oxidising agent by decomposition of water, the nascent oxygen thereby liberated being far more energetic than atmospheric oxygen, and acting directly on organic substances besides killing practically all life. It is important to note, however, that a well-designed and carefully-managed modern installation of biological sewage disposal works will produce an effluent with a very high degree of purification from the chemical point of view, and the sole object of "disinfection" or "sterilisation" is to attain an equally high degree of purification from the bacterial point of view, and thus to render as remote as possible the possibility of disease germs surviving in the sewage effluent or drinking water.

From these brief notes it will be seen that the progress in sewage disposal

SINCE THE BIRTH OF "THE SURVEYOR"

has reached the point where it is possible to return the liquid portion of sewage to a river practically in

as pure a condition as it was when supplied as water to the consumers who converted it into sewage. This is a great achievement, and if the many engineers, chemists, and biologists who are investigating the subject in all parts of the world to-day continue to work together as in the past, we may anticipate a still wider application of these methods in the near future.

STREET LIGHTING.

There are few departments of municipal activity in which greater progress has been made since the birth of The Surveyor than that which is the subject of this article. For this we may be thankful, for, truth to tell, there were few departments in such a primitive condition as that of public lighting at that epoch. All the large towns employed gas lamps for this purpose, while the smaller places which had no public supply of gas used oil, and the villages either followed their example or dispensed with public lighting altogether. Oil lamps are still in use in many villages in the absence of gas, and serve their purpose very well, though they are naturally inferior to the modern illuminants, and require a good deal of attention. But even where gas was employed at the time to which we refer, the light obtained did little more than mark out the line of the roadway. Flat-flame burners of 10 or 15 candle-power were used, singly as a rule, and clustered at important points in lanterns, which served to prevent their extinction by the wind, but which were rarely ornamental or even pleasing to the eye. The lamps were of necessity turned on and lighted by the traditional lamplighter, whose peregrinations commenced about an hour before dusk, in order that his round might be completed before darkness set in. Although gas had been used for public lighting from the earliest days of gas supply—the centenary of which was celebrated in 1912—the methods and appliances employed had varied but little, and even at the present day flat-flame lamps for street lighting have not altogether gone out of use, though their days are numbered.

THE COMING OF THE INCANDESCENT MANTLE.

But it happened that in 1885 a new system of illumination with gas had been devised by Dr. Welsbach, in which the heating power of the gas was employed to raise to incandescence a solid body containing certain metallic oxides, with the result that an immensely increased illuminating efficiency was obtained. By 1893 the incandescent gas mantle had been developed to a brilliant commercial success, and it immediately began to effect that change which has resulted in the universal raising of the standard of illumination, both indoors and out. One improvement followed another, and during the past ten years the efficiency of the incandescent burner has been practically doubled, while its use has become indispensable in all systems of lighting with gas. In 1891 the flat-flame burner at the best gave about 3 candle-power per cubic foot of gas consumed per hour; in 1897 the Welsbach burner, of which 2,000 had then been installed in Liverpool, gave nearly 16 candles per cubic foot; and in the following year the Kern burner was introduced, giving 25 candles per cubic foot. The improvement was due to progress in design, which secured a better mixture of the air and gas supply, producing a higher temperature, and this principle was also the basis of all the high-pressure systems that were subsequently developed. So great was the economy resulting from the new burners that in some cases gas companies found it to their advantage to replace with the new type, free of charge, the old flat-flame burners which they were supplying under contract. By the middle of the period with which we are dealing incandescent burners of 50, 75, and 100 candle-power were widely used, working on the ordinary mains at 15 to 30 tenths pressure. Liverpool by that time had 10,000 of them in use, and claimed to be one of the best-lighted cities in Europe, while in South London alone 20,000 were installed. In 1902, using coal gas enriched with carburetted water gas, incandescent burners supplied at high pressure were able to give from 30 to 35 candles per cub. ft., the Kern at ordinary pressure giving 20-25 and the older type 14-19 candle-power, while the best non-incandescent regenerative burner yielded only 7 to 10 candle power, the Argand 3¼, and the flat-flame (No. 5) less than 2 candle-power. At that time about one quarter of the gas used in our large towns for illuminating purposes was consumed in incandescent burners, but Germany was far ahead of us in this respect, with 90 per cent so employed.

HIGH-PRESSURE GAS BURNERS.

The next important step was the raising of the pressure of the gas supplied to the burners, by which means, as mentioned above, it was found possible to produce a better mixture, and to burn the gas completely with a smaller quantity of air, so as to secure a higher temperature at the mantle. The effect of this improvement was most remarkable. It was found possible to attain an efficiency of 40 to 50 candles per cub. ft. per hour, and even this high figure has been left far behind in recent years, the Keith high-pressure burner giving from 60 to 70 candle-power per cub. ft. Another change of the first importance was the successful development of the inverted type of mantle, which, having a curve of light distribution much better adapted for street-lighting purposes than the upright type, still further raised the efficiency of illumination. Moreover, the candle-power of individual units was immensely increased; even with low-pressure gas single burners are now made of 250 candle-power, and clusters of four give 1,000 candle-power; while with high-pressure gas no less than 4,000 candle-power can be produced in a single lantern, so that the utmost requirements of any public lighting scheme can be met with ease. Pressures up to 80 in. or 90 in. of water are employed, so that it is necessary to provide compressors and to lay special mains for the purpose, but this is being, or has already been, done in many districts. In Glasgow, for example, last year, forty-one high-pressure lamps, of 3,000 and 4,500 candle-power, were installed, displacing small lamps which gave 10,000 candle-power in all, and thus increasing the illumination by nearly fifteen times. It will be seen how vast is the advance that has been made in our ideas of adequate illumination for the public thoroughfares. In London, Birmingham, and other large cities also the system has made extraordinary progress.

AUTOMATIC CONTROL.

The inconvenience and cost, both in gas and labour, entailed by the individual lighting of gas lamps have led to the introduction in recent years of many methods of lighting the lamps automatically or from the works. Clockwork controllers, which turn the lights on and off at the proper times, and need only periodical winding, embody the automatic principle; distance control is usually effected by means of devices which are sensitive to a temporary change of pressure at the works, and where the conditions are suitable, large numbers of these have been installed with success. This principle has been carried further, so that some of the burners in a cluster can be extinguished at midnight and the rest left burning till dawn.

ELECTRIC LIGHTING.

Although in 1891 the public supply of electricity was only commencing, the possibilities of electric lighting for the streets were already realised, and some half-dozen towns were employing it for their principal thoroughfares. The incandescent electric

lamp offered no advantage over the gas lamp except the facility of lighting and extinction from the works, and then only if special mains were laid, while its cost was far in excess of that of gas. But the arc lamp, at that time the most powerful illuminant in existence, was appreciably cheaper than the flat-flame gas lamp, though it could not be economically employed except in the wider streets. Consequently the use of arc lamps for lighting important roadways was widely adopted, especially by municipalities which took up the supply of electricity, and found the public lighting load a valuable aid to their young undertakings. Arc lighting had been experimented with in the City of London as early as 1881, but the attempt was premature, and the trial was abandoned. It was in 1891, however, that, after the expenditure of many thousands of pounds on experimental work, the City Corporation entrusted the lighting of their main streets to a supply company, and the installation, including some 500 arc lamps, was put in operation in the following year. The scheme, however, which provided for the lighting of the whole of the City with electricity, using incandescent lamps for the side streets, was never carried out in its entirety. The arc lamps were all of the "open" type in those days, and gave nominally 2,000 candle-power as a rule, but the effective candle-power was nearer 500 candle.

IMPROVED ELECTRIC LAMPS.

The progress of public arc lighting was severely checked by the introduction of the incandescent gas mantle, but the arc lamp can be credited with a large share in the raising of the standard of illumination aimed at by the authorities responsible for the lighting of the streets. Moreover, like the gas lamps, the arc lamp was the subject of close investigation, and a considerable improvement in its capabilities was effected by the introduction of the "enclosed" type of lamp, though this was never very largely used for street lighting in this country. However, a far more important event was the invention of the "flame" arc lamp, which was at least four times as efficient as the open type, and gave a rich orange-coloured light which had a striking effect. At first this lamp was hampered by its short period of burning without attention, but the development of the magazine type of lamp, which was capable of burning as long as the permissible interval between successive cleanings of the globe, overcame this drawback. The flame arc was quickly followed by the metallic-filament incandescent lamp, which, while by no means equal in efficiency to the arc lamp, was nearly four times as good as the old carbon-filament lamps, and had the great advantages that its candle-power was maintained throughout its life with little deterioration, and it needed no attendance beyond the cleaning common to all systems of lighting. Moreover, though costly in the first instance, it lasted long often for thousands of hours. The result of these improvements has been that, in spite of the extraordinary progress that has been made in gas lighting, electric lighting is steadily increasing in popularity. Had the high-pressure gas lamp not been invented, there would have been no chance for gas in the main streets; as things are, the battle is keen, and victory falls sometimes to the one, sometimes to the other. In the West-end of London, for instance, large areas have been changed over from electric to gas lighting, whilst in the City and the Holborn district electricity has made headway. The competition is, in fact, so evenly balanced that co-operation has sometimes proved the best way out of the fight, and thus, in both of the areas last mentioned, the gas and electric lighting companies have shared the spoils between them.

GENERAL CONSIDERATIONS.

Limitations of space forbid us to dwell upon systems of lighting other than those dealt with above, which leave little scope for rivals. Acetylene gas lighting at one time appeared likely to come into use, especially in villages and small towns, and petrol-air gas is occasionally employed in such places, but the instances are few. The Nernst electric lamp had been adopted as an intermediate device between the arc and the glow lamp a few years ago, but was completely driven out by the tungsten lamp. We cannot, however, conclude this brief review without pointing out one of the most noteworthy and fundamental changes which have come over the street-lighting situation during recent years—namely, the point of view from which the subject is approached. Formerly, the criteria by which public lighting was appraised were exceedingly vague; the decision to adopt one or other illuminant was largely controlled by wholly extraneous considerations, such as the possession of gas or electricity works by the lighting authority, or the number of shareholders in a lighting concern who had seats on the council (we fear that these factors are still not without influence on the course of events in some instances). But nowadays praiseworthy attempts are made, with the hearty support and co-operation of the men in charge of the rival illuminants, to arrive at scientific standards of illumination, and to judge a system of street lighting wholly upon its merits. There are very great difficulties in the way; photometric methods are useful, and have been developed to a remarkable extent, but they do not suffice alone, and the average non-technical observer is usually largely led, and often grossly misled, by the apparent brilliance of an illuminant, without due regard to its effectiveness—a vastly different thing. During the past two years a joint committee of representatives of the leading engineering societies concerned has been deliberating with a view to the formulation of a standard specification for street lighting, and is approaching the end of its labours, the duration of which sufficiently indicates the complexity of the questions which it has had to solve. It is hoped that by this means a satisfactory criterion of the illumination produced by any given system may be arrived at, with consequent advantage to the public and the governing authorities alike.

TRAMWAY PROGRESS.

Although as far back as the seventeenth century somewhat primitive attempts had been made to facilitate the passage of heavy traffic through the streets of towns by laying rails in the roadway—oaken rails in those days—and more determined efforts to attain this end had been made about the middle of the last century, it was not until 1868 that the first Act of Parliament authorising the construction of a street tramway for passenger transport was obtained. The tramway, which was the enterprise of a company in Liverpool, was opened a section at a time in the course of the three years 1869-70-71, and it was in the middle of this period that the famous Tramways Act was passed into law, an Act which has exerted a profound influence not only upon tramway development, but also upon the fortunes of other branches of the public service, such as the supply of electricity and gas. Thus it came about that tramway construction on a practical basis had almost exactly attained its majority in the same year that saw the first issue of The Surveyor, the commencement of the period that we are about to review. The original Liverpool tramways had a total length of route of about 6 miles, and in 1891 they had increased to 28 miles—not a very rapid growth for twenty-one years. Now the city possesses a network embracing 63 miles of route, one of the busiest and most up-to-date systems in the United Kingdom.

THE "HAY-MOTOR."

In those early days the sole means of haulage was the horse, a patient, long-suffering animal, whose

arduous labours drew from D. Kinnear Clark, writing in 1878, this interesting pronouncement: "Tramways will not take their fitting place in the systems of transport in the United Kingdom until mechanical power is established in substitution for the power of horses. The employment of horse-power in the dire work of starting and dragging the ponderous cars in vogue is an element of barbarism germane, it may be, to the primitive habits of Oriental life, but very much out of place in a civilised country." But there was then no alternative, and for many years after the utterance of this trenchant and prophetic criticism the horse remained the locomotive of the street railway. How far Clark's views were justified may be judged from the fact that a horse was usually put to tramway work at five years of age, and was worn out in four years more, though covering only fourteen to sixteen miles per day.

THE EVOLUTION OF THE TRACK.

The earlier designs of tramway track consisted of wrought-iron bars, cast-iron plates, or wrought-iron rails of a kind, attached to the top surface of wooden longitudinal sleepers, the metal merely forming a protection to the timber. Naturally none of these devices gave satisfaction, but in 1870 the rolled-steel flanged rail with a groove in the head came into use, weighing 40 lb. to 60 lb. per yard, and still carried on a longitudinal sleeper. A really practical design was thus attained, and this was gradually improved by the efforts of a host of inventors, until in 1891 the customary rail was a steel girder with a deep web and broad, flat flange, weighing from 60 lb. to 100 lb. per yard, and laid direct on the concrete bed—which, we may note, had been employed since 1870. Before this system superseded all others a great variety of tracks with wood and iron cross sleepers and cast-iron chairs had been tried, and they did very well with the light cars drawn by horses. But they failed when steam came into vogue, and in 1891 nearly all new tramway undertakers applied to Parliament for powers to use steam haulage. For a long time the use of cross sleepers continued, and these were frequently of steel, riveted and bolted to the foot of the rail and well bedded in the concrete. The only system successfully employing longitudinal sleepers with mechanical haulage was that of John Kerr, who laid the rails on shallow steel sleepers, and this system had the advantage that the rails could be renewed without disturbing the sleepers or the concrete bed.

To sum up, the best practice in 1891 was to use girder rails weighing 80-100 lb. per yard, joined with heavy fish-plates, and laid on a bed of concrete at least 6 in. deep; the paving was of granite setts, with pitch or cement grouting. Wood-paving was sometimes employed. Chilled iron points were in use up to 1891, but were superseded by cast steel, the former being liable to fracture, owing to their brittleness.

THE POSITION IN 1891.

As we have already indicated, while the horse was the only tractor available, and was doing good work, the fact that mechanical power ought to be employed was fully realised at and before the time when our period commences—1891. Not only was this so, but about that date there was in the development of tramways a pause which, indeed, showed signs of becoming a backward movement. The use of steam for the propulsion or haulage of tramcars had made some progress, a few cable tramways had been constructed, and experiments had been made with electric traction by means of accumulators, with more or less success, but the ideal system had not been evolved, and whereas up to the end of 1889 437 tramway Acts had been passed, in 1890 only two were carried through. At that date there were in London 130 miles of street equipped with tramways, almost all operated by horse power, and all in the hands of companies, one of which (the North Metropolitan Tramways Company) had commenced work in 1871. The position at the end of June, 1890, was as follows:—The total route mileage of tramway in the United Kingdom was about 948, and the capital invested was nearly fourteen millions sterling, of which three millions was expended by municipal authorities (29 undertakings, with 244 miles of route), and eleven millions by companies (129 undertakings, with 704 miles of route). The average outlay was £10,580 per mile for lines and works, and £14,500 total per mile; the working expenses were 75 per cent. of the receipts, and the nett receipts returned an average profit of 5·9 per cent. on the capital expended. The following statistics will help to throw light on the position:—

	Year ending June 30th.	
	1891.	1893.
Total length of route in United Kingdom	963 miles	960 miles
Number of horses employed	29,012	30,225
,, locomotives	579	563
,, cars	4,067	4,098
Passengers carried per annum	566 millions	598 millions
Total capital invested	£14,163,000	£14,101,000
Gross receipts per annum	3,430,000	3,606,000
Working expenses	2,631,000	2,837,000
Percentage of expenses to receipts	77 per cent.	79 per cent.
Nett receipts	£799,000	£769,000
Percentage return on capital	5·65	5·45

AMERICA LEADING.

This was the result of twenty-one years' growth, and it will be seen that the prospects were not all that could be wished. It is interesting to observe that in the United States at this time there were no fewer than 11,634 miles of tramway track, with 37,274 cars (including trailers), of which only 4,460 miles were operated with animal power, there being 646 miles of cable tramway, 620 miles of steam tramway, and no less than 5,939 miles of electric tramway. These figures present a striking contrast with those relating to this country, and show clearly how very far ahead of us were the United States. We had only one electric tramway on the conduit system—that of the Corporation of Blackpool—a little pleasure tramway at Brighton, and two light railways in Ireland electrically operated. Hence it was that during the earlier stages of the adoption of electric traction in this country all our experience and much of our plant was derived from America.

Before leaving the "first period," as we may call it, of tramway development, we may give some comparative data relating to the various systems in use in the early 'nineties, premising that, besides those which we have mentioned, various systems of mechanical traction with compressed air, oil and gas were tried, as well as "fireless locomotives," which were charged with hot water at 400 lb. pressure per square inch, and were capable of hauling a car by means of the steam generated until the pressure fell to 50 lb. None of these attained to any degree of importance.

COMPARISON OF VARIOUS SYSTEMS.

It fortunately happens that the Birmingham Central Tramways Company had in operation in 1891 four different systems of traction—steam, horse, cable, and electric (accumulator system), and the summarised results obtained with these are given below, for the three years 1891-3:—

	Steam.	Horse.	Cable.	Electric
Average receipts per car mile	15·87	11·05	12·57	15·09
,, expenses ,, ,,	11·41	9·89	6·28	13·95
Percentage expenses to receipts	72	90	50	92·5

It will be seen from these data that by far the most profitable was the cable system, but the enormous cost of installation prevented its use anywhere except on routes where the traffic was very dense. The power required was about 25 h.p. per car as a maximum, including reserve, the average power required being about 15 h.p. Steam came next in order of merit, but the drawbacks to steam traction, which at that time involved the combustion of coke under the boilers, with the inevitable emission of fumes and sometimes vapour, are obvious.

The steam cars carried sixty passengers each, and weighed nearly 8 tons when fully loaded, necessitating a very substantial track. They were carried on four-wheel bogies, and ran on a track having a gauge of 3 ft. 6 in.; to protect passengers from the emanations from the locomotive an awning cover to the top deck was necessary. The car-bodies had to be borne on steel coiled springs instead of the rubber springs used with the horse cars, on account of their greater weight, and the wheels were of chilled cast iron, with brake gear operated by hand wheels as well as from the locomotive. On some tramways the locomotive was combined with the car body.

Owing to the limited haulage power of horses, the horse cars were of course smaller than the foregoing types, seating about forty-four passengers each, and weighing $5\frac{1}{2}$ tons fully loaded. Single-deck cars, each drawn by one horse, were sometimes used, seating from fourteen to eighteen passengers, and weighing $2\frac{1}{2}$ tons when full. Whether single or double deck, the cars were always carried on four-wheel trucks, with chilled-iron or cast-steel wheels. Three-axle "radial" trucks were known, and were used on a few lines. Lastly, the electric accumulator cars used at Birmingham were the least profitable; about three miles of route was operated on this principle for some years, the section being opened in 1890. Bogie cars were used, seating fifty passengers. The experiment was unsuccessful.

CABLE TRAMWAYS.

Besides the Birmingham cable lines, there were cable tramways in London and Edinburgh. The one at Highgate-hill, London, was the first of its kind in this country, having been opened in 1884, and it ran for about ten years. It was only $\frac{3}{4}$ mile in length. That at Brixton was $2\frac{3}{4}$ miles long, and ran until the London County Council replaced it by electric traction. The only remaining system in this country is that at Edinburgh, which was opened in 1888, the same year as the Birmingham cable tramways. The cost of the system, for a three-minute service, is nearly £20,000 per mile of double track. Considering the nature of the system, it is really surprising what can be done with cable haulage; but it is almost safe to say that no more tramways of this kind will ever be laid down.

ELECTRIC TRACTION.

It was in 1893 that the electric tramway invaded this country, not counting the isolated examples to which we have already referred, none of which survived in its original form. The first system equipped on the overhead trolley system was an 8-mile section of the South Staffordshire Tramways, which had formerly been worked with steam, like the rest of the 23 miles comprised in the undertaking. Thus it was possible to make a direct and convincing comparison between the rival systems; the working costs with steam were 7·04d. per car mile, and with electricity 4·06d. From that time the electric system has remained without a rival until quite recently. It is worth noting that, although the Americans had acquired such a long start of us, and had equipped a sample section of tramway on their system at Roundhay, our engineers at once struck out on new lines. In the American system the trolley wire has to be maintained exactly over the centre of the track, with the aid of a multiplicity of span-wires and pull-offs; the South Staffordshire lines, however, were equipped with trolley wires at the sides of the road, and a special form of swivelling trolley pole was devised which enabled the trolley wheel to maintain contact with the wire over widely varying distances. This lead was followed on practically all the British tramways.

In spite of the economic and other advantages of the electric trolley system, it had to fight hard to establish itself in this country; strong prejudice was manifested against it on the score of the unsightliness of the overhead wires, and the alleged obstruction they offered to fire-escapes—the latter a fatuous objection, for there was no difficulty in constructing escapes that would pass under the wires, and the cost of replacing the old-fashioned apparatus with these would have been comparatively trifling. Probably the dislike evinced was really the outcome of our national conservatism, which violently objects to any new thing. One effect of this aversion to overhead wires was to saddle the Metropolis with an underground conduit system of electric tramways at enormous cost, constituting a burden upon the undertaking from which it has never recovered. The policy of the County Council for some years has been to adopt the trolley system wherever the permission of the local authorities can be obtained. The only other conduit tramways in this country—the old Blackpool system and a short length through Bournemouth—have been converted to the overhead system with great advantage.

MUNICIPAL ENTERPRISE.

The success of the electrical system attracted the attention of the municipal authorities, who, moreover, had a strong prejudice against the occupation of the roadways by private bodies, and had a powerful weapon in the Tramways Act of 1870. Many of the old horse tramway companies were in difficulties, and were willing to dispose of their undertakings for what they would fetch. Consequently a considerable expansion of municipal enterprise in this direction took place, and although municipal control of the tramways of the country is by no means so complete as in the case of the electricity supply undertakings, a large proportion of them are now owned by the local authorities. As every one must be familiar with the modern system, which has become to a very great extent standardised, it is hardly necessary to enlarge upon the practice of the present day. The only innovation of importance, apart from the great improvements which have been effected in the technical features of the rolling stock, such as the motors and the introduction of mechanical and electrical brakes, covers to the upper decks, and various types of car-bodies, is the use of trailers. Hitherto the Government authorities have set their faces against the use of trailer cars, but in view of the impossibility of coping with the traffic solely by motor-cars, the London County Council have obtained powers to run trailers under certain restrictions. This, however, has not actually been done as yet.

SURFACE-CONTACT SYSTEMS.

Besides the systems to which we have already referred, innumerable attempts have been made to devise a satisfactory method of supplying power to the cars by means of contacts embedded at intervals in the surface of the track, thus avoiding the heavy cost of the underground conduit and the unsightliness of the overhead construction. The contacts, of course, had to be provided with automatic devices which connected them with the live cable while a car was passing over them, and ensured their disconnection at all other times; but, unfortunately, automatic apparatus inevitably fails sooner or later, especially under the arduous conditions met with in the surface of a roadway, and in the case of a surface-contact tramway system the consequences are apt to be fatal. Hence the system has never made much progress, and there are only two successful examples of such tramways in operation to-day. The London County Council equipped a length of track in the East-end on a surface-contact system, but it became the sport of party politics and was pulled up again; and that was the death-blow to surface contacts.

THE RAILLESS TROLLEY SYSTEM.

We must not omit to mention the introduction of the trolley omnibus, which, by means of double trolley wires, is enabled to run on the ordinary roads while maintaining connection with the supply of power from a central station. This system was

in extended use on the Continent for some years before the British authorities could induce Parliament to permit its introduction, but during the past two years several undertakings have adopted it, so far with good results. The "railless trolley" system is not intended to supersede the tramway, but to act as a feeder to it, and to serve sparsely populated districts, the cost of construction being of course far less than that of the tramway; moveover, if found unsuccessful on one route, it is not a costly matter to transfer the equipment to another; and if, on the other hand, the traffic is found to justify the cost of laying a tramway, the overhead equipment can readily be adapted for use with the latter.

SYSTEMS OF THE FUTURE.

But we live in times of constant change, and the question is now being discussed whether the independent vehicle, equipped with its own means of propulsion, will not oust the tramway, trolley-'bus and all. Some municipalities have experimented with motor omnibuses, usually with indifferent success from a commercial point of view, and sometimes at a material loss. It seems probable that the trolley-'bus will find the motor vehicle a serious competitor; but seeing that a tramcar can carry twice as many passengers as the latter, and has the advantage of a covered upper deck, the battle between these systems may well result in victory for the car—especially if the use of trailers in busy cities becomes general. The important extensions recently authorised by the London County Council at their Greenwich generating station indicate that the Council, at any rate, have no doubt as to the future. Another proposition which deserves serious attention is the possibility of running independent motor-cars on tramways propelled by their own petrol or steam engines. Whether this system will prove more economical than the supply of power from a central generating station remains to be seen. Seeing that electrical energy costs from 1d. to 2d. per car mile at present, the petrol car will find it no easy task to show a material advantage over the existing system. Lastly, the accumulator tramcar system is not dead yet, though it is dormant. Experimental work is in progress abroad, and he would be a bold man who would deny the possibility of success in this direction.

Limitations of space forbid us to digress into the wonderful advances made during the past twenty-one years in electric traction on railways, though the forthcoming adoption of this system on the great network of the Melbourne Government railways brings the subject within our scope. Suffice it to say that the first underground electric railway in the world—the City and South London Railway—was opened in 1890, and London now possesses well over one hundred miles of railway operated by electric power.

Such is the position at the end of our twenty-first year. Who shall forecast that which will obtain twenty-one years from now?

WATER SUPPLY.

Those who were actively engaged in water engineering as long ago as the year 1892 have probably some difficulty in grasping the fact that this period is already very remote to the rising generation. We are even apt, if not careful, at times to refer, in course of conversation, to the year 1912 as 1892, to the bewilderment of the listener, so near does that time still appear. Again, at the first glance it is difficult to believe that great changes have taken place in the last twenty-one years. In the year 1892 we were confronted with the same problems as to-day, and tackled them in much the same manner. We sunk wells, we drove headings, we made deep borings, we tapped springs, we surveyed gathering grounds, we built dams of masonry and of earthwork, we constructed reservoirs of concrete and brickwork, we erected cast-iron and steel tanks, our water mains were coated with Dr. Angus Smith's solution (sometimes, but not always, though we were beginning to be rather particular on the point), our valves, hydrants, and fittings were very similar to those in use to-day, we had very good meters, and our steam-driven pumps are still working well, duplicated since, however, in many cases by others driven by means of gas and oil engines, and notably by producer gas engines.

PURIFICATION.

We had, it is true, few ideas on the subject of purification. The microbe troubled us very little, we feared not the presence of coli, and had a firmer belief in the value of a chemical analysis than we now have in the chemical, bacteriogical, and microscopical examination all put together. For why, if the chemical analysis, upon which so much reliance was once placed, overlooked the presence of the disease germ, what fearsome thing may not still be lurking in the waters to be discovered by the scientist of the future? In the year 1892 we believed in sand-filters, and though there was some talk of microbes, the average engineer paid little heed to it. Then, again, as to quality, hard water was softened very effectually by the lime process where required, and if water at any place were under suspicion the consumers derived a false sense of security by using carbon or other filters. We were fairly well content with our methods, and if the health statistics were bad as compared with those of to-day, and if tyhoid epidemics were more frequent, we had no knowledge of the improvement which was to take place in the future, and we congratulated ourselves fervently on the enormous improvement in the general health since the beginning of the century. The pages of The Surveyor bear witness to the fact that in the year 1892, though the Vyrnwy Dam for Liverpool was just finished, Birmingham was still struggling for a new water supply, Manchester had its scheme in contemplation, and Swansea had designs upon Welsh gathering grounds, while "the slighted metropolis was still in the Royal Commission stage." There was a considerable amount of evidence given before the Royal Commissioners during the year, and our hopes were divided between obtaining water from Wales, provided that there was any left after the large Northern towns had made their arrangements, and tapping the inexhaustible supply of water supposed to exist in the chalk. The condition of the London supplies derived from the works of several different companies was giving cause for serious complaints. Inhabitants of the North-east of London daily congratulated themselves on the superior quality of the New River supply and blessed the name of Sir Hugh Middleton, but the fears of water famine in the East-end were acute, and Mr. Bryan, then engineer of the East London Company, must have had a strenuous time. Elsewhere water was found to be turbid and of very poor quality, and as Dr. Houston had not at that time shown us the comparative harmlessness of sewage-polluted water, and as the storage was very inadequate, we ought to have been much more alarmed than we were.

There is considerable evidence that in the period during which the The Surveyor was first produced as a technical journal there was great activity, the results of which are apparent in the improved condition of affairs to-day. The work of the London Water Commission ultimately resulted in the formation of the Metropolitan Water Board and of a great improvement in the waterworks of the metropolis; against all expectation, we have managed so to deal with our natural sources of supply and so to purify the water that neither of the alternatives so eagerly expected in 1892 has been found to be expedient—as yet at any rate. Whether the next twenty-one years will see a

change in our sources of supply is a matter for conjecture.

CAUSES OF IMPROVEMENT.

It is not wholly due to the work done since the year 1892 that the mortality from enteric fever and from diseases of all kinds has fallen. During that period the results of much of the preceding work have been apparent, the results of experiments have been applied, the conception of great works has been brought to realisation, and the new methods and principles now in operation have been built upon the foundations of the hard work of the past.

IMPROVED HEALTH.

It should be noted that the Registrar-General's report on the mortality of England and Wales in the ten-year period ended 1910 contains the following information:—The mortality from enteric fever has fallen considerably in the course of the last thirty years; the rate of mortality from enteric fever has fallen from 384 per million in the year 1896 to 69 per million in 1905. Speaking generally the curve shows an almost steady fall from the year 1875 to 1892, and *a much more rapid fall from 1899 to 1902*, since which time the fall has been more gradual. Better evidence could not be obtained of the value of an improved water supply and of better sanitary conditions, but one thing is very plain—viz., that a still greater improvement is to be effected. Many of the older persons in the year 1892 were of opinion that finality had been reached. The desired improvement in the death and disease rates had been maintained, and it was a counsel of perfection to take further trouble. Yet we see that great as the fall of the death-rate was between the years 1875 and 1892, it was much more rapid some years later—viz., between the years 1899 and 1902. This was doubtless due to the adoption of some of these counsels of perfection, and the lesson should be taken to heart that every improvement is worth making, and that one should not be satisfied in these days with anything less than an absolutely pure water in abundant quantity.

GENERAL IMPROVEMENTS.

The improvements in water supply work and practice since the year 1892 are immense. In almost every branch or detail there are great changes which render our work of the 'nineties a comparatively crude performance. To consider the matter in some detail, the engineer of to-day has before him splendid data obtained and recorded by the Geological Survey dealing especially with the water-bearing strata, the rainfall, and the quality of waters. Much of this material has been collected during the last twenty-one years, and is still being collected.

PURIFICATION.

Having obtained a source of supply, the engineer of to-day is enabled to treat the water in a variety of ways unknown in the year 1892. Instead of one possibility, the sand filter, water may be purified by settlement, coagulation, or by simple storage. Dr. Houston's method, whereby the sewage-polluted waters of the Thames and Lea are rendered suitable for the supply of London by storage, is only one of the many present possibilities. The pressure filter, whereby the most turbid and impure waters are clarified, the process being under complete control, is but another item for the consideration of the waterworks engineer. Waters containing iron or objectionable minerals can by this means be rendered suitable for drinking purposes. In the year 1892 much trouble was being experienced from plumbo-solvent waters, especially in districts where the supply was obtained from moorland gathering grounds. Modern methods have entirely done away with this danger whereby so many lives were lost formerly. As seen in the case of Sheffield and elsewhere, the simple expedient of adding powdered chalk to the water has proved effective in dealing with the difficulty. But the advance does not stop here. Hundreds of towns, cities, and districts are drinking water from which all harmful germs have been removed by means of sterilisation. Cheap and simple methods of adding minute quantities of hypochlorite of lime to the water have been devised, whereby typhoid epidemics have been suddenly stopped and the safety of many polluted supplies secured. Sterilisation is also effected by means of ozone and the ultra-violet rays. In short, however poor may be the quality of a water at its source, it is possible by modern methods to purify it absolutely at reasonable expense. It does not necessarily follow that it is expedient to use polluted water, but many of the difficulties which confronted the engineer of 1892 have been removed

How great our progress in water purification has been since the year 1892 may be gathered from the following quotation from our pages, relating to the Worcester waterworks and describing Anderson's revolving purifier:—"There is nothing new in the principle; it is the old plan of shaking up the water with some pieces of iron in it, allowing it to settle, and filtering off the thick matter, when the water is rendered bright and clear. Years ago it was common custom in the West of England to put a few rusty nails in a bottle of bad water and shake them up, by which the water was greatly improved. The wooden barrels for water on board ship are now exchanged for iron tanks, the motion of the ships enabling the iron tanks to keep the water sweet for a lengthened voyage." This is an extract from a paper read before the Sanitary Institute, and is fairly clear evidence that, with the exception of settling tanks, sand filters and aërating cascades, our appliances for purification in the year 1892 were somewhat crude.

PUMP IMPROVEMENTS.

Where water has to be lifted in very large quantities, the steam engine still holds its own, though it is being hard pressed by the Diesel engine and by the Humphry pump. In fact for low lifts and very large quantities it certainly appears as if the Humphry pump will supersede the steam engine. The adoption of the Humphry pump by the Metropolitan Water Board is sufficient evidence. Probably the most important change in pumps is the use of the centrifugal pump for very high lifts. A very great change has taken place during the period under consideration in centrifugal pumps which are now generally used for waterworks purposes. The improvements in electrical machinery have also had a very important bearing on pumping.

IMPROVED METHODS OF CONSTRUCTION.

In ordinary methods of construction the engineer of to-day is far in advance of the engineer of 1892. The application of reinforced concrete alone has made an enormous difference. It has been applied with success in a variety of ways. At present the bulk of the work has been done in America and abroad, but there is a considerable amount of reinforced-concrete work in this country. It has been used for reservoir construction of all kinds, including large dams, retaining walls, service reservoirs, and elevated tanks; also ferro-concrete mains have been found to compare favourably with iron or steel pipes. In fact, this material is used in place of ordinary masonry, and very often in place of iron or steel on all kinds of waterworks structures.

IMPROVED MAINS.

With regard to mains the engineer of 1892 used cast-iron pipes almost exclusively. Since that time wrought-iron and steel pipes of all sizes have come largely into use. In America and in the Colonies there is a great increase in the use of wooden stave pipes, which prove to be so economical, lasting, and generally efficient that they may even become serious competitors with the cast-iron and steel pipes elsewhere. The use of plain concrete-lined tunnels for large conduits under pressure is notable

in the case of the New York Catskill supply, while similar tunnels lined with reinforced concrete are used at Los Angeles.

NEW METHODS OF WORKING.

The free use of concrete as a water-tight material would not be possible were it not for the improved methods of cement-grouting under pressure, which at the present time form one of the most valuable resources of the engineer. It must not be thought that cement-grouting under pressure was unknown in the year 1892; its value had been demonstrated and the process was applied, but it has been left for a later generation to make full use of this valuable method.

Another remarkable difference between the practice of the year 1892 and the year 1912 is the ease and speed with which work can be constructed. The advent of the motor truck, of improved cranes, and of machinery for handling materials of excavators and the like makes it possible for the modern engineer to carry out his work at a rate and with a thoroughness undreamed of formerly. The best modern works of construction include electrical carrying and mixing plant of all kinds, and facilities are daily increasing. The standardisation of materials has also been of great assistance to the engineer.

MEASUREMENT OF FLOW.

As stated above, there were very good meters in the year 1892. There were positive and inferential meters, which measured the water in vessels of known capacity, or from which the quantity of water flowing through was inferred from the number of revolutions made by a fan or turbine as the water passed. The Venturi meter, which has no moving part in contact with the water, and which is capable of measuring accurately the largest volumes of water, is being used in all parts of the world. It has further been applied for the purpose of dosing chemicals or sterilising agents to waters flowing through mains. The meter is used to record the flow through some of the largest conduits in existence, and its development forms one of the chief advances in waterworks engineering in recent times.

Since the year 1892 methods have changed, new inventions have been applied, things have been perfected, and the good results are tangible. Immense water undertakings have been designed and brought to completion in all parts of the world, and the value of a pure water supply has been fully demonstrated and grasped. Moreover, the remunerative character of a water-supply undertaking has been recognised to such a degree that the Government policy is now to encourage local authorities to become owners of the water undertakings within their districts. Thus water engineering has advanced, and we may to-day look backward upon twenty-one years of work that has shown steady and rapid improvement, and which is, moreover, of the highest possible value to mankind.

LEGISLATION AND LEGAL PRECEDENTS.

To deal adequately with the many Acts of Parliament relating to municipal and cognate matters, and the innumerable judicial decisions in connection therewith, would require a volume. We have endeavoured within the space at our disposal to summarise the more salient and important enactments introduced and to present a selection from the leading cases decided in the past twenty-one years.

PUBLIC HEALTH.

The statutory contributions to the law of public health consist of the Private Street Works Act, 1892, the Public Health Act, 1896, the Public Health Act, 1904, the Public Health (Regulations as to Food) Act, 1907, and the Public Health Acts Amendment Act, 1907.

The Public Health Acts Amendments Act, 1907, is divided into ten parts, only the first of which (containing general provisions as to its application) is in force without an Order of the Local Government Board or the Secretary of State.

Part II. relates to streets and buildings. So far as it applies to repairs to private streets it will be noticed under the head of "Highways." Generally it provides that the deposit of building plans is to be of no effect after certain intervals, and that such plans may be retained by the authority; gives the authority power to vary the position or direction, and to fix the beginning and end of new streets; contains provisions as to new crossings over footways; empowers the authority to recover damages caused to footways by excavations, to alter the names of streets, to round off street corners, make by-laws as to chimneys, enforce the paving of yards, and prevent the closing of entrances to courts. There are also an extended definition of a "new building," and provisions as to temporary buildings, the removal of materials in streets, the regulation of the deposit of building materials and excavations, the repair or enclosure of dangerous places, the fencing of lands adjoining streets, and the secure fixing of hoardings.

Part III. contains sanitary provisions. Sec. 41 of the Public Health Act, 1875, is extended to cases where a drain, &c., is suspected to be a nuisance. Faulty cisterns, gutters, &c., and deposits of material causing damp in buildings are made nuisances within the meaning of the Act of 1875 Rain-water pipes are not to be used as soil pipes, nor water or stock pipes as ventilating pipes, and the local authority may require old drains to be laid open for examination before they are connected with sewers. There are also extensive powers as to the provision of closet accommodation and the conversion of privies into water closets, the recovery of expenses of work done for the common benefit of several owners, entry on premises, removal or alteration of urinals, the provision of urinals at inns, &c., the testing of drains, the filling up of cesspools, the provision of public lavatories, the removal of road refuse, the provision of sinks and drains in old and new buildings, the provision of an ambulance, and the suppression of offensive trades.

The subject of Part VI. is recreation grounds. The Local Government Board are authorised to make rules, subject to which the local authority are to have (in addition to any powers under any general Act) further powers with respect to the enclosure or setting apart of areas in public parks, &c., for games, bands, reading and refreshment rooms, &c., and the necessary incidental arrangements.

Part VII. enables the local authority to make regulations as to traffic in particular streets, and to make by-laws as to the use of the seashore and promenades.

Part IX. relates to sky-signs. New sky-signs were prohibited, and signs existing at the passing of the Act were not to remain for more than three years, and then only with the licence of the local authority.

Part X. contains miscellaneous provisions relating to bathing places, and by-laws as to these, life-saving appliances, and pleasure boats.

The powers of local authorities under sections 175 and 176 of the Public Health Act, 1875, as to the purchase of land are extended to highway purposes.

RIVERS POLLUTION PREVENTION.

Prior to the passing of the Rivers Pollution Prevention Act, 1893, it had been held by the courts that proceedings under the Act of 1876 could not be taken against a local authority merely because a sewer vested in them polluted a stream, they themselves not having constructed or interfered with the sewer. The Act of 1893 was passed to provide

for such cases. It enacts that where sewage matter falls, flows, or is carried into a stream after passing through or along a channel which is vested in a sanitary authority the latter shall, for the purpose of sec. 3 of the Act of 1876, be deemed to knowingly permit the sewage matter so to fall, flow, or be carried.

A further enactment for facilitating proceedings in the case of rivers situated partly in England and partly in Scotland—the Rivers Pollution Prevention (Border Councils) Act, 1898—enables the Local Government Board to constitute joint committees of the councils of any of the counties through or by which such rivers pass, and to confer on such committees all or any of the powers of sanitary authorities under the Act of 1876.

In 1895 it was held that the Manchester Ship Canal is within the Act of 1876, inasmuch as the waters both of the Mersey and of the Irwell flow in the Canal (*Mersey, &c., Watershed Joint Committee* v. *Stockport Corporation*, Queen's Bench Division, June 6th, 1895).

Amongst other points decided in connection with this subject may be mentioned the following :—

Water percolating through the ground in no defined or visible channel is not a "stream" (*McNab* v. *Robertson*, 1897, A.C. 129).

If a person has a legal right to divert, impound, and use the water of a stream, he has the right to return it to the stream after use, even though it may have become putrid by the impounding, and he is not liable to the consequent pollution of the stream, in the absence of any negligence or unnecessary exercise of his right (*River Ribble Committee* v. *Halliwell*, 1899, 2 Q.B., 385).

In a case in which the local authority were themselves in default, through failure to make provision for dealing with sewage in their sewers, the court, in the exercise of its discretion, refused, at the instance of the defaulting authority, to make an order against persons causing their drains to discharge into such sewers (*Kirkheaton Local Board* v. *Ainley*, 1892, 2 Q.B., 274).

The consent of the Local Government Board is necessary each time proceedings are taken under secs. 4 and 5 of the Act of 1876, although taken in respect of the same pollution (*Ex parte Mersey, &c., Joint Committee*, 1895, 59 J.P., 756).

And such consent must be obtained before the authority gives to the alleged offender the two months' notice of intention to take proceedings required by sec. 18 of that Act (*West Riding River Board* v. *Robinson*, 1906, 23 T.L.R., 249).

If a person has a right to discharge drainage into a public sewer, through a connection lawfully made, the local authority cannot cut off the connection even if he discharges trade effluents which prejudicially affect the sewer (*Eastwood* v. *Henley Urban District Council*, 1900, 1 Ch., 781).

Where the sewers of a local authority are more than sufficient, but their purification works are insufficient, for the requirements of their district, they cannot be required to give facilities to manufacturers for carrying trade effluents (*Brook* v. *Meltham Urban District Council*, 1908, T.L.R., 809).

Persons who drain noxious trade effluents into a public sewer communicating with a stream, through a channel constructed before 1876, without using the best practicable and reasonably available means to render it harmless, are guilty of an offence under sec. 4 of the Act of 1876 (*Butterworth* v. *West Riding Rivers Board*, 1908, 25 T.L.R., 117).

SEWERS AND DRAINS.

There has been no general legislation on the subject of sewers and drains, but there have been many judicial decisions elucidating various points. We can only note some of the more important of these, in addition to those referred to in connection with the subject of river pollution.

In *Falconar* v. *South Shields Corporation* (1895, 11 T.L.R., 223) a stream formed by the junction of two watercourses, both of which had received sewage (one for many years and the other during recent years), was held to be a "sewer."

The term "sewer" does not include an engine-house and pumping machinery for lifting and forcing along a rising main the sewage of a district to a common outfall (*King's College, Cambridge*, v. *Uxbridge Urban District Council*, 1901, 2 Ch., 768).

Neither does it include a cesspool (*Meader* v. *West Cowes Local Board*, 1892, 3 Ch., 18; *Button* v. *Tottenham Urban District Council*, 1898, 78 L.T., 470; *Butt* v. *Snow*, 1903, 89 L.T., 302).

A conduit may be a "sewer" notwithstanding that it does not convey sewage, but merely rain or surface water (*Ferrand* v. *Hellas Land, &c., Company*, 1893, 2 Q.B., 135; *Durrant* v. *Branksome Urban District Council*, 1897, 2 Ch., 291; *Holland* v. *Lazarus*, 1892, 66 L.J. Q.B., 285).

So also may an open channel made for carrying water from a road, and communicating by gullies and pipes with an underground drain (*Wilkinson* v. *Llandaff, &c., Rural District Council*, 1903, 2 Ch., 695).

A line of pipes which is constituted a sewer by the reception of the drainage of more than one house remains a sewer even though all the houses but one may subsequently adopt other means of drainage (*Vestry of St. Leonard, Shoreditch*, v. *Phelan*, 1896, 1 Q.B., 533).

In connection with the subject of combined drainage there have been many decisions, a few of which only can be noticed. A conduit is a drain, it will be remembered, within the statutory definition, not only when it drains one building only, but also when it drains premises within the same curtilage.

In *Vestry of St. Martin's* v. *Bird* (1895, 1 Q.B., 428) it was held that the Lowther Arcade did not constitute premises within the same curtilage. But in *Pilbrow* v. *Vestry of St. Leonard* (1895, 1 Q.B., 433) two blocks of apartments, separated by a 20-ft. causeway closed at one end, were held to be premises within the same curtilage. These cases are not easy to reconcile.

In deciding whether a combined drain is a sewer it is immaterial that the drain is entirely on private property (*Travis* v. *Uttley*, 1894, 1 Q.B., 233). But a combined drain is only a sewer from the point at which it receives the drainage of more than one building. Above that point it is a drain (*Beckenham Urban District Council* v. *Wood*, 1896, 60 J.P., 490).

The hopes based upon the effect of section 19 of the Public Health Acts Amendment Act, 1890, in relieving local authorities from liability in respect of combined drains in certain cases, have not been fully realised owing to the limited interpretation placed by the courts upon that enactment.

The first blow was dealt by the decision in *Hill* v. *Hair* (1895, 1 Q.B., 906), where it was held that the Act of 1890 did not apply to a combined drain made before the Act was passed. But this decision was disapproved in *Bradford* v. *Eastbourne Corporation* (1896, 2 Q.B., 205), where the contrary view was held, and the latter case was followed in *Seal* v. *Merthyr Tydfil Urban District Council* (1897, 2 Q.B., 543). The section was thus rehabilitated so far as this point is concerned.

But a further blow was struck at it by the decision in *R.* v. *Hastings Corporation* (1897, 1 Q.B. 46), where it was held that, although in districts where Part III. of the Act of 1890 has been adopted a combined drain may be a "single private drain" within the meaning of the section, this only enables the local authority to proceed under sec. 41 of the Public Health Act, 1875, in the event of a nuisance; and that for all other purposes the drain remains a sewer.

Ten years later the section received a still greater injury at the hands of the House of Lords in *Wood Green Urban District Council* v. *Joseph* (1907, 1 K.B., 182). In that case several houses belonging to different owners were drained in pairs by means of Y-shaped arrangements of pipes into a single drain (in private ground), which communicated

with a public sewer. It was held that the drain was not a "single private drain" within the meaning of the section, but a "sewer" vested in and repairable by the local authority, for all purposes. The sting of this ruling lies in the *ratio decidendi* viz., that the drain in question was not such a drain as owners are compellable to provide under secs. 23 to 25 of the Public Health Act, 1875. It is difficult to imagine a case in which an owner could be compelled to provide a combined drain under these sections; and therefore it will be seen at once how this decision emasculates section 19 of the Act of 1890.

TOWN PLANNING.

In Part II. of the Housing and Town Planning Act, 1909, we have an entirely new departure. The object of the Act is to enable local authorities to make town planning schemes with respect to land which is in course of development or appears likely to be used for building purposes, with a view of securing proper sanitary conditions, amenity, and convenience.

The Local Government Board may authorise a local authority to prepare such a scheme, or to adopt a scheme prepared by landowners, but no scheme is to have effect until approved by order of the board; and before the board approve a scheme they must advertise their intention in the Gazette; and if within twenty-one days any one interested objects the draft order must be laid before Parliament for thirty days, and if either House presents an address against it within that time no further proceedings are to be taken thereon.

The board are authorised to prescribe a set or sets of general provisions for carrying out the objects of the Act, and also to make regulations as to procedure. Power is given to the responsible authority, after giving such notice as provided by a scheme, to remove buildings, &c., and execute necessary works at the expense of the persons in default.

There are provisions for payment of compensation to persons whose property is injuriously affected by a scheme, and for the recovery by the authority of half the increase in value accruing to any property by the making of a scheme.

Land required for a scheme may be purchased by the authority by agreement, or (when authorised) compulsorily in the same manner as for the purposes of Part III. of the Housing of the Working Classes Act, 1890.

If the local authority fail to prepare a scheme when necessary, or to adopt an owner's scheme which ought to be adopted, or to consent to modifications proposed by the board, the latter may order the authority to remedy the default, or may approve an owner's scheme, in which event it is to have effect. If satisfied after a local inquiry that a responsible authority have failed to enforce a confirmed scheme, or to execute necessary works, the board may order them to do what is necessary, and the order may be enforced by mandamus.

"Local authority" means the council of any borough or urban or rural district. All expenses of a local authority under the Act, or any scheme, are to be defrayed as expenses under the Public Health Acts, and money may be borrowed for the purposes of schemes as for the purposes of those Acts. Money so borrowed is not to be reckoned as part of the debt of a borough or urban district council under the Public Health Act, 1875, sec. 234, subsecs. (2) and (3).

The changes in the department of the highway law which have taken place in the period under review are so numerous and of so far-reaching a character that we are unable, owing to limitations of space, to deal with them adequately in the present issue, and we propose, therefore, to continue our review next week, when the legislation introduced in connection with the questions of the housing of the working classes, and commons and open spaces will also be touched upon.

1892—1913.

[We are indebted to an esteemed correspondent for the following lines apropos of the coming-of-age of THE SURVEYOR.]

The morn appears, the haze-dimmed light
Hangs hesitant on yonder swarthy hill:
Enter a child with toddling feet and face afright.
Surveys—oh, prescience rare!—Dame Nature's scheme.
Under its murky pall where storm clouds loom;
Rests next on knoll to watch a rosy gleam
Vast-spreading in a screen of orient gloom.
Evanescent the shade! Beneath the purpling void
Young manhood, with all-conquering sway
O'ercomes the cloud. Darkness thus destroyed,
Resume the light and hail potential day.

R.

COUNTRY HOUSE SEWAGE TREATMENT.*

By HERBERT FREYBERG, F.S.I.

The first thing to do with sewage is to get it swiftly, silently and smell-less away from the dwelling, and it will be realised that there must be some fall in the ground from the house in order to accomplish this by gravitation. Where the fall is not a self-cleansing one, additional flushing at the head must be provided, and, where possible, the bath wastes should be utilised for this. The treatment of sewage is dependent on many conditions, but the governing factors are the extent of land available, the contour of the surface, and the nature of the subsoil. Assuming these to be not unfavourable, most of the difficulties disappear, especially if the effluent has a run of any length before it reaches a tributary of some watercourse.

Sewage should, in my opinion, first be collected in a tank with the inlet at a level which will not disturb the scum and an outlet at that which will not interfere with the sludge, so that a clear volume of liquid is left in between. This tank can be covered in, when, of course, ventilation is necessary. The outlet can, if there is sufficient fall, dribble continuously over a filter-bed composed of gravel, clinker, coke breeze, or any other similar material, which will vary in depth according to the fall available for one or two filter-beds, and whether land treatment is possible before the effluent reaches the nearest water course. The effluent on leaving the filter should be allowed to flow slowly over some land, and its course should be altered from time to time and the ground dug over. It is most important that the land should not be overdosed, but allowed time for rest and aëration. So much depends on the lie of the land and character of the soil, that all these details should be considered and provided for when the selection of the site is made. If a house is built on a dead level with a heavy wet clay soil, the satisfactory disposal of the sewage becomes indeed an anxious problem.

A good system for a small house standing in limited grounds is a three-division underground chamber having some 500 cub. ft. capacity, the first compartment constructed on the septic tank principle with capacity for about 400 gallons, the next compartment with about double that capacity from which there is a flow into a final chamber through a coke breeze filter some 2 ft. thick, from which it can be regularly pumped out of the third chamber over the kitchen garden, where there should be no more offence than if rain-water were being dealt with.

Ulverston Public Hall Scheme.—The Local Government Board have granted the application of the Ulverston Urban Council for a provisional order to borrow £3,000 towards the cost of a public hall, subject to the money required in excess of that amount being raised by public subscription. The sum of £1,850 has already been raised.

Tar-painting Apparatus.—We learn that the Southampton County Council have placed an order with Messrs. Johnston Brothers, of 79 Mark-lane, E.C., for twelve of their "1913" pattern patent double-furnace tar-boilers, each to be fitted with double Waithman's apparatus for tar-painting by hand. This firm carried out for the county council a contract of over 600,000 yds. during last season, and the present order is certainly a strong recommendation for their boilers and appliances.

* Extract from paper read last night before the Society of Architects.

Rail Corrugation.

By F. O. C. NASH, Assoc.M.Inst.C.E., City Engineer's Office, Newcastle-upon-Tyne.

Tramway engineers in general will read with a considerable amount of disappointment Mr. Wakelam's paper on the above subject,* for it is impossible not to accept his own modest estimate of his efforts and to agree that the investigation into the true cause of rail corrugation is not thereby much advanced. However, it is impossible to bring together so much evidence on the subject without in some degree clearing the air, and to a considerable extent assisting in the work of investigation.

While it is impossible in the case of a phenomenon due apparently to causes so many and so complex to advance a theory that shall not in some direction be open to criticism, the author here suggests an explanation that has the merit of accounting for the majority of the observed facts, and which with a small amount of ingenuity can be extended to cover them all. At the outset it must be admitted that no theory should be accepted which does not account for all of the phenomena connected with rail corrugation which scientific investigation proves to so belong.

Before dealing with the evidence of other observers we should do well to ask ourselves in what way may the corrugation of a rail be effected in the shops, the use as a tool of only a tram wheel hung on springs being allowed. Assuming that the rail is initially straight and homogeneous, we could effect our purpose in one of the following ways:—

(1) By placing the rail on a rigid base and using the wheel as a hammer the rail could undoubtedly be hammered into some imitation of a rail corrugated by vehicular traffic, whether steam, electric or cable driven.

(2) By using the wheel as a grinder, and by either keeping the travel of it along the rail uniform and the pressure variable, or by keeping the pressure uniform and the travel variable, a similar effect could be produced. In this case also a further variation might be introduced by varying the speed at which the wheel revolved.

(3) By employing some combination of any of these methods.

It need not be insisted upon that always and invariably there is a grinding action, due to slipping going on between the wheels of a car and the rail. It is obvious also that this grinding is very much increased by driving and braking, and by the passage of the car round a curve, and that, although too much must not be made of this effect, it undoubtedly sets up a vibration of the car springs, and if it does not entirely cause it, contributes considerably to the ultimate destruction of the rail.

HAMMERING.

As to hammering, in the wheels of a car held down under great pressure by springs we have an ideal apparatus for hammering the rail out of all utility, provided that the necessary number of shocks are communicated to the springs to keep the wheel vibrating. That the shock is provided at every joint of a worn or badly laid track is a commonplace that need not be emphasised. And even in the case where welded joints are used, and this shock very appreciably lessened, there are always sufficient obstructions on the rail head to initiate vibration and to produce the dynamic effect called hammering.

That at low speeds, unless the rail joints are very uneven, corrugations are not formed is intelligible enough when it is remembered that the amount of the shock impulse is determined by the speed of the car, and that vibrations of this kind are cumulative, which latter fact accounts for there being a critical speed below which the vibrations are either not set up at all, or if set up, they tend to die out.

It is to be remembered that the corrugation of the surface travelled over is caused by all vehicles hung on springs, and is as noticeable on macadam roads as upon tram and rail tracks. That the corrugations should often occur on one rail only goes to support the theory advanced, for, while oscillation must of necessity affect both wheels on an axle, it is quite possible that one end of an axle might vibrate in a vertical manner without the other end being affected.

That some tracks should be free from this evil may be due to the fact that the joints of the rails are either welded or very well designed and made, or to the fact that the cars using the track are variously designed and neutralise each other's particular variety of damage.

As to the vibration of the rail itself, this is, of course, not a cause, but an effect due to the impacts of the spring-driven wheel on the head of the rail. It may be agreed as regards a resilient bed that this would undoubtedly lessen the shock caused by any obstruction, and to some very slight extent obviate the evil, but, as is common knowledge, rails laid upon timbers are still badly subject to corrugations.

COLD ROLLING.

It is very difficult to believe with Mr. Worby Beaumont that cold rolling has anything to do with the matter, and as for his theory that the crests of the corrugations are kept bright by the car wheels jumping over them (I hope he is not misreported), it is a good deal more entertaining than useful. The corrugations being formed by a particular, and, perhaps, the most frequent, type of car travelling at a certain speed, it follows that other cars travelling at other speeds, or having springs of a different frequency, must tend to create other corrugations of a different pitch. It is obvious that if such is the case such other traffic will tend to keep the corrugation ridges bright enough.

Changes of structure in the steel of the rail and crystallisation can be dismissed as totally inadequate causes of the phenomenon under consideration. Variations of temperature may also be neglected, since a very simple calculation will prove that under no probable variation of temperature will a stress be produced sufficient to cause any deformation or anything approaching it.

Corrugation of surface under the dynamic effect of spring-hung vehicles is a well-known phenomenon to anyone who has at any time been responsible for the maintenance of highways.

The cases are more nearly identical than at first appears. In both cases we have surfaces travelled over by a variety of spring-hung vehicles. In each case, though all classes of traffic damage the surfaces, the damage that is most noticeable is that effected by a particular type of vehicle travelling at a certain speed, and probably having springs of similar frequencies. Although a macadam road may be said to have been "cold rolled," we doubt whether Mr. Worby Beaumont would claim the case in support of his theory.

As to the remedy, this must be supplied partly by the track designer in the direction of improved joints, and by the car designer in the direction of supplying vehicles having such a variety of effects upon the track that the result is the difference and not, as is now often the case, the sum of their individual effects.

* The Surveyor, December 13th last, p. 814.

War Office Contracts.—Messrs. Hill & Smith, Limited, of Brierley Hill, who are just completing an air-ship shed for the War Office at Farnborough, have received instructions to proceed with the erection of a similar shed on the Medway for the Admiralty. The new shed, which consists of steel superstructure covered with galvanised corrugated sheets, will be 550 ft. long, 120 ft. wide, and 112 ft. high, and will be fitted with sliding doors. These doors alone, including necessary supports and overhead track girder, will weigh approximately 550 tons. The contract includes foundations and erection complete.

Royal Sanitary Institute: The Exeter Congress.—A public meeting will be held to-day (Friday) in the Guildhall, Exeter, for the purpose of electing a local reception committee and making other arrangements in connection with the twenty-eighth congress of the Royal Sanitary Institute, which is to be held in that city from July 7th to 12th next. The meeting will be attended by Mr. H. Percy Boulnois, M.Inst.C.E. (chairman of the council of the institute), Mr. H. D. Searles-Wood, F.R.I.B.A. (chairman of Congress Committee), Mr. W. C. Tyndale, M.Inst.C.E. (chairman of Exhibition Committee), and Mr. E. White Wallis, F.S.S. (secretary of the institute).

FACTOR OF SAFETY IN REINFORCED CONCRETE STRUCTURES.

By ROBERT G. CLARK, ASSOC.M.INST.C.E.

From the January issue of *Ferro-Concrete*.

The factor of safety in a reinforced-concrete structure has generally been denoted by the ratio of the maximum working stress in the steel to the ultimate strength of the steel. For example, assuming that the working stress is 16,000 lb. per square inch, and the ultimate strength is 64 000 lb. per square inch, the factor of safety would be 4 by this theory.

Others, again, take the view that if the steel is stressed beyond the elastic limit the structure has, to all intents and purposes, failed, and, taking this line of reasoning, the factor of safety is expressed by the ratio of the maximum working stress to the elastic limit of the steel. Assuming the working stress at 16,000 lb. per square inch, and the elastic limit at 45,000 lb. per square inch, we then have the factor of safety reduced to about 2·75. This, however, is purely a theoretical calculation which deals with the steel only, but in any scientifically designed reinforced work we know that the concrete shares with the steel an equal responsibility concerning the stability of the structure, so that before the factor of safety can be accurately determined it is essential to see that the concrete also has an ample margin of safety.

The designer, in the matter of the quality of the steel, can safeguard himself by specifying that the British Standard Specification must be adhered to, but unfortunately no such standard is available for the concrete.

It is true that as far as the cement is concerned we have the assistance of the British Standard Specification as regards quality, but in the matter of the quantity of cement the greatest latitude is allowed when we have mixtures varying from 1:4 to 1:9 parts of cement to aggregate.

Dealing with the aggregate used for the concrete, this is more or less controlled by the materials available in any given district, and here again, to make matters worse, much difference of opinion exists as to suitable concrete materials. Very often the selection is left to the contractor, whose natural aim is to get something cheap in order to outstrip his competitors, and as the designer is generally many miles away he may not know of this arrangement, and the prejudicial effect it may have upon the factors of safety provided by his elaborate calculations.

In the past it cannot be denied that the concrete has been more or less overshadowed by the advocates of particular kinds of reinforcing steel, but the concrete in reality needs more attention than the steel, not only because of the reasons stated above, but also for the reason that the lifetime of the structure depends upon the efficient protection of the steel from corrosion. Therefore, as we assume in assessing the factor of safety of the steel that it will not deteriorate, then every care must be taken to protect it, and this can only be done by having the concrete composed of the best materials available, carefully graded and mixed with a generous quantity of the best cement.

It is by no means uncommon for competitors to state their calculated factor of safety, and it is interesting to note that for precisely the same work the factors of safety given by various firms vary from 4 to 9.

How the latter figure is arrived at is frequently a mystery, especially in cases where the firm submitting the lowest tender quote the highest safety factor.

It is obvious that something should be done to standardise the method of calculating the factor of safety, and that any method adopted should include due consideration of the strength of the concrete mixtures. It is altogether unfair to fix a limit of working stress on the concrete unless inquiry is also made into its constituent parts, as the limit may be much too low for some mixtures or too high for others.

In conclusion, it must be pointed out that the actual factor of safety is much above the calculated value if the best materials are used, but it should be remembered that the calculated factor of safety is only used for purposes of comparison. With a good concrete and steel efficiently protected the factor of safety increases as time progresses, owing to the fact that the concrete increases in strength with age, and in this respect affords a striking contrast with structural steel, timber or brickwork, which are at their best when new.

THE SHREWSBURY HOUSING SCHEME.

DESIGNS FOR COTTAGES.

The Housing Special Committee of the Shrewsbury Town Council have presented a detailed report from the architect, Mr. A. E. Williams, with respect to the municipal housing scheme. In this Mr. Williams stated that he had now prepared a scheme for laying out the estate. The general lines of roads were the same as already submitted by the borough surveyor, Mr. W. C. Eddowes, since it was, in his opinion, the best and most economical way of dealing with a site of that description. A valuable feature of this arrangement was the provision of a playing green, which was under observation from practically every house. He had, however, suggested an extra house, making a total of sixty-three, or twelve per acre, as was allowed under the Housing and Town Planning Act. In arranging the grouping of the houses, he suggested that, having regard to the nature and levels of the site, it would be advisable to limit the number of houses in any one block to four, and thus save considerable expense in excavations and foundations, and also avoid unnecessary steps. He had, therefore, prepared designs for semi-detached and blocks of three and four cottages.

Block of Four Cottages, Design A.—Accommodation—Ground floor: Large living-room, scullery-bathroom (with bath, sink, copper, &c.), larder, coal and water-closet, the latter in the end cottages being accessible from the scullery and thus under cover. Height: Floor to ceiling, 9 ft. First floor: Three bedrooms, one only being provided with a fireplace. Height: Floor to ceiling, 8 ft.

Semi-detached, Design B.—Accommodation—Ground floor: Large living-room, scullery-bathroom, and generally as described for Design A. First floor: Two large bedrooms, one with fireplace.

Semi-detached, Design C.—This block has been designed principally for those cottages on the south side of the estate, and facing north, the chief feature being that although this block requires a greater frontage, it has the advantage of getting the sunshine into the living-room. Accommodation—Ground floor: Living-room, scullery-bathroom, coal, water-closet, larder, and by continuing the unbroken line of roof provides a shelter in front of house in which can be placed a seat. First floor: Three bedrooms.

Block of Three Cottages, Design D.—Accommodation—Ground floor: Living-room, scullery-bathroom, larder, water-closet, and coal. First floor: Three good bedrooms, and hanging cupboard in best bedroom.

In the design he had provided for facing the walls to the height of 4 ft. above floor level all round the houses with Lilleshall machine-made common facing brick, the remainder to be treated with cement rough cast. The whole of the roofs to be covered with red Broseley tiles. The constructional and artistic treatment of outside to be as plain as possible, omitting all mouldings. The floors, as indicated on plans, to be laid with red quarries on lime concrete, and others to be finished with cement. Red-tile skirtings to be provided on ground floor. The walls of living-room and bedrooms only to be plastered. Walls of scullery, bathroom and offices to be pointed and white-washed. Outbuildings had been avoided in every case, everything being under the main roof.

The committee report that the necessity for erecting a greater number of houses with three bedrooms had been so apparent that they had arranged for fifty-seven three-bedroom houses and six two-bedroom houses only, instead of thirty-one of each class as originally intended. On the architect's recommendation it had also been decided to erect sixty-three houses on the site instead of sixty-two, as the number proposed would then comply with the Local Government Board's allowance of twelve houses per acre. The estimated cost was as follows: Land, £809; roads, footpaths, fencing and planting, £590; sixty-three houses, at an aggregate cost of £9,981; architect's commission, £350; contingencies, £279; total, £12,000. The approximate yearly receipts would be: Six houses at 3s. 9d., £58 10s.; fifty-seven houses at 4s. 6d., £666 18s.; total, £725 8s. The original estimate of £10,700 did not include several items of expenditure which, with the increased cost of materials and the erection of an extra house, and providing for three bedrooms as stated in the bulk of the houses, made the total cost as now estimated at £12,000.

Against this it should be noted that the income was also increased by the sum of £58 10s. per annum.

Institution of Municipal and County Engineers.

SOUTH WALES DISTRICT: MEETING AT SWANSEA.

The excellent progress made by the Institution of Municipal and County Engineers during the past twelve months was the subject of comment by the president, Mr. R. J. Thomas, at last Saturday's meeting in the South Wales District, not the least gratifying part of his remarks having reference to the accession at the last two council meetings of something like 100 members, an event, as was pointed out, quite unprecedented in the annals of this body. After alluding to the arrangement by which the Local Government Engineers of New Zealand have become affiliated to the institution—representing another 100 members—Mr. Thomas, following some observations on the recent acquisition of more commodious offices, touched briefly upon the subject of the Orphan Fund, which, he stated, was dealing at the present time with nine or ten cases of distress—some of a most pitiable character. A scheme had, he proceeded to observe, been practically formulated for organising a voluntary defence fund, so that in future the advice and assistance of the institution's solicitor will be obtainable by members suffering from unjust treatment at the hands of their councils. The town planning competition arranged in connection with the forthcoming annual meeting at Great Yarmouth was later on referred to by the president. It had, he said, been brought to the notice of the council that some of the requirements were probably greater than some of the younger members might be prepared to face, and in order to secure a good competition and a large number of entries it had been decided to reduce the requirements very considerably; for example, the bird's-eye view required under the new regulations was now excluded, as was a condition with regard to other details. He hoped that members desiring to take part in the competition would communicate with Mr. Cole, the secretary, who would at once forward particulars with regard to it. He was anxious that the competition should be a thorough success, and that members in the South Wales District—particularly the younger ones—would not overlook it.

Weather conditions were anything but ideal for Saturday's gathering, and probably accounted for a large number of absentees, but, as will be seen from the list which follows, the attendance was well up to the average for the district. The proceedings themselves were entirely successful, the two papers submitted for consideration being discussed with considerable thoroughness, as our report shows. Those present at the meeting, in addition to the president, included Messrs. G. H. Bell (Swansea), H. A. Clarke (Briton Ferry), hon secretary, W. E. Clason Thomas (Neath), A. P. I. Cotterell (London and Bristol), D. J. Davies (Swansea), J. Davies (Swansea), W. J. Davies (Nantyglo and Blaina), A. Fitzmaurice (Swansea), B. Griffin (Swansea), E. J. Harpur (Maesteg), W. Harpur (Cardiff), W. L. Harpur (Brecon), F. Hatcher (Neath), R. Hutton (Swansea), D. James (Swansea), A. Jenkins (Swansea), A. D. Jenkins (Swansea), D. M. Jenkins (Neath), J. D. Jenkins (Pentre), D. A. Jones (Merthyr Tydfil), N. V. Jones (Glyncorrwg), W. J. Jones (Rhondda), G. S. Morgan (Pontypridd), J. Morgan (Pontardawe), A. J. Oborn (Burry Port), S. H. Peregrene (Briton Ferry), E. C. Pole (Cardiff), H. C. Portsmouth (Swansea), D. H. Price (Bedwellty), E. G. Protheroe (Swansea), F. Read (Rhondda), J. Revell (Briton Ferry), G. Swarbrick (Swansea), J. Thomas (Swansea), O. Thomas (Swansea), and R. H. Wyrill (Swansea).

A meeting of the members of the district, presided over by Mr. W. HARPUR (Cardiff) was first held at the Guildhall for the purpose of electing a District Committee, and as a result of the deliberations it was resolved to elect a committee of thirteen, consisting of the chairman of the district (Mr. W. Harpur), the hon. secretary (Mr. H. Alex. Clarke), the district representative on the council (Mr. G. A. Phillips), and the following elected members: Messrs. H. Tremilling (Newport), G. Bell (Swansea), D. M. Jenkins (Neath), W. L. Harpur (Brecon), A. J. Oborn (Burry Port), J. C. Pardoe (Barry), W. J. Jones (Rhondda), members; and D. L. Jones (Merthyr), J. F. Shellard (Newport), and G. H. Bell (Swansea), associate members.

The general meeting afterwards took place in the council chamber, where the members were welcomed by the MAYOR (Mr. D. Williams). Those of them, said his Worship, who attended the previous meeting of the institution in Swansea would no doubt have become aware that some very great improvements had been carried out in the town in the past few years. Like all ancient towns, Swansea had been the victim of the bad conditions that prevailed in the old days, and it demanded a great expenditure in order to bring themselves up to date. They had several important improvements in view, among these being the development of the Town Hill estate, upon which it was ultimately proposed to erect about 2,000 houses. A tramway would be necessary, and the corporation had been helped very materially by the town planning scheme produced by Mr. Raymond Unwin and Mr. Bell, the borough surveyor. In conclusion, his Worship said it was a real pleasure to him to welcome the representatives of so many other public bodies, and his only wish was that the weather had been a little more propitious in order that the town could have been seen to better advantage.

The PRESIDENT (Mr. R. J. Thomas), in acknowledging the welcome of the mayor, said they were pleased to find that Swansea had progressed, and was progressing so rapidly. Trade appeared to be flourishing there, and he trusted that happy state of things would continue. In the short time he had been in the town he had seen very strong evidence of the improvements which were being carried out, and he wished the corporation every success in their efforts. The members of the institution were naturally much interested in the development of the town planning scheme, and he congratulated the authorities on the undertaking they had set on foot.

A vote of thanks having been accorded to the mayor, the members left the Guildhall to make an inspection of the Castle-street improvement, and, following luncheon, paid a visit to the refuse destructor works. Two papers, "Swansea Tramways, Past, Present and Future," by Mr. G. Swarbrick, deputy borough surveyor, and "The Development of the Pentre Valley in Relation to the Destructor," by Mr. G. H. Bell, assistant borough surveyor, were afterwards submitted for consideration, the discussion taking place at the Hotel Cameron, where the members were entertained to tea by the borough surveyor.

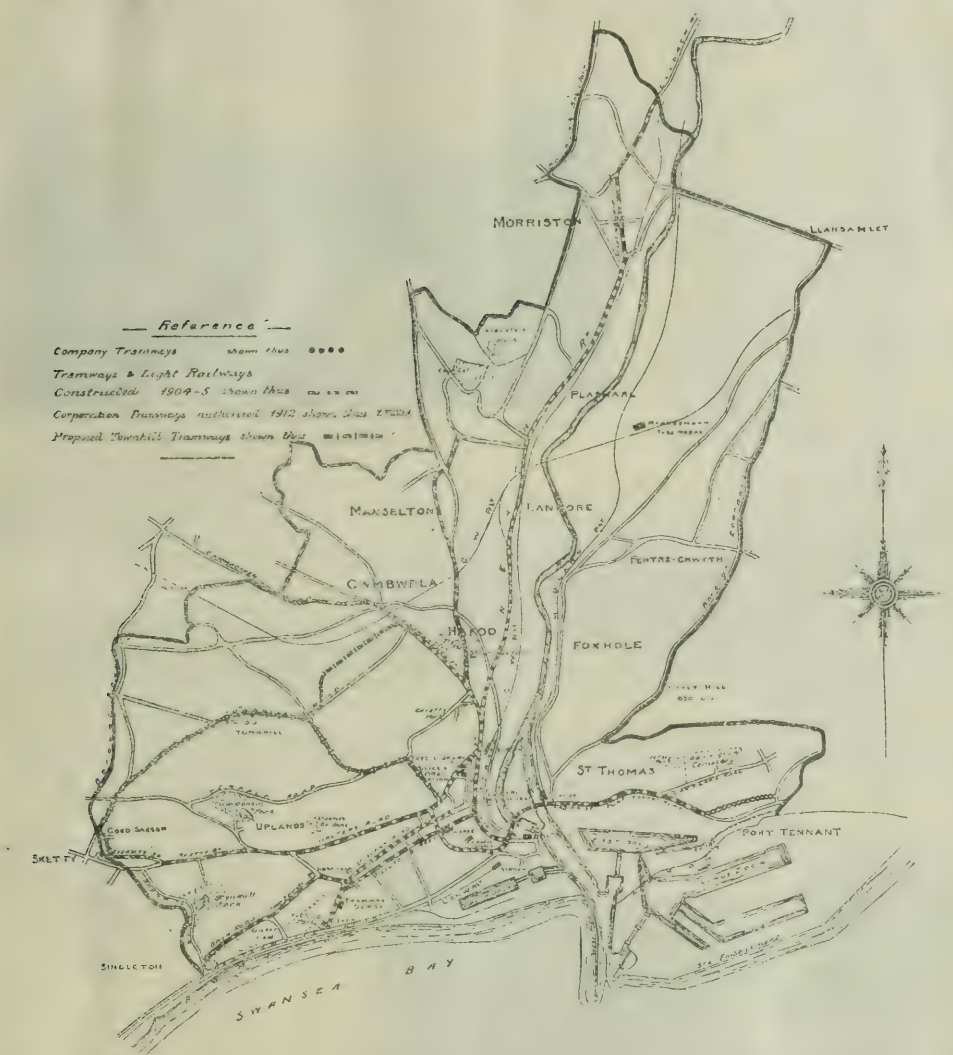
SWANSEA TRAMWAYS, PAST, PRESENT AND FUTURE.

By GEO. SWARBRICK,
Deputy Borough Surveyor, Swansea.

Since July, 1905, when Mr. George Bell, the borough surveyor, submitted a paper to the Institution of Municipal and County Engineers on "Some Municipal Works in Swansea," there has not been very much tramway work actually carried out in Swansea, but a great deal has, however, been done on paper. Such work as has been completed may present some points of interest generally to the members and provoke interesting discussion.

It should first be stated that last year the corporation and the tramway company came to terms in regard to a new lease of the lines, constructed by the company under their Acts of Parliament dated 1874, 1878, 1879 and 1882, which, by sec. 43 of the Tramways Act of 1870, the corporation would not have been able to possess finally until a very remote time at the end of the century. The borough surveyor made an exhaustive report on the subject, and arrived at an average term of twenty-four and a-quarter years in respect of a new lease of the whole mileage of the company's lines, and the lines subsequently constructed by the corporation, and stated that: "An average term of this number of years in respect of the whole mileage of the tramways would be equivalent in value to the collective value of the varying terms of the different sections under the existing conditions."

Mr. MacElroy, the general manager of the Manchester tramways, was then called in as specialist to advise, and eventually an agreement was entered into between the corporation and the tramway company for a lease of thirty years of the whole undertaking on terms and conditions which were considered mutually satisfactory and equitable. The ground being thus cleared, arrangements could then be made for certain extensions which were very much needed, and which by the terms of the new lease would be worked by the tramway company. Previous to this, in 1908, the tramway in High-street having got into a very bad state of repair, and the corporation being anxious to improve the sides of the roadway, arrangements were made between the corporation and the company whereby the tramway from College-street to Prince of Wales-road was reconstructed and doubled, with new material, and the whole width of the roadway, including the tramway track, laid with soft-wood paving. The rails were 95 lb. to the yard, from Belgium, laid on creosoted pine sleepers, 8 ft. by 9 in. by 4½ in. deep, placed 3 ft. apart centre to centre. The rails were jointed by fishplates weighing 49¼ lb. per pair, having six 4-in. Ibbotson's bolts and nuts to each pair. The rails were attached to each sleeper by means of four ¾-in. diameter coach screws 6 in. in length. Sole plates, 24 in. long, 10 in. wide, and ¼ in. thick, were placed under each joint between the rails and the sleepers. Concrete 6 to 1 was laid from 9 in. to 6 in. deep under the level of the rails, and upon which the flooring and paving were laid. Cranked tie-bars, 2 in. by ⅜ in., placed 6 ft. apart. The points and crossings were made of Allen's "Imperial" patent manganese steel, the former in pairs, consisting of two points, and 10 ft. 9 in. long over all, each point having a movable tongue, thereby doing away with the dummy point and providing smoother running for the cars.



SWANSEA TRAMWAYS: DIAGRAM SHOWING EXISTING LINES AND PROPOSED EXTENSIONS.

The first work undertaken by the corporation and the tramway company after the agreement was the reconstruction and doubling of part of the line from Swansea to Morriston, a length of 6 fur. 2·25 chains, and paving the track with granite setts. At the same time the corporation widened the roadway to 60 ft., and also laid down granite-sett paving for the full width of the road. The method of laying the track and materials used was similar to that in High-street.

Following on the agreement between the corporation

and the company, Parliamentary powers were obtained last year for laying tramways in Castle-street (now widened to 60 ft.), Temple-street, Castle Bailey-street, Mount-street, Oxford-street, Wern Fawr-road and Carmarthen-road, and the tender of Messrs. W. Griffiths & Co., of London, has been accepted for carrying out a portion of the work—viz., Castle-street, Castle Bailey-street, Temple-street, Oxford-street and Mount-street. The remainder of the lines—viz., Wern Fawr-road and Carmarthen-road—will be commenced as soon as negotiations for the purchase of properties for road widenings have been completed.

The present mileage of the tramways, reduced to single line, is as follows: Company lines, equal 8·58 miles; corporation lines, equal 10·33 miles; the above extensions, 1·56 miles; total when completed, 20·47 miles. The Parliamentary plans and detail drawings of these works are open for the inspection of the members.

Mainly for the development of the valuable estate possessed by the burgesses on Town Hill, it has long been contemplated to construct a tramway up Mount Pleasant, Terrace-road and Penygraig-road, and the borough surveyor prepared reports and schemes for the same. The construction of this tramway has now become urgent owing to the acquisition by the corporation of 107½ acres more land on Town Hill by purchase, for the sum of £19 250, from the Duke of Beaufort and the Garden Suburb Freehold Company. In their determination to develop the same as soon as possible the corporation have thus become freeholders of the whole of the hill.

A development scheme, on town-planning lines, has been prepared for the corporation by Mr. Raymond Unwin, F.R.I.B.A., in conjunction with the borough surveyor, which provides space for about 1,400 houses on the southern slope of the hill alone. This plan is submitted for the inspection of the members as an excellent example of town planning in an extremely difficult place.

A report has just been obtained by the corporation from Mr. Stephen Sellon, M.INST.C.E., on the best method of dealing with the problem of tramway communication between the town proper and Town Hill.

The total length of the Mount Pleasant and Penygraig-road route is 4,580 ft. (0·867 of a mile), and the total rise is 466·56 ft., which gives an average gradient of 1 in 9·82. The steepest gradient on Penygraig-road is 1 in 5·56 ft. for the length of 140 ft., and that on Terrace-road is 1 in 7·78 for a length of 125 ft., and on Mount Pleasant 1 in 7·3 for a length of 140 ft. The lengths of roadway which have gradients steeper than 1 in 8 total up to 1,440 ft.

With such severe gradients it appeared that the only practicable method of working a tramway would be by means of cable, and that working by electricity in the ordinary manner was out of the question. However, Mr. Sellon, in his admirable report, advises that a tramway can be safely worked by ordinary overhead electric traction by reducing the ruling gradient of 1 in 5½ referred to by means of cutting and filling to 1 in 8. If these recommendations are adopted a double line, 4ft. 8½ in. gauge, would be laid throughout, and the roadway widened to 40 ft. Mr. Sellon's scheme embraces the construction of a tramway on the northern slope of the hill north-east to the works district at Cwmbwrla, and a tramway along Town Hill-road southwest to the residential district of Sketty. These tramways, being of the same gauge, would gives means of intercommunication between the town and the magnificent future dwelling area of Town Hill, and also the works districts, being connected to the existing tramways in Grove-place, Carmarthen-road, and at Sketty.

One of the conditions of the Local Government Board in giving sanction for the purchase of the Duke of Beaufort's land on Town Hill is that the corporation should agree to build, within a stated time, 300 houses for the working classes on the land, and this they have undertaken to do; so within a very few years we may look forward to not only these houses but a large number of houses for all classes of the community, and a network of up-to-date tramways giving access to every part of the borough.

The work in connection with the corporation tramways constructed in 1904, and the extensions herein referred to, was designed and carried out under the direction of Mr. George Bell, ASSOC.M.INST.C.E., the writer being his chief assistant in the matter. Mr. Dd. Jones, the general manager of the Swansea Improvement and Tramway Company, represented the company throughout. Mr. Ed. Fitzmaurice, of London, being their engineer, who collaborated with Mr. Bell in devising the details of the work and superintending the same.

Messrs. Wm. Griffiths & Co., of London, were the contractors for the High-street and Neath-road improvement, and they were represented by Mr. B. Griffin, ASSOC.M.INST.C.E.

The accompanying diagram shows the existing, intended and proposed future tramways.

THE DEVELOPMENT OF THE PENTRE VALLEY IN RELATION TO THE DESTRUCTOR.

By G. H. Bell,

Assistant Borough Surveyor, Swansea.

There were several considerations that led to the choice of this subject, and not the least important, because of our modern town planning manner of viewing changes in the character of towns, was that of the evolution of the Pentre Valley from its primitive and probably pleasant state of bygone years, through a period of pronounced unattractiveness, to the more cheerful condition which we may hope it will again assume in a few years more. The other considerations arose from the fact that within the valley, and constituting active and essential factors in its development, there have been, and are still, several civic activities which are of interest to municipal engineers and surveyors.

From a configuration or scenic point of view the valley has no interest. It is small and insignificant, being only some 600 yds. in length, and the greatest depth of that portion with which we are dealing is not more than about 40 ft. It is situated in the heart of industrial Swansea, and therefore importance should attach to its future. Notwithstanding its ugliness, which, on a dull day, is particularly felt, the little valley has been chosen by the Housing Committee of the Swansea Corporation as one of their sites for dwellings for the workers.

So far as homes are concerned, the place affords none of the amenities which we try to couple with other factors in determining the choice of position for residences. It has no upland breezes, no view, no foliage; in fact, at present no pleasantness or characteristic operative towards enjoyment. It is not, however, devoid of qualities favourable to the purpose of municipal housing.

Proximity to the places where the dwellers will work is a great advantage. It remains for the Housing Committee to so influence the further development of the valley that there shall be united with this advantage artificial amenities such as may be created by the provision of vegetation. The sides of the valley rise somewhat steeply from the Cwm-road, which, since the disappearance of the stream, occupies outwardly the bottom position. The course is serpentine, with a general bearing N.W. and S.E.

At the time when the industrial evolution commenced, the stream called the Burlais Brook, of about 10 ft. or 12 ft. in width, ran somewhat parallel with and on the west side of the roadway. On the east side of the road were a few cottages, a woollen factory, and a rope walk; while at one point, between road and stream, stood the old Cwm foundry, which, with the cottages, exists to this day. Had it not been for failure to agree as to purchase terms between the corporation and owner, the foundry would have disappeared instead of remaining to obstruct the completion of the culverting of the stream.

At a later date a few villas were built some distance up the eastern slope, and subsequently the closely built small houses were erected surrounding the high levels. A squalid character was then gradually given to the valley, which has clung to it ever since. Development seemed foreign to its nature, notwithstanding the change that went on all round.

The stream had become a receptacle for refuse of all kinds, from pots and pans to mattresses, and, besides constituting a very insanitary place, it entailed considerable expense annually in keeping the course free from obstruction and filth. Another aspect of the unfortunate character that the valley had acquired may be realised when it is stated that the gas company gave up as hopeless the attempt to maintain the lanterns of the street lamps along the Cwm-road, which were destroyed at nights by stones thrown by the rough element which foregathered upon the adjoining slopes.

This was the state of things when the corporation were looking, in 1903, for a site for a refuse destructor. Here was a place that afforded centrality for the disposal of refuse, and where the products of combustion could be advantageously disposed of for a number of years. The borough surveyor saw the

opportunities, and upon his recommendation the site, which was corporate property, was adopted for the destructor. The erection took place in 1904 by the Horsfall Company, and is fully described in a paper submitted to the institution on July 14, 1905, by the borough surveyor. The plant has been in continuous work, except for the necessary stoppages for cleaning and repairs, and there has never been the slightest nuisance caused either from the cells or the chimney stack since the works have been in operation.

The quantity of refuse dealt with has been fully up to the daily average of 64 tons, and the quantity of

PENTRE VALLEY BEFORE CULVERTING OF BURLAIS BROOK.

clinker produced therefrom has not exceeded expectations—viz., about one-third of the refuse. In order to improve the burning of the refuse, the steaming power of the boiler, and to reduce the repairs of the cells, certain improvements in the plant have been effected this year, which will now be described.

The old transverse flues between every two cells had thin walls, which quickly became burnt through, and the flues themselves did not conduce to good draught. Therefore it was arranged to build solid 36-in. walls in place of these flues, and to leave openings 3 ft. 9 in. square in each new wall near the clinkering front of the cells. These openings being in line would in effect constitute, in conjunction with the last cell, or that nearest to the boiler, which is now used as a combustion chamber, one continuous new flue. New arches over the cells were put in, and these have the advantage of much stronger abutments and supports. Therefore we have now four cells for burning refuse instead of five, the fifth cell acting as a combustion chamber. The old main flue, to which the transverse flues were connected, serves only as a by-pass flue when the boiler is not in full steam. The effect of the alteration is a much-improved draught and higher temperature of the gases at the boiler. The increase of temperature has not been measured, but that it is considerable is indicated by better steaming of the boiler, as proved by actual tests of the running of the electric generating plant, without the use of coal, and by the fact that since the change was made the fire-bars of the coal-fired furnace in the boiler have been so fused as to drop from their bearings. The same amount of refuse, or 60 to 64 tons per twenty-four hours, is burnt by the four cells as formerly by the five cells, by a larger quantity being fed at each charge. The charging and clinkering is done every half hour instead of every twenty-four minutes, as before the change. Each cell, therefore, is still allowed two hours for the consumption of the increased charge. There has been no change in the number of men engaged in the work, but some modification has been made in their duties.

The destructor has been a distinct advantage to the corporation, not only in getting rid in a sanitary manner of half of the house and trade refuse produced in the borough, but in reducing the haulage of the material, which previously had to be taken to tips about 1½ mile further away than the site of the destructor. The clinker has been utilised in the manner contemplated, in culverting the Burlais Brook, and in building the retaining wall and filling up the ground to form the building site. This work has proved to be a great sanitary improvement, and was carried out much below the estimated cost of £13 880. The clinker made admirable concrete, and the blue brick lining in cement has successfully withstood the acids in the water and the scouring action caused by the high velocity due to such a steep gradient as 1 in 45. The space for tipping the clinker above and alongside the culvert is not yet exhausted, but will not last much longer. A self-acting incline was put in and is now in operation for carrying the clinker to the lower levels, and has proved most satisfactory for the purpose. Large quantities of mortar have been made from the clinker and Aberthaw lime, and regularly disposed of or used for corporation work. This is now sold at a reduced price of 4s. per ton, which allows a fair profit.

A committee of the corporation considered for some time the advisability of laying down machinery for making slabs from the clinker, but eventually permitted the borough surveyor to make a start by hand labour. The venture has been very successful, and the slabs are satisfactory, both in regard to hardness and strength. The manufacture of paving slabs was commenced in April, 1911, and the quantity made and used to the end of 1912 amounts to 6,727 sq. yds. Two home-made jigging machines are used in making the slabs, and found to be most effective. As the space for manufacturing the slabs is very limited, wrought-iron racks are fixed under cover for stacking the slabs on the flat before removing them from the moulds, and these have been most useful. When the slabs are sufficiently dry they are stacked on end in the yard, where they are kept for three months before being sent out for use, which time is found to be quite long enough.

PENTRE VALLEY, SHOWING WORKS CARRIED OUT.

Building blocks have also been and are being made, as well as kerb and channel. The paving slabs are made 2 ft. 6 in. by 2 ft., 2 ft. by 2 ft., and 2 ft. by 1 ft. 6 in., all 2½ in. thick. They are faced with concrete ¾ in. thick of Porthgain granite chippings, ¼-in. gauge, and granite dust in the proportion of 2 of chippings and 1 of dust to 1 of cement, the body of the slab being 3 of clinker to 1 of cement. They are charged at 2s. 9d. per sq. yd., which is sufficient to cover all outgoings and capital charges and leave a reasonable profit. The kerbs, faced as above, are 12 in. by 6 in. by 2 ft. 6 in. long, to be laid flat, and

charged at 1s. 9d. each. The channel, 15 in. by 5½ in. by 2 ft. 6 in. long, all clinker, is charged at 1s. each. Messrs. Johnson's London Portland cement is used at present.

Part of the scheme for culverting the stream was the demolition of ten dilapidated dwellings and the erection of ten others for the housing of the displaced persons. The new houses were built in 1910, a little to the north of the destructor, from the design of the borough surveyor, which provided for the construction of the walls with concrete blocks and of the roofs with concrete *in situ*. The rents of the demolished houses were very low, and consequently a very small and cheap type of dwelling had to be erected as a substitute. The erection was done by contract, and the concrete blocks were made by the contractor from destructor clinker, for which he paid 2s. 6d. per ton. The houses are of two classes—(*a*) consisting of one living room, scullery, and two bedrooms, which were built for £145, and are let at 4s. 6d. per week; (*b*) consisting of one living room, scullery, and one bedroom, having cost £135, and being let at 4s. per week. Soon after erection it became apparent that there was a defect due to condensation of moisture on the ceilings of the upper floor, the ceiling being the underside of the flat roof. This trouble was cured by inserting wall ventilators just at the level of the ceilings. There has also been some little trouble from leakage through the roofs, which has necessitated tarring and sanding the upper surface. From an appearance point of view the blocks cannot be said to be a success, as the walls are dull and heavy looking.

Workmen's Dwellings Erected on Filled Ground over Burlais Brook Culvert.

In May of last year a start was made towards the erection of the long terrace of fifty houses which will occupy the position on the filled ground over the culvert. Mr. H. C Portsmouth, of Swansea, is the architect, and the work is being vigorously carried out by the contractors, Messrs. Marles, of Swansea. Already twenty-two houses have been completed, and are occupied. The whole lot have to be completed in twelve months from date of commencement. Such is the great shortage of houses in Swansea that the dwellings have about ten times their number of applicants for tenancy. These houses are also of two classes—viz., (*a*) having kitchen, scullery, and one bedroom, costing £110 each, and being let at 4s. per week, and (*b*) having an additional bedroom, being built for £145 each, and let at 5s. per week. The walls and roofs are constructed in the ordinary way of bricks and slates. The houses are bright and pleasing in appearance, and will form a valuable part of the large number of houses for the working classes which the corporation will ultimately possess as the result of the enterprising policy of the Housing Committee. Private enterprise has lamentably failed to keep pace with the rapid growth of population in the borough. Great overcrowding has stimulated the Housing Committee to provide for the shortage of houses, and it is much to their credit to be able to say that, in addition to the 103 houses, inclusive of those now being and to be erected at Cwm-road and at Graig Trewyddfa, the committee intend building another 350 dwellings on Town Hill in the very near future. Surely, never was a local authority made to feel so unmistakably that the provision of houses may be one of their most important functions. Circumstances have, during the last ten years or so, irresistibly called upon the Swansea Corporation for action in this direction, and it has been very interesting to watch the response, and the gradual growth of the function, which has already developed very considerably, and shows promise of being able, in the future, to guarantee that every self-supporting family that comes within the confines of the area over which the corporation has jurisdiction shall not only be certain of a house, but one that is up to a proper standard of suitability and obtainable at a reasonable rent. This incidental reference to the housing policy of Swansea need not be looked upon as valueless to members of the institution. In South Wales the question of housing has been, and will be for years to come, one of great moment, and one in which members no doubt feel much interested.

In conclusion, it may be well to say that the further development of the Pentre Valley does not depend upon any complete scheme that has yet been formulated. Its further development has still to be determined

The Cwm-road, being arterial, and part of the only good route for heavy traffic between the docks and the large Cwmfelin tin-plate works and the district beyond, must not be interfered with except by improving and widening it. A good use to which the slope opposite the new houses might be put, after first building a retaining wall and filling up to some extent, would be a children's playground. Having devoted the base of the valley to residential purposes, future action should be in harmony therewith. The slopes at the back of the houses and south of the foundry ought to receive some suitable treatment; the foundry should give way to the completion of the culvert and the filling up of the site; an avenue of trees might be planted along the road; and with a few other minor improvements the place could be given a pleasurable aspect. For years there has been a question of spanning the valley with a bridge so as to link up the districts on each side. The road alongside the destructor is intended for this purpose, and a gap has accordingly been left in the terrace of houses.

In most districts there are places such as this valley that are inconvenient and objectionable. As time goes on it will become more and more the duty of municipal engineers and surveyors to deal with such interesting matters. They must be prime movers in town modelling. Of those members who visit this valley some may remember from a previous visit, whilst others will be able to imagine, what it was like before the destructor began its changing influence; they will see how altered it is now, hygienically and usefully, how much remains to be done before it can be pleasing to the eye; and they will also be able to indulge in forming a mental picture of the ultimate appearance of the valley. In respect of the latter mental activity it is hoped that the question of further development may form one basis for discussion of this paper, and that some good ideas may emerge.

DISCUSSION OF PAPERS.

The President said they had before them two very excellent papers, written by members of Mr. Bell's staff, and to him personally it was a source of very great gratification to find that their younger members were coming forward to supply papers. It was a very healthy sign of their institution, and he hoped it would be felt even more in the future. They wanted the younger members to come forward and give them papers, and if all the papers were as concise and good as those presented to that meeting they would be very fortunate.

Mr. G. Bell (Swansea), in opening the discussion, remarked that the information given in the paper by Mr. G. H. Bell would be very useful for reference at any time the members of the institution had similar problems to deal with. He wished, however, to sup-

plement the paper by the analyses of the Swansea destructor clinker made by the borough analyst in September, 1909. The figures were as follows: Moisture 4·50 per cent, alkalies 1·90 per cent, magnesia 1·50 per cent, organic and volatile matter 3·50 per cent, silica 51·60 per cent, alumina and ferric oxide 31·20 per cent, and carbonate of lime 10·30 per cent. The effect of the clinker having such a large proportion of carbonate of lime was that it made it very nearly as good as hydraulic lime, and altogether the analyses compared favourably with puzzolana, a natural product, which might be called a natural cement. The acid flowing through the Burlais Brook was mainly sulphuric acid from the washing of tin plates from the works above. He had been rather concerned as to the action of that acid on the concrete, but he took the precaution of putting in blue bricks, which had withstood both the acid and the scour of the water in the culvert. With a gradient of 1 in 45, the velocity in the culvert worked out at 10 ft. per second. That was very high, but they were fortunate in that the water did not run deeper than 9 in., so that the volume was not very large; but he knew from observations which he had made that the blue bricks had not scoured at all. The reason for making the culvert so large—namely, 6 ft. by 6 ft.—was the desire to facilitate access to it. When they were spreading the clinker over the new culvert they broke it up and rammed it, and it was periodically flooded with water brought down by a 10-in. pipe, continued as the filling went on, and that had made the clinker quite hard and perfectly safe to build on. The steam supply from the destructor boiler had been as much as 1,800 units for working the tramway fourteen hours, from 8 in the morning until 10 o'clock at night. The tramway was 4 miles in length, and although it was not working at all times, the power was always there when required, yet the department did not pay anything for this current as they should do. The generating set worked up to an average of about 200-horse power.

Mr. W. HARPUR (Cardiff) proposed a hearty vote of thanks to Mr. Swarbrick and Mr. G. H. Bell for their very excellent papers. They were not, to his mind, papers which lent themselves to very much criticism. They were descriptive papers, describing work which had been done, and not controversial. There was in Mr. Swarbrick's paper the question of the cross sleepers under the tramway track. He noticed there was a depth of concrete varying from 6 in. to 9 in. If he had 6 in. under the rail level it would leave only 1½ in. of concrete under the sleepers. To have only 1½ in. of cement under some of the sleepers seemed very little. In laying the tramway track with timber sleepers, Mr. Swarbrick had attempted, and he believed he considered he had largely succeeded, in obtaining a more or less resilient tramway track. That was a kind of track which was very greatly needed. If they could have a track of that description it was going to be a success. The resiliency, he believed, would lead to a reduction, if not the entire elimination, of the trouble they had in some tramway tracks of corrugation of rails. He did not know whether any appearance of corrugation had shown itself on any portion of this tramway track. With regard to Mr. Bell's paper, he was sorry that time would not permit of their going up to Town Hill. He was sure the members of the institution who came from districts other than South Wales did not know the difficulties of town planning in very hilly districts, and they would have been very much interested in the scheme. He had seen the district, and he could assure them it was a district which was a very difficult one to decently plan. The plan would be extremely valuable to members of their institution, particularly in South Wales, where the town planning problems were very serious and difficult—owing to the hills and narrow valleys. With regard to the destructor scheme, and the culverting in connection with it, it had proved a very great success. One could only imagine, and particularly from what was said in the paper, the filthy condition in which that brook must have been before it was culverted. He knew whenever they got a built-on area next to a brook, unless very great care was taken in preventing it, the brook became the receptacle of all the filth that could be poured into it. He understood that was the case with this particular brook, and he could imagine what it was like. He took it that a portion of the ground was to be laid out as a public park, recreation ground, or garden. He hoped that might be carried out, because he was certain in a district with a population of that kind, which appeared from what one could see to be a very careless set of people, if they could lay out an open space or garden where the children could go and play, it kept them off the streets, and was very instructive to them, and led them to think; beside that, he believed that parks and gardens in squalid districts made the people more careful in the upkeep of their own homes.

Mr. D. M. JENKINS (Neath) seconded the vote of thanks to the writers of the papers. He attended the meeting of the institution in Swansea in 1905; but although he lived not far away, and frequently visited the town, he had not had an opportunity until that day of seeing the recent progress at the Pentre Valley. All the members who saw the place in 1905 would agree that very effective work had been done, or would be done when the development scheme was complete. It was a very striking testimony to the enterprise of the corporation, as well as to the skill and foresight of Mr. Bell. Mr. Harpur had touched upon some aspects of that question which would commend themselves generally to the members. There was one remark in Mr. Bell's paper with which he fully agreed, that was that the housing problem in South Wales was one of the greatest moment. It was exercising the mind and attention of local authorities, large and small, all over the country. In old towns like Swansea the housing problem was accentuated by the necessity of demolishing old houses, and they had to provide dwellings for people who were displaced by demolition schemes. No one could realise the seriousness of that problem until they came into close touch with it. In the neighbouring town of Neath the housing problem had been in a most acute stage for some time. Since 1903 they had been constantly occupied with it. They had erected a large number of houses, and were now engaged on a scheme for the erection of ninety-three houses, to be let at rentals of from 4s. 6d. to 5s. 3d. per week. He was afraid when that scheme was completed they would have to enlarge their programme. In working out a scheme of that kind they had to provide for the lower paid labourers—that was the great difficulty in dealing with the problem. They had had to exercise the greatest economy, and it was a question of what was desirable on the one hand and practical on the other. That was the difficulty which people who went about visiting these houses in an academic way did not appreciate. He thought the opportunities they had had that day of seeing the work done by the Swansea Corporation should be a great advantage to them in their further efforts. The references in Mr. Swarbrick's paper to the Town Hill estate had been very interesting. Those of them who attended the South Wales Cottage Exhibition in Swansea, about three years ago, were very much struck by the excellent lay-out of the estate dealt with and by the potentialities of the whole district. He knew Mr. Bell was very much occupied by the best means of transit between the estate and the town, and it was very interesting to know that a comprehensive scheme of tramways to serve this area was likely to become an accomplished fact. He thought the corporation had been well advised to acquire at a very high price—some people would call it a fancy price—the extra land. A better site could not be found anywhere. A great deal of attention had been given to the planning of this section, and they had plans for this section which would be of the very greatest value. Mr. Bell had devoted a good deal of thought to this subject of town planning, and the Swansea Corporation was to be congratulated in having the benefit of his experience. They had also been well advised in securing the services of Mr. Raymond Unwin, one of the most brilliant exponents of town planning in the country.

Mr. JOHN MORGAN (Pontardawe) said that one thing not thoroughly considered in connection with housing was the general neglect to provide accommodation for small families. He had failed to get his own council's co-operation on that point; his idea was to provide for both large and small families. The council wanted to build houses for "respectable" people, but the object of the Act was not to do that, but to provide for those turned out of houses which had to be demolished. They had fifty houses condemned, and the families occupying these would be turned out as soon as the twenty-eight houses they were erecting were completed, so that he took it they would have to go on building for the next two or three years at all events.

Mr. H. C. PORTSMOUTH (Swansea) stated that in

the Cwm-road scheme there were twenty-five houses of Class A. with a living room, scullery, and one bedroom, and twenty-five of Class B, with a living room, scullery, and two bedrooms. The first cost £110 each, and were let at 4s. per week, and the second type cost £145, and he believed they were let at 5s. per week. He had been rather struck with the remarks of Mr. Morgan as to small houses. A lot of people complained that they were too small; what they wanted was a house to accommodate a man and his family. But he thought that was wrong, because there had been ten times more applications for these houses than they could deal with. But speculating builders wanted to build houses of five or six rooms, and would not erect this small type of dwelling, which were quite suitable for widows or a man and his wife without family, and he thought the houses really met a demand. With regard to the cost, the A type of houses worked out at 5d. per cubic foot, and the B type at 4½d.; so that the smaller houses were rather more expensive in the matter of construction than the larger ones. As regarded the foundations, he knew that Mr. Bell took great care with these. He (the speaker) put a concrete raft 12 in. thick over the whole of the site, and there had been no trace of any settlement, so far as he had seen. The precaution he had mentioned was one which he considered ought to be taken on a site of that kind. His belief was that the houses would be successful, and would lead to the erection of houses of a similar type elsewhere.

Dr. EVANS (medical officer of health, Swansea) said that every time he had been in the Cwm-road district he had felt that houses should never have been erected there at all, and that the Burlais Brook could have been cleansed. The tramways were most important, because they were so closely connected with the question of housing. They were one means of dealing with the problem, and instead of houses being built in Cwm-road the lines should have been run right out of the town to a part where there was plenty of land. (The mayor: "And landlords.") His opinion was that it would pay to run cheap tramways and even to lose on them, as occurred in connection with the public roads.

Mr. F. READ (Rhondda) said most of them had looked into the question of these cheap houses, and all who had spoken had found it was impossible to let the houses to cover expenses for anything like 4s. a week. In Swansea they seemed to have achieved the impossible, and he for one would like to know how it was done. Take a house costing £135, and let at 4s. per week.

Mr. PORTSMOUTH: I think you are wrong; the smaller houses are £110, and the larger houses £145.

Mr. READ: I am speaking from the printed paper before me. The class A, consisting of one living-room, scullery and one bedroom, cost £135. Taking it at twenty houses to the acre, and allowing £800 per acre for the land and £10 for the road, the charge on each house for principal and interest would be £8 6s. per annum; repairs, £2; insurance, 3s.; rates, £2 8s.; and, allowing nothing for establishment charges, there was an annual expense of £12 17s., and a gross income of £10 8s.—a loss of £2 9s. per annum on each house. He noticed in the building of these houses the clinker was charged at 2s. 6d. per ton. Was the clinker broken up? He did not know how Mr. Bell had the conscience to charge 2s. 6d. per ton.

Mr. G. BELL: It was broken and screened.

Mr. READ remarked that the enterprise of speculative builders did not keep pace with the demand for this class of house, but if each house involved a loss of £2 9s. a year, the pace was much too hot for the local builder.

Alderman JENKINS (Swansea), referring to Mr. Jenkins' remarks as to the high cost of land at Town Hill, said it worked out at £140 per acre. They bought 130 acres at that price. They had already a large estate of 600 acres there, capable of being developed. If they worked that out on Mr. Raymond Unwin's scheme, and assuming that the development of the whole area took thirty years, they would be able to let the land at £2 8s. per house, which included roads and sewers. If they averaged that for the whole area, and developed it in thirty years, it was equal to £200 per acre on the whole of the land on the Town Hill estate. So he did not think they could say the cost of the land was excessive.

Mr. A. J. OBORN (Burry Port), speaking with regard to the smaller type of houses which had been described as suited to the requirements of a man and his wife without family, inquired what would be the attitude of the council under sec. 15 of the Housing and Town Planning Act should "encumbrances" eventually make their appearance?

Mr. D. H. PRICE (Bedwellty) said that his authority took the view that the average collier requires an extra living-room in which to change his clothes on returning from work, and had embodied that idea in thirty out of sixty houses which they had erected at a cost of nearly £200 each.

The MAYOR (Mr. D. Williams), in the course of some observations, insisted that it was the duty of the municipality to provide housing for the people, whether in competition or not with private enterprise.

The PRESIDENT (Mr. R. J. Thomas) congratulated the borough on the activity they had shown in taking the housing question in hand, and all credit was due both to the council and to their surveyor for the way in which they had tackled it. It was obvious that the council was doing its duty to the community it represented, and that all they had undertaken was good, sound, honest work which would last for many years, and always redound to their credit. It was clear from what they had seen and heard that day that the same rules could not be applied in dealing with varying local conditions. In the matter of the cottages described to them that day, for example, he had been surprised to find they had gone to the extravagance, as it might be called, of putting in hollow walls. In the Home Counties they were compelled to build these solid. The whole matter was a credit to the corporation, who had ventured to provide for those who could not provide for themselves. It should not be a question whether a scheme should pay, but rather the increased health and prosperity of the people, and surely that was one of the objects of the Housing and Town Planning Act. With reference to the tramways, it seemed to him that these were very well laid, and he observed that their engineer was in favour of a resilient track. They had had a discussion in London recently on the subject of corrugation, and it was remarkable to find among the variety of opinions expressed how many were favourable to a resilient track as against a solid one as a means of preventing corrugation. It appeared that they had a scheme for extending the lines up to the higher portions of the town, but the gradient of 1 in 8 was a matter which would require very careful consideration. It seemed to be a very steep one for the overhead system; but they had no doubt had advice on the question, and he hoped it would prove perfectly satisfactory and secure.

Mr. R. H. WYRILL (Swansea) said that Mr. Bell had expressed some doubt as to erosive action on the culvert at Pentre Valley with a gradient of 1 in 8. He could assure him from his own personal knowledge that they need not be afraid of that action. Culverts were in existence lined with concrete, and not blue bricks as in this culvert, that were standing twice that velocity absolutely successfully. They had some of their culverts at Cray reservoir at a gradient of 1 in 10 which gave a velocity of 400 against 161 gallons, and these were actually sound after long working, although they were scoured by water from the mountains which brought down a large amount of gravel and stone. If they stood that with rough concrete of 6 to 1 they need not have any fear of their blue bricks standing a velocity of 10 ft. per second. They might be satisfied that was a permanent job. As to the question of rails and jointing of rails on the trams, that was more a question of practical engineering. It required little observation to see if there was any deflection on the end of the rail. They had a fishplate 24 in. long, 10 in. wide, and ⅝ in. thick. That might be right, but in his opinion it required to be supported properly by concrete. Mr. Swarbrick did not appear to have mentioned the thickness of the concrete and the support of the fishplate. He thought they would find if this was very thin they would have deflection of the rail ends, which would cause a certain amount of undulation in the tramcars, ultimately to the destruction of the track. The reason he mentioned it was that, in consequence of having to sink down through the concrete to water mains, he found there was a portion of the concrete which was absolutely knocked out of form, and if that was so it gave one the idea that it might be a source of weakness. It was a point which required to be considered seriously in the future. Another point

concerned the houses which they had seen that day was the building of the houses with hollow walls. It had been stated that it was extravagant that they should in that district build with a hollow wall. That was what they had to do to apply themselves to the conditions which they had to meet. The hollow wall might not be necessary with a climate of 20 in. of rainfall; there on the coast they had 45 in. of rainfall, and the hollow wall was necessary. The hollow wall was sufficient up to 70 in. of rainfall, and above that they had to adopt extra precautions. In the district of Cray they had a rainfall varying from 80 in. to 110 in. The caretakers' cottages were in a most exposed condition. The rain did not fall horizontally, but vertically, because it was always blowing, and the rain was always searching for a crack to get in. There they had first to saturate the wall with a coating of boiled oil brushed in with a thick brush; but they had one case where that was not sufficient, and they had to grout it with a solution of Portland cement. Where they had extreme conditions they must adopt measures so that the hollow wall in the rainfall of 45 in. was absolutely necessary. With regard to the Town Hill scheme it was proposed to deal with that as a complete town plan. He believed, according to the arrangements, there was provision for 7,000 population on the site south of the Town Hill. There would be accommodation for 10,000 people on the other side of the hill. Taking the normal increase of the population of Swansea that would fill up in a very short time. The population was beginning to overflow Swansea in every direction. The housing problem had become so serious there partly because of the proscribed area and partly because of the abnormal prosperity of the district.

Mr. DAVID JAMES, tramways manager, stated that under the new agreement the number of workmen carried on the company's lines had increased during the past twelve months from about 40,000 to 130,000 a month.

Mr. B. GRIFFIN (Swansea) expressed himself as being very much in favour of the resilient road bed for tramways, the rigid bed being, in his opinion, one of the causes of tracks shattering themselves.

The vote of thanks having been accorded,

Mr. G. SWARBRICK, in reply, expressed his acknowledgment for the cordial vote of thanks accorded to him for the paper. Mr. Harpur had raised a question as to the thickness of the concrete under the sleepers. The paper stated that the thickness varied from 6 in. to 9 in. The 9 in. were laid where the sleepers were —that meant they had a 4½-in. sleeper with 4½ in. of concrete underneath it. Then Mr. Harpur mentioned the question of rail corrugation. He had noticed that there was slight corrugation on the flat curve about High-street station. It appeared to be a general experience that the greatest corrugation was on the flat curve. At a meeting of the institution held in December, as referred to by the president, a paper was read by Mr. H. T. Wakelam on "Rail Corrugation." He stated that the replies received made it clear that corrugations were not caused by resilient tracks, and in this he was supported by Mr. Harpur, who stated "that he rather fancied the rigid bed had a good deal to do with corrugation. Naturally, if they had got two hard substances, one hammering upon the other, it had a bad effect upon the rails, and more or less upon the wheels also. Mr. Harpur agreed with Mr. Wakelam that a certain amount of resiliency with stability was just the thing that was wanted, but the difficulty was how were they going to get that on the ordinary road? If they had a resilient tram track they must pull their paving to pieces—their paving must go with it or it was impossible to have a resilient track. Now he thought, after seeing the track and paving in High-street, which was laid four years ago and subjected to very heavy traffic, the members would agree that the paving had not been affected by the laying down of a resilient track. If they had not got the ideal track it was a step in the right direction. There were several reasons for advocating a resilient track in preference to a rigid one. Every car of the weight of an electric car—and some of them in Swansea weighed 12 tons—set up a wave of vibration (as was generally admitted) when moving at any speed, owing to the inequalities of the surface caused by mechanism slightly, and dirt on the track. This wave of vibration travelled along the rail in front of the car, and reaching the joint, if the joint was light, shook and tended to loosen it, the joint being the weakest part of the rail; or, if the joint was loose, the car hammered the loose joint and set up another wave both forward and backward of the car. Again, if the joint was absolutely rigid, with anchors in a perfect mass of concrete, it would be found that there was no room for expansion of the rail at all, and the middle of the rail would move either horizontally or vertically. Also, where there was vibration it would be perfectly clear that a substance like steel would not be perfectly quiet on a substance like concrete, and it only took time for the paving under the rail to crack as well as the paving adjoining the rail. Then the water got down and the rail became a sort of grinding wheel on the concrete with water and sand between the rail and concrete, so that it was practically impossible to try and get that rail tight again without stopping the traffic and packing. Now, with regard to a resilient or sleepered track, the vibration wave was at once deadened owing to the resilience of the wood. The sleepers, being buried in and carefully packed with concrete, formed a cushion which carried the rail. The size of the sleeper was big enough to absorb all vibration set up in the rail, and instead of that vibration being felt a long distance away from the approaching car it was absorbed by two or three sleepers, the resilience of which, however, was not sufficiently elastic to allow either the verging or the adjoining paving being broken, owing to the fact that any vibratory blow was deadened in the first instance owing to the presence of wood. Again, at the points it was essential to obtain as much strength as possible—in fact, to make the joint as strong as the rail—but care must be taken in the design of this joint that it should not be too rigid and arrest the vibratory wave; but it should be as strong as the rail, and also be resilient enough to allow the sleepers, which were placed directly under the sole plate, and 2 ft. 6 in. either side of the joint, to at once absorb the vibration. The difference of arresting the vibration and absorbing the vibration was this: If a vibratory wave flowing along came to a perfectly rigid joint it was arrested and thrown backwards along the rail as when a ripple of water struck a vertical wall, and then rebound or break back again from the wall. In absorbing the vibration there must be a resilient substance hard enough not to allow the rail to move, yet resilient enough to allow the vibration to be absorbed either totally or to a great extent in its cubical contents. Thus, a small piece of wood or thin sleeper was useless, and the larger the sleeper the better, only for all commercial purposes 8 ft. by 9 in. by 4½ in. was large enough.

Mr. G. H. BELL thanked the members for the reception given to his paper. The remark of Mr. Harpur that the papers were not controversial relieved his mind very much. He was pleased that the papers had provoked so good a discussion.

INSPECTION OF SIDCUP-ELTHAM TRIAL ROAD SECTIONS.

A most successful meeting of the South-Eastern District of the Institution of Municipal and County Engineers was held at Sidcup on Wednesday, the 8th inst., when over forty members were present, including Messrs. H. W. Bowen (West Sussex), J. W. Bunting (Maidstone), J. H. Brierley (Richmond), H. W. Barker (London, W.), W. Laurence Bradley (Tonbridge), E. R. Capon (Epsom), W. W. Cooper (Slough), R. Chart, jnr. (Croydon), W. A. Clegg (Dorking), T. Clayton (Reigate), G. F. Carter (Croydon), A. Dryland (Surrey County), S. R. Drake (Leatherhead), A. G. Gibbs (Midhurst), W. H. Grieves (Sutton), F. T. Grant (Gravesend), F. Grove (Kingston), F. Harris (Tonbridge), W. T. Howse (Bexley), G. Jerram (Merton), H. W. Longdin (Penge), H. P. Maybury (Kent County), J. Marshall (Malling), E. F. Morgan (Croydon), C. G. Mason (Guildford), A. E. Nichols (Folkestone), J. H. Norrish (Godalming), F. R. Phipps (Basingstoke), A. E. Prescott (Eastbourne), W. Phillips (Horsham), F. Roberts (Worthing, hon. district secretary), J. L. Redfern (Gillingham), C. Chambers Smith (Westminster), T. E. Tiffin (Dartford), F. Wilkinson (Wimbledon) and G. M. Seels (New Malden).

The members assembled at New Eltham Station, and inspected the whole of the trial sections of road between there and Sidcup. Mr. H. P. Maybury, the county surveyor of Kent, explained the method of construction of each section, and pointed out the special features of the various materials laid down.

On arriving at Sidcup the party adjourned to the Black Horse Hotel, where a meeting was held, and an interesting discussion on the trials took place, Mr.

Maybury giving further particulars as to cost and maintenance of the various sections as follows:—

Summary Showing Cost of Repairs on Road Board Trials, Sidcup, up to December 31st, 1912.

No. of section	Cost of construction	Cost of reconstruction.	Cost of scavenging	Cost of repairs.	Total expenditure.
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
1	103 16 4	101 0 0	7 17 4	19 0 8	231 14 4
2	96 12 9½	75 17 1½	8 4 4	9 0 2	189 14 5
3	155 7 4	—	7 17 4	19 9 7	182 14 3
4	199 19 3	—	7 17 4	18 19 2	226 15 9
5	306 3 0	—	7 17 4	—	314 0 4
6	145 7 0	—	7 17 4	8 6 6	161 10 10
7	81 16 0	—	7 17 4	29 11 4½	119 4 8½
8	110 16 0	-	7 17 4	92 6 10	211 0 2
9	144 6 10	—	7 17 4	19 19 11	172 4 1
10	158 18 0	—	7 17 4	6 1 0	172 16 4
11	157 19 6	—	7 17 4	6 6 6	172 3 4
12	158 8 0	147 13 6	7 17 4	15 2 0	329 0 10
13	106 1 0	—	7 17 4	47 3 4	161 1 8
14	162 18 6	-	7 17 4	12 10 8	183 6 6
15	144 18 0	—	7 17 4	7 0 8	159 16 0
16	156 2 0	-	7 17 4	15 3 0	179 2 4
17	376 0 3	-	7 17 4	90 9 8	474 7 3
18	232 13 0	—	7 17 4	59 19 3	300 9 7
19	239 14 0	—	7 17 4	9 12 6	257 3 10
20	196 4 0	—	7 17 4	1 19 0	206 0 4
21	220 12 6	—	7 17 4	371 7 1	608 16 11
22	165 3 0	—	7 17 4	2 4 8	175 5 0
23	299 12 6	—	7 17 4	—	307 9 10
	4,128 8 9½	324 10 7½	181 5 8	861 13 6½	5,495 18 7½

After the meeting the members were entertained to tea by Mr. Maybury, who was duly thanked for his hospitality.

In the evening about twenty-five members sat down to dinner at Frascati's Restaurant, Oxford-street.

The chairman of the South-Eastern District (Mr. Arthur Dryland) presided, with the president of the institution (Mr. R. J. Thomas) and the secretary (Mr. Thomas Cole).

After the loyal toast, songs and recitations were given by the following: Messrs. R. J. Thomas, A. E. Prescott, G. F. Carter, F. Harris and F. Roberts.

Mr. Grieves very ably presided at the piano.

MOTOR VACUUM ROAD CLEANSING.

MANCHESTER DEMONSTRATIONS.

A series of working demonstrations of the motor vacuum road cleansing machine which Messrs. J. & P. Hill, Ordnance Works, Sheffield, have recently introduced, are being given this week in Manchester. The machine was seen in operation in a number of streets of that city on Wednesday and yesterday, and the arrangements for to-day—when the demonstrations will be completed—provide for two extensive runs, commencing in each case from St. Peter's-square, at eleven and three o'clock respectively.

Scarborough Spa Improvements.—The work of widening the Scarborough Spa promenade seaward has been started, and is proceeding night and day as the tide permits. The contract was secured by Mr. A. Moore, of Scarborough, who expects to complete it by the end of May. The length of the widening will be 207 ft., and the width at the broadest part 40 ft. The sea wall will be of stone similar to that of the existing wall. Tenders have also been invited for the erection of a café. In all £8,000 will be expended on the improvements.

Heavy Crops from Sludge.—At a recent meeting of the West Kent Main Sewerage Board the secretary, Mr. Henry F. Prater, reported that the corn grown on the board's farm had been delivered to Messrs. Cannon & Gaze, Limited, in accordance with the tender accepted at the board's last meeting, and a cheque had been received for the sum of £317 in discharge of the account. The secretary further reported that the public sale of the remainder of the crop was held on December 4th last, when all the lots were sold, realising a gross sum of £412. The committee considered the result of the sale very satisfactory, and recommended that the attention of the farmers and others should be called to the very good results obtained from the crops grown on the board's land, manured only with the sludge from the works. The sludge can be obtained free on application to the outfall works, Long Reach, Dartford.

THE HOT PANEL AND HOT FLOOR BORDER SYSTEM OF HEATING.

At a recent meeting of the Junior Institution of Engineers, Captain H. Riall Sankey, R.E., M.INST.C.E., gave the Hon. Members' Lecture, taking for his subject "Hot Panel and Hot Floor Border System of Heating."

The dominant feature of the new method, he explained, is the use of radiant heat rather than the heating of the air. The fact was often lost sight of that the object of heating a building or room was to make people comfortable; hence, it was usual to specify that the heating power and heating surface should be sufficient to maintain the temperature of the air 5 ft. from the floor at a specified temperature of, say, 63 deg. Fahr. The result had been that most of the systems hitherto adopted had been devised so as to heat the air, and radiant heat had been, to a large extent, neglected.

It was generally conceded that for comfort, when sitting in a room without a fire, an air temperature of about 63 deg. Fahr. was needed, and in order to obtain this temperature the surfaces of ordinary radiators required to be at the fairly high temperature of, say, 150 deg. to 180 deg. Fahr. This temperature, however, decomposed the dust in the air, thus producing a disagreeable and characteristic smell. When radiant heat from a fire was available, the air temperature could be as low as 55 deg. Fahr., or even 50 deg. Fahr., and yet the sense of comfort and warmth was greater than in the previous case. To maintain the temperature at 50 deg. or 55 deg. a hot-water system of heating would, however, be required in many cases. Such a system, although ideal, was more costly. The hot panel and hot floor system did not unduly heat the air, as it supplied the radiant heat needed for comfort.

A hot panel, Captain Sankey explained, consisted essentially of a small pipe bent backwards and forwards and embedded in a semi-conducting composition; ½-in. drawn, lay-welded steam pipe was used. The heat-carrying medium—say, hot water—circulated in the tube, and the heat was conducted through the walls of the tube to the composition, through which it spread to the surface of the panel, whence it was radiated into the room; in effect, heat at a comparative high temperature issuing from a small surface was converted into the same amount of heat at a lower temperature issuing from a large surface. A hot panel might contain more than one length of tube in order that the flow in each length might be controlled by external valves. A hot panel could be made up in an iron frame, thus forming a detached unit similar to the ordinary radiator, or it might be built up against a wall very nearly in the thickness of the plaster. Hot borders were formed by placing drawn, lay-welded ½-in. pipes about 1 in. below the level of the floor, close to the walls, around the whole or part of a room, and embedding these pipes in semi-conducting composition. A hot border of any width desired—say from 6 in. to 18 in.—could thus be formed. Similar pipes could also be embedded along the cornices of a room. The semi-conducting composition had to be chosen with great care to obviate cracks which would otherwise be produced by the expansion and contraction of hot pipes. The various advantages of the new system were treated mathematically, and a number of illustrations were given.

At the conclusion of the lecture a hearty vote of thanks was passed to the lecturer, who afterwards replied to a number of questions.

Spraying Street Trees.—In the district of Columbia (says *Engineering and Contracting*) two high-power spraying machines are used for destroying leaf-eating insects on street trees. The machines cost about £300 each, and are successfully used on a total of 18,532 trees in a year.

Proposed Improvements at Bournemouth.—The town council propose to spend about £11,000 on improvements on the sea-front in connection with the Undercliff drive extension works. It is intended to link up the Undercliff drive by a bridge with an East Overcliff drive at Boscombe. The Parks Committee also propose to introduce in the retaining walls and embankments of the drive an extensive system of rock gardens, similar to the scheme at the western end of the drive near the shelters, and at the zigzag path on the East Cliff.

Office Conversations.

MORE OR LESS IMAGINARY.

[*Contributed.*]

I.—Non-feasance and Misfeasance.

Ah, good morning, Mr. Smith. Everything all right? Good—eh, what? The footway paving in Dennison-square cracked all to pieces? But, surely—— You warned me about it? Well, really, when I come to think of it, I believe you did; but you needn't rub it in with quite such brutal plainness. We're all liable to error of judgment, miscalculation and all that sort of thing, and it's easy enough to be clever afterwards. The dangerous man, to my mind, is the one who's too clever before. You must remember that I've never seen the job yet. Better to have left it to you then? Well, you've got me there, Mr. Deputy; but that won't remedy matters. The question we have to decide is what's to be done now. Break it up? Heavens, man, and be the laughing stock of the town! Make open confession to every idiot on the Ratepayers' Defence! Publish the fact that you—well, *we*, if you like it better—have had a momentary attack of incompetence! Why, they'll judge us by it for ever—it'll hang to us till our dying day—every job we take in hand 'll be accompanied by an admonishment not to do it as we did the Dennison-square paving! No, that certainly won't do, Mr. Deputy. The paving must stop at all hazards.

* * * *

It'll crack worse and worse—and still worse? Of course it will, and we must keep on making good the cracks. You'll have to get a good man—let me see, how about Watson? Think he'll do? Well, get Watson then, he's reliable, and tell him to run 'em in as they appear, only it must be done early in the morning, first thing, before the members of the Ratepayers' Association are up. And remember, no more *in situ* on such treacherous ground. More concrete? Not the least little bit of use. Eighteen inches would give if the ground's as bad as you describe it. Slabs? Yes, we'll stick to slabs in the future. No matter how they go, they're easily picked up and relaid. By-the-bye, Watson might cut out one or two of the worst bits and lay slabs. Pack 'em well up on a bed of fine clinker—it'll be quite enough. Ah, I'm with you there. If Dennison-square had been done with slabs in the first place, we wouldn't have had all this trouble; but what's the use of talking of that now? Look ahead, Mr. Smith, that's what we've got to do. Successes are built for the most part on past failures. Heaven help the man who's had no failures! Most probably he's a liar, and if he isn't, well, he's got some big troubles ahead.

* * * *

Now, let's forget Dennison-square for the present. Yes, yes, quite so—the job if done with slabs wouldn't have cost more altogether than the foundation alone cost. Stick to slabs in the future? Certainly. The Thirlman estate? Ah, that was a good job; with only a few inches of clinkers, too. As good now as when it was laid, in spite of new connections to every house. Yes, in future always specify slabs. Which slabs? Now really, Mr. Smith, you ought to know better. What make? Haven't you learned yet that it's no part of a surveyor's duty to specify certain makes? He may have his own opinion and stick to it, and get his own way in the end; but he must never express himself too definitely in writing. Why, there'd be a charge of bribery and corruption before the ink was dry on the paper! No, no, none of that for me! Use your intelligence, Mr. Smith, in making things as unintelligible as possible, and you'll save half the rubs of official life. If you ask me which is the best slab, I can tell you; but I won't commit myself to a written statement. Which is the best slab, you ask. Well—here, whisper in your ear——

* * * *

Yes, that's all this morning—oh, you might send Wilson in as you go along. It's about time I had another little conversation with the young man. Come in! Now look here, my boy, things have arrived at a serious pass. There's a vulgar commercial aphorism—I hate 'em all, but they're effective at times—to the effect that if a man can't get on he'd better get out. Now that just about sizes up your case, Wilson. You do your best? Possibly—I'll give you the benefit of the doubt—but that won't ease my conscience. I've had a round sum to make an engineer of you, and as an honest man I've either got to make an engineer of you or return the round sum—less, of course, a proportionate reduction for the five months you've been fooling around in general. Frankly, I don't like pupils—at the best of times they're more trouble than they're worth, and when they'll neither work nor study they're the very—— No, you needn't grin, my boy, I wasn't going to commit myself!

* * * *

The fact of the matter is, Wilson, that you're what is known as a cheerful idiot. You've the ability and the intelligence and yet you're content to let a fellow like Sparks knock spots off you. You've a natural aptitude for draughtsmanship, clean lines, well-defined printing, no sloppy architectural taint—— Oh yes, you needn't look surprised; I can praise as well as blame. I've watched you at work—yes, at work, I repeat it, for you do work sometimes—and I say you've natural aptitude, and yet you prefer to hatch up any excuse to loaf your time away. Malingering! The very word makes my blood boil. It's one of the most contemptible of things, and—— Eh? You were ill—really ill? Nonsense. Your back was bad and your head ached? With leaning over the board all day? I repeat—nonsense! What you were after was to get outdoors, so as to be able to crawl into the "Railway" and play snooker pool for the rest of the afternoon. How do I know? My boy—my poor innocent boy—I was a pupil myself once!! Now, look here, once and for all there must be an end to this kind of thing. I'm going to make you a sporting offer. You see those packages there? Well, they contain one of the latest drawing tables, and the table's for you. You'll be able to stand at the board in any position you like now—in fact, you could almost stand on your head at it. Upright 'll be your mark, I take it, and then we'll have no more headaches or backaches, I hope, or—— You'll do your best? That's right—that's what I like to hear. I withdraw any threat I was about to make. It's a matter of honour now, isn't it? That's settled then, and——

* * * *

Hullo, there! Yes? Oh, send him up, only for heaven's sake tell him I'm up to my neck in it. Another confounded ratepayer on the grumble—that's about the seventeenth this week. You can go now, Wilson, and remember our compact. Mr. Gurney? Take a seat, please. Mr. Gurney-Gurney? I beg your pardon, but I really didn't notice the hyphen on your card. Well, and what can I do for you, Mr.—ah—Gurney-Gurney? Dear me, that's very sad! Tripped over the cover—twisted your ankle—bruised your leg—tore your trousers—smashed your hat—cut your thumb? And minor contusions? Really, I'm extremely sorry; but—— Cover six inches above the surrounding surface of the road? No, no, not quite that, surely. Four inches, perhaps, or three, or—two. What are we going to do? Well, frankly, we can do nothing—absolutely nothing. Our liability? My dear sir, we haven't any. Now please be calm and—no, no, it's no use talking like that—you must really control yourself. Hard to do in the circumstances? Very hard, very hard indeed; but if you'll allow me to say so you're not doing it or attempting to do it. Now——

* * * *

That's better. If you'll sit quiet and listen I'll endeavour to explain the situation. It's this way. When the manholes were built in that road the covers were laid flush with the surrounding surface. They're not so now? That I've allowed already. Really, if you won't interrupt we shall get on much better. The road has since worn away, and the covers are consequently slightly—yes, slightly—say an inch or an inch and a-half—no I won't allow even two inches—the covers, I repeat, are now slightly above it. You can hold what opinion you please, and I must reserve the right to hold mine. After all, an inch more or less doesn't alter the case. No, not in the least—well, say six inches, it's all the same in the end seeing that we're speaking between four walls. And anyway, we've no liability. Omission and com-

mission—precisely. In the one case we're liable, in the other we aren't. Yes, I do mean to say it, and I repeat it. Had the covers been put in above the surface of the road, it would have been different. Our act is one of omission only, and if you bring forty actions and carry them all through the House of Lords to the Throne itself you'll lose every one of them. Hard? Of course it is, as I said before; but life's full of hard things, and we all have to take our share. You've had a little more than yours? I don't deny it.

* * * *

Perhaps it'll ease your feelings if I tell you that we've entirely discarded the old pattern of cover, and are using one which will entirely obviate further accidents, and—— No comfort to you now? It won't heal your ankle or restore the skin to your leg? Or even buy you a new hat? Or a new pair of trousers? Well, no; but still, there are other ratepayers, and they at least—— Hang the other ratepayers? Well, it's not for me to back up such sentiments, although, between ourselves—— I shall hear further about the matter? Yes, I'm afraid I shall, and plenty more about it, too. I can only express my regret, Mr. Gurney—ah—Gurney, and if you'll take my advice—— Oh, very well, if you prefer to take your solicitor's, that's another matter; only remember——

CITY OF CHICAGO PUBLIC WORKS DEPARTMENT.

THIRTY-SIXTH ANNUAL REPORT.

This volume, which is for the year ended December 31, 1911, relates to both sides of public works matters, technical and financial, and contains a large amount of useful information as to the manner in which various municipal engineering problems are dealt with in Chicago. It opens with the commissioner's report, which forms a kind of summary of a few of the leading matters referred to in the reports which follow it. These include that of the city engineer, Mr. John Ericson, which occupies about half the volume; reports by the superintendents of sewers, water, streets and "compensation" respectively, and a short formal report by the city architect, the remainder of the space being occupied by the report of the head accountant.

WATER SUPPLY.

The estimates of the amounts of water consumed daily in various ways are noteworthy, for only 10 gallons are set down to public use, 40 gallons being estimated as the loss through defective plumbing and 56 gallons through wilful waste and underground leakage. That the proportion of water actually used is very small is clearly indicated by the fact that the surveys conducted by the water department showed that in many districts the consumption of water during the night was nearly as great as that during the day. In very cold weather a part of the loss is that due to taps being left running in order to prevent the freezing of pipes. It is estimated that the introduction of metering would lead to a reduction of 75 gallons per head from the present 190 gallons to the less unreasonable but still enormous figure of 115 gallons. At present about 6 per cent of the services are metered.

BRIDGES.

The commissioner reports very unfavourably on the condition of the city bridges. One bridge was removed by order of the Federal authorities, an interesting item of administrative procedure in view of the remarks which were recently made by our contemporary *Engineering News* with regard to our criticisms of the administrative position in relation to New York's water supply. That a number of other bridges were condemned is not surprising in view of the very rapid growth of the city, and the reluctance of the authorities to replace unsatisfactory bridges without giving careful consideration to the nature of the structures which are to replace them will, no doubt, tend to the building of satisfactory permanent bridges.

SEWAGE.

More than 19,000 million gallons of sewage were pumped by five sewage pumping stations during the year 1911, one of these stations having a capacity of 200 million gallons a day. A large proportion of the sewage pumped is, presumably, the wasted water already referred to. The mileage of sewers is 1,894, and there are, in the city, 75,000 catch basins and street outlets.

NEW CITY HALL.

The cost of the new city hall, up to the end of the year, was over £1,000,000, including more than £100,000 spent on providing temporary quarters.

ROADS.

During the year more than 2,400 million sq. yds. of pavement were cleaned by hand at a cost of nearly £180,000, and more than £2,200 were spent on ditching work on the 55 miles of country roads within the city boundaries. These roads are from 16 ft. to 20 ft. wide, the crust of limestone, slag or gravel being usually about 12 in. thick. They cost about £2,000 a mile. Those made in the past two years have been provided with a 6-in. foundation course of limestone, bonded with screenings, and rolled, and a wearing course, 3 in. or 4 in. thick, of medium stone with a bitumen binder.

Most of the macadam roads are now oiled with "straight" oil in the spring. The cost of oiling is a little less than 1½ cents (say ¾d.) per square yard.

The kinds of paving used in Chicago include asphalt, brick, granite, cedar blocks and macadam.

ELECTROLYSIS.

A special electrolysis survey was begun during the year with a view to discovering electrolysis conditions and recommending remedies. The report on this subject is illustrated by photogravures of water pipes showing damage by electrolysis. Large holes of a remarkable character had been formed in some pipes, the area damaged being in some cases very small, the holes having almost the appearance of having been punched or chiselled. One illustration shows a 1-in. service pipe destroyed by electrolysis, practically the whole pipe having been attacked and thinned down in this case, and other illustrations show holes which, in a length of pipe equal to its diameter, must be more than a quarter of the cross-section of the pipe in area.

The reports are accompanied by a large number of plans, diagrams and other illustrations, and contain a great deal of valuable comparative data.

A ROAD FOR MODERN TRAFFIC.

TRINIDAD ASPHALT MACADAM.

Surveyors throughout the country who have under their control roads which have to carry very heavy traffic are naturally anxious to obtain the best material for surfacing such roads at a minimum cost. Owing to the great increase in the number and weight of vehicles which now use the highways it is necessary that the surface shall be made to meet the demands which the modern traffic needs.

In this connection we can recommend surveyors to inspect the numerous roads that have been laid during the past few years with Trinidad asphalt macadam, and which have given excellent results under all conditions of traffic.

The use of Trinidad asphalt macadam as a satisfactory road material has increased so greatly that our readers will probably remember a new works was opened at Tottenham in the spring of last year by Messrs. H. V. Smith & Co., Limited, of 20 Victoria-street, Westminster, S.W., and a very large number of roads have been laid with the material supplied from that works.

Nearly the whole of the Thames Embankment, as we stated last week, has been laid with Trinidad asphalt macadam, in addition to many roads at Chelsea, Walthamstow, Fulham, Hackney, Finsbury, Hammersmith, Willesden and elsewhere.

It is claimed for Trinidad asphalt macadam that it gives an up-to-date road for modern traffic at a reasonable price, and that it requires no concrete foundation, and can be laid in various thicknesses to meet the different classes of traffic. A great feature of the material is that as it is supplied to the site hot, it can be laid in all weathers, winter or summer.

Messrs. H. V. Smith & Co., Limited, 20, Victoria-street, S.W., will be well known to surveyors as contractors for tar-spraying, and every year this firm carries out very large contracts of this nature throughout the country.

"The Civic Engineer's Who's Who."—The first issue of "The Civic Engineer's Who's Who" (London: St. Bride's Press, Limited, 24 Bride-lane, E.C., 2s. 6d. nett) gives wonderfully complete lists of the engineering officials of England and Wales. For a first issue it is very creditable.—*Glasgow Herald.*

Assistants' and Students' Section.

CONDUCTED BY SYDNEY G. TURNER, ASSOC.M.INST.C.E.

All communications in regard to this page must be addressed to The Editor, St. Bride's House, 24 Bride-lane, Fleet-street, E.C. *Envelopes must be marked "Assistants' Section" in the top left-hand corner. Correspondents are invited to submit questions for consideration and answers to the questions which appear. For the contributions considered to be the most meritorious, one or more premiums in books will be awarded monthly. Diagrams must be drawn to scale on separate sheets, ready for reproduction.*

THE MONTHLY PREMIUM.

The following books have been selected in respect of the premium for December, and they have been duly forwarded to those to whom the awards were made:—

To Mr. D. G. Bevan, of Darlington—

Molesworth's Pocket Book of Engineering Formulæ (Spon).

"Technical Electricity," by Davidge & Hutchinson (University Tutorial Press).

To Mr. H. G. Overfield, of West Bromwich:—

"Building Construction," by C. F. Mitchell (Batsford).

"Brickwork and Masonry," by C. F. Mitchell (Batsford).

"Electric Tramway Traction" (St. Bride's Press, Limited).

To Mr. H. E. Lunn, of Islington:—

"Public Health Law," by Sydney G. Turner (St. Bride's Press, Limited).

QUESTIONS.

This week answers are invited to the following questions:—

299. Surveying.—Will some reader kindly give a sketch and description of Colby's Compensation Bars for the accurate measurement of base lines? (Student.)

300. Retaining Wall.—A retaining wall is required to support a roadway having no footpath, and consequently heavy vehicles such as steam rollers, &c., will seriously surcharge the wall. The height of the roadway above the adjoining ground is 8 ft., and the filling will be good clay. Design a suitable wall in mass concrete, and show calculations. (D. G. B., *Darlington.*)

301. Waterworks.—Two pumping engines deliver water at the rates respectively of 1,620 and 1,150 gallons per minute together into three pumping mains 10 in., 11 in. and 14 in. diameter. What is the velocity in and the discharge of each main? (D. G. B., *Darlington.*)

302. Hydraulics.—By fixing a short tube to the orifice in the side of a vessel, a considerable increase in the discharge is obtained. Explain why this is so, and give the comparative "coefficients of contraction" with and without the tube. (E. S. M., *Luton.*)

303. Reinforced Concrete.—Give sketches of the usual forms of falsework for reinforced-concrete construction, showing how the moulding is arranged at the junctions, such as between the column and principal rafter, a column and cambered roof, &c. (T. H., *Leicester.*)

[The Editor is at all times glad to hear from readers who desire to submit questions regarding matters of general interest, points of daily practice, &c., for insertion in the "Assistants' and Students' Section." Questions which are published are taken into consideration, as well as other matter, in awarding the Monthly Premium.]

REPLIES TO QUESTIONS.

294. Traction.—Compare the tractive force required for heavy vehicles over roads of various surfaces and grades, and show how this affects the cost of transport. (H. V. O., *West Bromwich.*)

The tractive resistance of different road surfaces varies greatly with the state of repair of the surface and with the weather.

The following list compares the tractive resistances of different surfaces under various conditions, taking asphalt (with a resistance of about 40 lb. per ton load on the level) as a standard:—

Asphalt	1·0
Paved road, in good order	1·5 — 2·0
" " in fair order	2·0 — 2·5
" " covered with mud	2·0 — 2·7
Macadam road, dry and in good order ...	2·5 — 3·0
" " wet and in good order	3·3
" " in fair order	4·5
" " covered with mud ...	5·5
" " covered with loose stones	5·0 — 8·0

The figures given above hold good for different surfaces at the same gradient.

The tractive resistance depends not only on the surface of the road but on the gradient, and it increases directly with the sine of the angle of inclination.

Thus if W = total load in lb.,

f = ratio of the tractive resistance to the total load on the level, and

i = the sine of the angle of inclination.

the tractive resistance on the gradient

$$= (f + i)\ \text{W lb.}$$

Take an example of an average road, for which $f = \frac{1}{20}$. On an incline of $\frac{1}{20}$ the tractive resistance will be twice that on a level part of the same road.

It is difficult to compute the financial advantage of favourable grades and surfaces with any accuracy, but it is certain that the necessity for either lighter loads (and consequently more journeys) or for a higher tractive force, in an unfavourable district, will have a detrimental effect on the cost of transport there. (H. M. W., *Worcester.*)

NOTES.

We have received the following from Mr. Henry C. Adams, ASSOC.M.INST.C.E., to whom the thanks of readers of the Assistants' and Students' Section are due for his interest:—

In further reply to Question No 296, on p. 15 of your issue of the 3rd inst., your correspondent "Perplexed" may be interested in the following extract from "The Sewerage of Sea-Coast Towns" (Crosby Lockwood & Son, 5s. nett).

"The lines of 'high and low water mark of ordinary tides' shown upon ordnance maps represent mean tides—that is, tides half-way between the spring and the neap tides, and are generally surveyed at the fourth tide before new and full moon. The foreshore of tidal water below 'mean high water' belongs to the Crown, except in those cases where the rights have been waived by special grants. Mean high water is, strictly speaking, the average height of all high waters, spring and neap, as ascertained over a long period. Mean low water of ordinary spring tides is the datum generally adopted for the soundings on the Admiralty charts, although it is not universally adhered to. The spring tides around the coast of England are 4 in. higher, on the average, at the time of new moon than at full moon, the average rise being about 15 ft., while the average rise at neaps is 11 ft. 6 in. The height from high to low water of spring tides is approximately double that of neap tides, while the maximum height to which spring tides rise is about 33 per cent more than neaps, taking mean low water of spring tides as the datum."

SEA-COAST EROSION.—For a very complete and inexpensive library on the cause, prevention and repair of coast erosion the following three works are recommended: "Coast Erosion and Foreshore Protection," by John S. Owens, M.D., Assoc.M.Inst.C.E., F.R.C.S., and Gerald O. Case (price 7s. 6d., post free 7s. 10d.), with numerous illustrations and diagrams; "Sea-Coast Erosion and Remedial Works," by R. C. Allanson-Winn, M.Inst.C.E.I. (price 1s., post free 1s. 1d.); and "Erosion of the Coast and its Prevention," by F. W. S. Stanton, Assoc.M.Inst.C.E., F.S.I. (price 3s., post free 3s. 2d.), with numerous maps and other illustrations. The publishers are the St. Bride's Press, Limited, 24 Bride-lane, Fleet-street, London, E.C.

CORNWALL ROADS.

MAINING AND DISMAINING: COUNTY SURVEYOR'S REPORTS.

The question of maining and dismaining of roads came before a meeting of the Highways Main Roads and Bridges Committee of Cornwall County Council on the 9th inst.

Two reports had been prepared by the county surveyor (Mr. A. E. Brookes), the addendum to the first being an alternative scheme. The initial report stated that the course recommended in regard to the different stretches of road, entailing as it did the dismaining of a certain mileage of road, might be felt to be a retrograde step. To ensure, therefore, the maintenance of a proper and reasonable standard of efficiency it was suggested that the more important of those so dealt with, together with the other roads which were of importance, but not sufficiently so to become main roads, should be classed as secondary roads, and the county council should make an annual grant per mile towards the cost of their maintenance, provided they were maintained to the satisfaction of the county surveyor. One of the principles recommended, if the scheme were adopted, was that a class of secondary or subsidised roads should be created to be divided into two classes—"A" to have a grant of £30 per mile per annum, and "B" £20.

The alternative report contained a scheme which did not provide for the creation of a class of secondary or subsidised roads, and stated that on a detailed inspection of the roads suggested for maining convincing evidence has been forthcoming that in the majority of cases it would be futile to recommend maining, as the local authorities would not entertain the heavy expenditure which would be necessary to the conditions of maining. The obvious conclusion was that the prevailing conditions must continue unless aid under less stringent conditions than those in connection with maining could be rendered. The committee had therefore been asked to consider whether the improvement of the particular roads set out was of sufficient importance to warrant, as had been recommended, the creation of a class of secondary roads towards the improvement and maintenance of which the County Council were empowered to make conditional grants. It was desired to make clear that in the case of roads which were proposed to be dismained and created secondary that they were either purely of local utility, or formed routes of tourist traffic during the summer months, and were of the same class as district highways. To main the roads set out in the schedule of both reports would, it was estimated, cost on the average at least £600 per mile, which was anticipating ten to twelve years' expenditure by the district councils on those roads. In addition, they would have thrown upon them a moiety of the cost of the dismained roads, and would receive very little relief, if any, in the case of the secondary or subsidised roads. It was quite appreciated that, although the suggested subsidy was only towards, and conditional on, an equal or greater expenditure on the part of the local highway authority, there were undoubtedly several serious grounds for objection to the proposal. Assuming that in the opinion of the committee it was desirable that these district roads should be improved, and in view of the objections arising under a system of secondary or subsidised roads, it was desirable that the committee should consider as an alternative the principle of establishing a class of second grade or second class main road, to be directly maintained by the county council, in connection with which the usual conditions of maining should be so far relaxed and modified as to permit of those roads being placed in a satisfactory condition within the limit of expenditure compatible with utility. The report did not, however, recommend the committee to entertain the maining of any road in the Eastern Division under those conditions, unless they could be maintained conjointly with the existing main roads directly by the county council. It should under such conditions be clearly understood that a subsidy or contribution towards the cost of the maintenance, &c., of a highway or main road was purely a voluntary grant which might be withdrawn or withheld by the county council at the end of any financial year.

After full discussion the committee decided not to entertain the principle of secondary or subsidised roads, but agreed to main and recommend for dismaining the roads in the schedules of the second report, and, without committing themselves to a definite policy, admitted the principle of forming a grade of second-class main roads.

LOWER THAMES VALLEY DISTRICT SURVEYORS' ASSOCIATION.

MEETING AT TWICKENHAM.

An ordinary meeting of the above-named association was held at the Town Hall, Twickenham, on Saturday, the 4th inst., and was presided over by Mr. H. F. Coales, Assoc.M.Inst.C.E., the president.

A further discussion took place upon Mr. E. Willis' paper, entitled "Some Notes on the Effect of Intercepting Traps in House Drainage."* The discussion may be summed up briefly as follows: That some doubt exists as to the comparative purity of sewer and drain air, and that until this has been conclusively proved it would be inadvisable entirely to do away with intercepting traps. Probably in such places as are fortunate enough to have an entirely new system of drainage the intercepting trap might with advantage be dispensed with, but it was thought that it would not be advisable to abolish all intercepting traps irrespective of circumstances, and that the conditions surrounding each case should in future be considered before abolishing the trap. The public generally would have to be educated to see that their drains are kept properly flushed from the house apparatus, which would undoubtedly be the means of removing the causes of complaints which are received.

The association further discussed the question of fire hydrants, which had been provided at the expense of local authorities, being used by other statutory authorities without first obtaining the consent of the local authority, or without making some payment for such use to cover the cost of maintenance and repairs.

Mr. R. W. Hindhaugh, the surveyor of Ham, Surrey, was unanimously appointed a member of the association.

Other matters which came under discussion were as follows: The making up of private streets which are situated in two or more districts—as to the method of procedure and apportionment, the removal of clinkers from a laundry—as to whether the surveyor can legally be called upon to have these removed: the surfacing of roads subjected to motor-omnibus traffic with tarred macadam or other material of a similar character.

The association also discussed several clauses in the Metropolitan Water Board's "Various Powers Bill, 3 and 4 George V., 1913," with regard to fire plugs and hydrants, giving of notice to the board before opening up the ground, and as to the discharge of water from bursts and excavations into the sewers.

A Scarborough Town-Planning Scheme.—Mr. Thomas Adams, Local Government Board inspector, held an inquiry at Scarborough lately into an application by the Scarborough Town Council for authority to prepare a town-planning scheme. It was stated that the scheme embraced only 40½ acres of land on the northern extremity of the borough boundary, and near the new improvements at Peasholme Park. The inspector remarked that it was a small area for a town-planning scheme for a town the size of Scarborough. The borough engineer, Mr. H. W. Smith, said it might be taken for a beginning. The committee in charge had requested him to consider other sites.

Bridge Building.—Students, young engineers, and surveyors will find much useful information in "Preliminary Studies in Bridge Building," by Reginald Ryves, Assoc.M.Inst.C.E. (London: St. Bride's Press, Limited, 24 Bride-lane, E.C. Price 2s. nett.) The book is described as the "first of a series of small volumes, each complete in itself, dealing with the design of ordinary highway bridges of moderate span." Though highway bridges alone are referred to, the matter contained in this volume is largely applicable to railway bridges, aqueducts, and similar engineering undertakings. The five primary types of bridges are described, and the conditions determining the best site for each of the three types of streams are discussed in detail; while, in connection with wandering streams various modes of designing abutments or approach spans are dealt with. Improvements of fords and the effect of eccentric loading of vehicles on the girder loads are among the numerous other items touched on.

Scotsman.

* The Surveyor, December 13, 1912.

SOME RECENT PUBLICATIONS.*

PROCEEDINGS OF THE AMERICAN SOCIETY OF CIVIL ENGINEERS. Vol. xxxviii., No. 9.

The greater part of this volume is occupied by a paper on "Irrigation and River Control in the Colorado Delta," by H. T. Cory, M.AM.SOC.C.E.; and although this paper is not of direct interest to the majority of SURVEYOR readers, it is one which is likely to prove highly interesting to all engineers whose spare time reading is extended to subjects beyond the range of their own duties. It may be suggested that irrigation engineers, and those in charge of river control works, will find that this paper will occupy an important place in the literature of the subject.

A short paper on the "Prevention of Mosquito Breeding," by Spencer Miller, M.AM.SOC.C.E., has probably provoked an interesting discussion, which will, no doubt, be reported in due course in a subsequent volume of the "Proceedings." The author quotes in full the "Mosquito Brief" of the American Mosquito Extermination Society. In this authoritative document it is stated that there are more than 100 species of mosquito in the United States, and it is pointed out that rank growths of weeds and grass may conceal small breeding puddles, while the pitcher plant holds enough water to breed a small and rare species. Different kinds of mosquitoes have habits as well defined as those of birds or flies. Migratory mosquitoes, which breed in salt and brackish marshes, fly long distances, but are not carriers of malaria, though they may be a serious pest. The author's own observations lead him to the conclusion that the most troublesome varieties of mosquitoes are those bred in man-made water holders. The next paper is on "The Sanitation of Construction Camps," by H. F. Gray, junr., AM.SOC.C.E., and contains useful practical notes on the house fly and dangerous mosquitoes. This paper is worth the attention of surveyors of districts which are visited by hop-pickers, and temporary workers generally, who are accommodated in camps.

THE PRACTICE OF ELECTRICAL WIRING. By D. S. MUNRO, A.M.I.E.E. Price 3s. nett. London: H. Alabaster, Gatehouse & Co.

Electricity is such a universal requirement of modern civilisation, and its applications in both the domestic and commercial spheres are so many and various, that, as the author of this book states in his introduction, an unwired modern building is an anachronism. It certainly behoves the modern engineer or architect to acquire a good working knowledge of the principles of electrical wiring, and it is to afford assistance in this direction that Mr. Munro has written this book. It is a practical treatise written for serious work, and the twenty-seven chapters into which it is divided contain information upon every detail of wiring work. We have no hesitation in recommending this book as a concise and reliable treatise on the subject.

WHITAKER'S ALMANACK, 1913. Price 2s. 6d. (cloth), 1s. (paper).

It is safe to say that of all works of reference "Whitaker" is the most universally used, being consulted by persons of every class. It owes the unique position it has attained to the accuracy and volume of useful information which it contains, and to the fact that it is a marvel of cheapness. It would be entirely superfluous to give any description of so well-known a work. Suffice it to say that the new issue is again larger than its predecessors and of equal excellence. It may be mentioned, however, that the index has been compiled afresh, and that among the new subjects dealt with are Labour Unrest and the National Insurance Act. "Whitaker" is as indispensable as ever.

NORTHAMPTON. By S. S. Campion, J.P. Price 3d. London: The Homeland Association, Limited.

A really remarkable little book at the price. It deals quite satisfactorily, though necessarily briefly, with Northampton as a residential town—and the district has, in this respect, claims which will be a revelation to those who know it only as a great industrial centre; with its history, which is as vivid as it is important for the prominent part it has played in our country's history; with its industries and its recreative and educational facilities; and with its local treasures of historical and architectural interest. And, despite its low price, it is printed on art paper, is admirably illustrated, and includes a folded-in plan of the borough on the scale of 3½ in. to the mile.

THE WRITERS' AND ARTISTS' YEAR BOOK, 1913. Edited by G. E. Mitton. Price 1s. nett. London: A. & C. Black.

This book may be aptly termed the Authors' Business Guide, affording as it does complete information as to the most likely destinations where "copy" of any kind may be placed. It contains not only a directory of journals, magazines and newspapers, with information as to the kind of matter likely to be accepted, and the rate of payment, but also much miscellaneous matter of interest to authors, such as lists of clubs and societies, law of copyright, names of press-cutting agencies, and so on. To the regular or occasional writer the Year Book cannot fail to be of interest and usefulness.

"Minutes of Proceedings of the Institution of Civil Engineers," vol. cxc. Municipal engineers will find the chief item in this volume is a paper on "The Works for the Supply of Water to the City of Birmingham from Mid-Wales," by E. L. and W. L. Mansergh. It occupies eighty-six pages, including the discussion and correspondence, and is illustrated by three plates and eight cuts. There are two papers on that hardy perennial "Madras Harbour," and on its "Remodelling and Equipment," by Sir F. J. E. Spring; and the other on its "Alteration of Form," by H. H. G. Mitchell. There are two papers relating to important works on existing bridges, Blackfriars Bridge and Menai Suspension Bridge; and a number of useful "sign-posts" pointing to foreign sources of information on various subjects will be found among the abstracts.

The *Contract Record and Engineering Review* of Toronto for December 18th takes the form of a bulky issue consisting of valuable information on the special subject of "Brick and Clay Products." Striking features of the number are its imposing array of appropriate advertisements, and a cover which is most effectively designed.

The Limmer Asphalte Paving Company, Limited, of Caxton House, Westminster, S.W., send us an exceedingly useful "Telephone Directory," arranged with an alphabetical index for a handy-reference record of names and addresses of firms and others with whom one has frequent telephone communication. It is a most handy time-saving appliance.

Drainage Works and Sanitary Fittings.—A third edition, revised and brought up to date, particularly as regards the questions of concrete sewers, sewer ventilation and flushing, and the Public Health Acts Amendment Act of 1907, still further evidences the success of this little manual,* which manifestly deserves the attention and confidence of all concerned in the important subject with which it deals.—*The Bookseller.*

The Wear of Creosoted Wood Blocks.—A portion of Tenth-street in Minneapolis, Minn., was paved in 1902 with creosoted wood blocks, this being the first pavement of this type to be laid in the city. The blocks were 4-in. Southern yellow pine, treated with 12 lb. of "Kreodine oil." They were laid upon a 6-in. natural cement foundation, over which was spread a 1-in. cushion of sand, at an angle with the kerb of about 62 deg. No cross-expansion joints were used, but on each side of the street next to and parallel to the kerb there were 1-in. expansion joints. The joints as well as the space between the blocks were filled with paving pitch, and the street was finished with a ¼-in. coating of sand to absorb the excess pitch on the top of the blocks. In a paper presented to the American Good Roads Congress, Mr. Ellis R. Dutton, city engineer of Minneapolis, Minn., states that the first pavement has proved a complete success, as there has been practically no repairs on account of the blocks, and the wear has been only about ¼ in. up to the present time. Mr. Dutton also states that in 1911 he took out sample blocks from the pavement laid in 1903 on Third-avenue South, and found that the yellow-pine blocks showed a wear of ⅛ in., while the Norway pine blocks showed a wear of ¼ in. These blocks had carried exactly the same traffic.

* Any of the publications reviewed, or referred to as received, will be forwarded by the St. Bride's Press, Ltd., on receipt of published price.

*"Drainage Work and Sanitary Fittings." By Wm. H. Maxwell. Price 2s. nett. London: St. Bride's Press, Ltd., 24 Bride-lane, E.C.

Correspondence.

For every ill beneath the sun
There is some remedy or none;
If there be one, resolve to find it;
If not, submit, and never mind it.
—ANON., *circa* 1843.

THE INSTITUTION OF MUNICIPAL AND COUNTY ENGINEERS' TOWN PLANNING COMPETITION.

To the Editor of THE SURVEYOR.

SIR,—I am glad to see that the council of the Institution of Municipal and County Engineers are amending the conditions for their "Town Planning Competition." From the report in your last issue they appear to be revising the conditions in certain directions even more drastically than I suggested in my former letter [THE SURVEYOR, November 22, 1912], for I think the sheet of details might have been retained. In other directions the brief notice of the council's meeting does not suggest that they are likely to remove my objections.

These objections were—firstly, to the inadequate premiums offered; secondly, to the request for a bird's-eye view of a town 5 miles long and nearly 2 miles deep; and, thirdly, to the vagueness of the description and absence of any sketch or block plan.

With regard to premiums, I think the council should offer 50 guineas at least, or none at all. I feel very strongly that it is better not to hold a competition unless the premiums offered are such as to induce the best men in the municipal ranks to compete. Our architectural friends will be keenly on the look-out to detect and criticise our shortcomings in design, and for the honour of the profession it is to be hoped that the competition will attract some of the best men in our ranks.

The conditions first issued were evidently inspired by the wish to secure a scheme for dealing with the town in which the next annual meeting is to be held; but I would respectfully suggest that it would be much more satisfactory to invite schemes for an ideal seaside town rather than hamper competitors by requiring them to deal with existing built-up areas, and dovetail into their schemes purely local features. The scheme would certainly gain by being a national rather than a local scheme.

The descriptions given were very vague and unsatisfactory, and it is necessary that these should be made sufficiently clear for all competitors, and be accompanied by a block plan of 6 in. to a mile, showing the contours at every 25 ft. at least. It would be better still if the plan could be given to the scale of 12 in. to a mile, as required from competitors, and showing the contours at every 5 ft. or 10 ft.

It is to be hoped the council will bear in mind that, unlike many architectural competitors in private practice, municipal officials can only devote their spare time to such a competition; and if it is possible to reduce the area and population to be provided for, it is not likely adversely to affect the scheme.

It is usual to state whether the plans are to be submitted on stretchers, rollers, or plain; and to ask for a short description of the laying out, limited, I would suggest in this case, to, say, 2,000 words. It might also be desirable to give the principal buildings, number of piers, parks, &c., to be provided in the scheme, state the number of houses per acre, and if the scheme is to conform to the Model By-laws or be designed under town planning conditions.—Yours, &c.,

SURVEY.

January 15, 1912.

[While nothing was said on the point by the president in his reference at Swansea, on Saturday last, to the competition, we have reason to believe that the question of premiums has had the consideration of the Town Planning Committee, and that the competition, as a result, will be made more attractive in this respect.—ED. SURVEYOR.]

WORKING-CLASS HOUSING.

To the Editor of THE SURVEYOR.

SIR,—I read, with interest, Mr. Palmer's paper on the above subject, and, with twenty-five years' experience in working-class housing, I must say I agree with Miss Tabor that the fireplace must be retained in bedrooms.

Adverting to the parlour, I endorse the statement that the majority are made mere "show" rooms, and in the forty houses just completed in our district we have made the living room a combination of sitting-room and living room. This has been effected by putting a Yorkshire cooking range in both living room and scullery. I anticipate your readers will think the scullery will be the real living room, but it is not so, because the copper back boiler for the supply of hot water to the sink and bath is fixed in the living room: the housewife is always wanting hot water, and therefore keeps the living room fire going continuously. (Coals 4s. to 5s. per ton.)

For your readers who are interested in miners' houses I subjoin the conditions which my Building Committee set out with. I might say the district is practically the outcome of developments around one of the largest collieries in South Yorkshire, situate between Barnsley and Doncaster. The conditions vary materially from some experiments which were well known to the committee, and which were great improvements on the ordinary colliery village, but from an intimate knowledge of the mining population they laid down the following conditions:—

(1) There must be nothing in common except that roadway houses must be semi-detached, each having its own garden area and one access only, and that it must be self-contained.

(2) Each house must have three bedrooms, two of which should have fireplaces, a cellar, bath, with hot and cold water laid on (sink the same), water-closet, concrete over the whole area of house, and all plumber's work and drainage accessible and up to date.

I may say these conditions have been attained except in eight houses, which have pantries instead of cellars. The cellars, I must point out, are a local need, the outcome of a large number of allotments: pigs are kept by the allotment holders, and the cellars are necessary for curing purposes.

The houses are at the rate of sixteen to the acre, but with allotment land owned by the council, and adjoining the site of houses, they run at the rate of five to six houses per acre.—Yours, &c.,

JOHN W. WILSON,
Surveyor.

Council Offices,
Bolton-upon-Dearne,
Yorkshire.
January 9, 1913.

BITUMINOUS MATERIALS.

To the Editor of THE SURVEYOR.

SIR,—It is indeed satisfactory to observe a contribution on this subject from Mr. Francis Wood, who is well known as an advocate of asphalt-macadam in his borough of Fulham, and although, in his opinion, my suggestions are out of court altogether, I would nevertheless like to endorse Mr. Dussek's contention that the Trinidad Government are perfectly correct in designating Trinidad Lake asphalt as such, inasmuch as it is certainly a material which exceedingly closely resembles the description of the original solid, black, bituminous, inflammable substance known as "asphaltos," which used to be found floating on the surface of the Lacus Asphaltites, or Dead Sea.

Notwithstanding the fact that natural asphalt (a very different material to rock asphalte) when properly refined and fluxed, is capable of coalescing or forming by concretion various materials into a mass such as asphalt-macadam, to put forward the argument that it is simply a concrete is a corruption of the English language. Like cement it is only the matrix in the composition of a concrete and not a concrete in itself.—Yours, &c.,

CECIL NATHAN.

3 London Wall Buildings, E.C.
January 13, 1913.

To the Editor of THE SURVEYOR.

SIR,—Because I mentioned the fact that the Trinidad Government described the Trinidad Lake material as asphalt I am sorry Mr. Wood should conclude

The Surveyor
And Municipal and County Engineer.

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that this was my reason for describing it also as asphalt.

Mr. Wood will, I think, agree that my opinions are more likely to be formed from the extensive experience my firm has had in the manufacture and handling of Trinidad bitumen, and in mentioning the fact—in support of my statement that this material was an asphalt—that the Trinidad Government described the product as such, I also stated that the concessionnaires of the lake called it asphalt, and it is and always has been sold by them as asphalt.

I do not think, as Mr. Wood suggests, that the Trinidad material has been called asphalt by anyone simply because it can be used in the manufacture of mastic or other asphalt, but it is more likely to be due to the fact that the line between bitumen and asphalt cannot be clearly drawn. If it were called asphalt because it was used to make asphalt, then for the same reason oil might just as well be called grease, and bitumen might be said to be paint or printers' ink.

I have all along contended that the correct definitions of bitumen, asphalt, &c., have always been known and no revision of names is necessary or possible, but to prevent advantage being taken of those who have not had the opportunity of studying the subject specifications—as I have previously suggested—giving the analyses and distinguishing characteristics of all natural materials might be issued to enable anyone to ascertain when, say, a natural or artificial product was being offered.—Yours, &c.,

A. E. H. DUSSER.

Canal Bank,
Deptford, S.E.
January 15, 1913.

INSTITUTION OF WATER ENGINEERS' WINTER MEETING.

To the Editor of THE SURVEYOR.

SIR,—On reading your report of the proceedings of the Winter General Meeting of the Institution of Water Engineers, in your issue of January 3rd I observe that in the account of my remarks the reporter has in several places failed to hear correctly, with the result that inaccuracies appear in your report, and in some instances obscure the meaning of the context.

The more obvious of these errors are as follows:-

Page 12, col. 1, lines 11-12 reads: "... and had quite an anxiety to communicate wherever they went."	should read: "... and were quite an anxiety to the community wherever they went."
Page 12, col. 1 In several places the word "mollient" appears.	In each case this should be "mordant."
Page 12, col. 1, 14 lines from foot: The word "river" should read	"water."
Page 12, col. 2, line 14: "... being brought into intimate contact, and its chemical attraction at the time of exerting its force."	"... being brought into intimate contact, and its chemical attraction having time to exert its force."

You will no doubt think it desirable to correct these inaccuracies, as they detract considerably from the value of the report.—Yours, &c.,

WM. PATERSON

Amberley House,
Norfolk-street, Strand, W.C.
January 14, 1913.

ROAD BOARD GRANTS AND THE POPULATION BASIS.

There were so many interesting and suggestive passages in the reply which Sir George Gibb, chairman of the Road Board, made to the influential Scottish deputation he received on December 13th that we reproduced this reply in full in last week's issue, in order that our readers might know exactly what was the position the chairman of the Road Board took up as regards the very important matters which formed the basis of the representations made to him on behalf of a number of Scottish counties.

Before commenting generally upon the matters of principle and expediency involved, it will be necessary to review certain comparative data, and to consider the significance of some authoritative statements and important suggestions which have recently been made; and such a general review of the situation can best be made after the publication of our annual retrospect in the Special Issue, which will appear on January 31st. But the occasion must not pass without a protest against the doctrine that Road Board grants should be made on a population basis. To begin with, we cannot see the need for making arbitrary distinctions between different parts of the kingdom. The Road Board neither simplifies nor justifies its decisions in the case of County Mayo, for instance, by subjecting its scrutiny of applications from that area to a dominating factor based on the population of Ireland, nor is there any practical reason why through traffic in Perthshire should be studied under a constraint imposed by a financial revival of the Great Wall. As far as the Act goes, it puts Mayo, Perthshire, and Dorset on the same footing; and why go further, unless for reasons which are real?

It is desirable to recognise the county as a highway unit, but we cannot see that there is any merit in taking the population of a county, or of any area, as a guide to the total of the grants to be made in that area, except in so far as the Road Board, as an equaliser of burdens and as a department created by through traffic developments, might make its grants more or less *inversely* in proportion to density of population or rateable values. The Road Board has absolute discretion in the matter, and there seems to be no reason why the grants should not be determined by a dozen prime factors, some affecting a large area of a definite character, some applying to the county, and some purely local. The board employs one whole-time engineer officer, who gives a part of his time to the scrutiny of individual applications amounting to more than half a million a year, but it has not one officer engaged for the purpose of studying different areas and their claims on the central fund. It would surely be a great economy to put the whole matter into the hands of a capable technical official instead of spending large portions of the time of the chairman and of busy public men in long arguments, and in the getting up of cases to be pressed on the special attention of the board.

LOCAL GOVERNMENT BOARD INQUIRIES.

The Editor invites the co-operation of SURVEYOR *readers with a view to making the information given under this head as complete and accurate as possible.*

INQUIRIES HELD.

Ashby R.D.C. (January 10th. Mr. A. A. G. Malet).—£4,875 for the purposes of a sewerage scheme for Ravenstone.—The clerk, Mr. G. Farmer, stated that the necessity for the scheme had arisen through complaints. There had been a claim for loss of cattle alleged to be due to drinking water in a brook polluted by sewage. That claim was settled out of court. They had entered into a provisional agreement for the purchase of 4a. 22p. of land for the outfall site, at £110 per acre—a total of £455. That included a right of road to the land. Mr. T. I. McCarthy (engineer) explained the scheme, stating that it took in an area with 220 houses and 1,016 population. Mr. L. L. Baldwin (surveyor to the Coalville Urban Council) spoke in support of the scheme.

Bristol T.C. (January 3rd. Mr. F. H. Tulloch).—£5,634 for the purpose of street improvements.—The necessary particulars were given by the city engineer, Mr. L. S. MacKenzie, and the consulting city engineer, Mr. T. H. Yabbicom.

Clacton U.D.C. (December 31st. Mr. R. H. Bicknell).—£8,000 for the erection of a sunk bandstand.—The importance of a sheltered bandstand having been emphasised by the clerk, Mr. G. T. Lewis, the surveyor, Mr. D. J. Bowe, gave details of the scheme. He expressed the opinion that the Gap and the bandstand would be very much more successfully treated separately than together in a comprehensive scheme. Asked if he had made any provision for tidal waves, Mr. Bowe said he had been at Clacton three years and had never seen one, but he had allowed a sufficiently high level for the water; the amphitheatre would be 16 ft. above high-water mark at spring tides.

Cowbridge R.D.C. (January 9th. Mr. P. M. Crosthwaite).—£1,480 for the provision of a cemetery at Hendre Wen for the parish of Llanharran, and £330 for works of water supply for the parishes of Llanharran and Peterston-super-Montem. The surveyor, Mr. G. E. Morris, dealing with the cemetery, said that the area of land to be taken was 4a. 6r. adjoining the roadway, the purchase price being £503. With respect to the proposed loan for a water supply, it was stated that since the Eight Hours Act came into operation much more water had been used than formerly by the miners. The clerk, Mr. J. Stockwood: They have two washes a day now.

Dublin T.C. (January 3rd. Mr. P. C. Cowan).—This was a continuation of the inquiry into the housing scheme in the city. The Trinity Ward scheme, estimated to cost £17,940, was considered at the first sitting, and evidence was now given with respect to the Beresford-street area, the cost of the scheme being stated at £34,000. It was stated that the Beresford-street and Church-street area comprised 3a. 3r. 11p., on which it was intended to build 147 three-roomed houses and 84 two-roomed houses. In that scheme and in the Ormond Market scheme the corporation had adopted a policy which had not been adopted before—to let the houses at a rent of 1s. per room.

Cillingham U.D.C. (December 31st. Mr. Courtenay Clifton).—£870 for the purchase of land at Toronto-road, for the erection of workmen's dwellings; £350 for the purchase of land in Wood-street, Brompton, for sites for working-class dwellings; £2,500 for the purchase of land in Woodlands-lane, for the purpose of housing, street improvement, and public walks and pleasure grounds, and town planning.—The borough surveyor, Mr. J. L. Redfern, stated, with respect to the Toronto-road scheme, that there was a frontage of 587 ft., with a minimum depth of 85 ft. 2 in., and a maximum depth of 114 ft. 4 in., which would enable them to build houses in accordance with the by-laws. Thirty-four houses could be erected. As to the land in Wood-street, he thought that £4 per foot frontage was not an excessive price for such a position. If desired they could erect half-a-dozen houses of a suitable type there—self-contained cottages with more than the 400 ft. of air space at the rear, as required by their by-laws. They could be built strictly in accordance with the by-laws in every respect. It would be the class of house required, with large living room, scullery, and larder downstairs, and three bedrooms upstairs. The rent would be about 4s. 6d. a week, tenant paying rates—about 5s. 9d. in all, he should say. With reference to the Woodlands-lane scheme, Mr. Redfern stated that the area of the estate was 12 acres 3 poles. The place was admirably adapted for pleasure grounds, and the property would prove very valuable for the town planning scheme which the council had under consideration.

Penrith R.D.C. (January 8th. Mr. A. A. G. Malet).—£1,730 for purposes of extensions to the mains of the Western water scheme, in the parishes of Dacre, Hutton Soil, and Skelton.—Mr. J. W. Smith, clerk to the council, said in the districts to be supplied by the extensions the population was small and for the most part scattered, and about three-fourths would be supplied. The supply of water was ample, the gaugings having been taken in the droughtiest season known over a number of years. The work would be carried out by contract. The engineer was Mr. Joseph Graham, and he was not a salaried officer of the council, neither would any salaried officer be employed. The whole of the works would be within the council's district, and each separate extension would be within the limits of the particular parish.

Workington T.C. (January 7th. Mr. A. A. G. Malet). £5,750 for the purchase of the High and Low Park farms at Loweswater, and £2,876 for the carrying out of protective and other works at Crummock Lake.—The town clerk, Mr. John Warwick, stated that the Park Beck connected Loweswater with Crummock Lake. Its water was not so pure as the water of Crummock Lake. In passing along the stream between the two lakes a certain amount of pollution took place. There were one or two farms on the banks of this stream, and the pollution rendered it imperative that the water should be delivered some distance below the intake of the Crummock water supply. This stream had been stopped up and overflowed its banks instead of finding its way into the lake. It overflowed meadow lands, and the major portion of that pollution found its way into the bay from which they took their water supply. The surveyor, Mr. H. B. Williams, said the works on Park Beck would not affect any other owner.

Ystradgynlais R.D.C. (January 7th. Mr. P. M. Crosthwaite).—£30,000 for sewage and sewage disposal works (including the execution of works in the Rural District of Pontardawe), and also £3,169 for works of water supply in Ystradgynlais Higher for Ystradgynlais Lower Parish.—Mr. Gerald Swayne, M.INST.C.E. consulting engineer to the council, gave the details of the scheme. Mr. Wyndham Lewis, clerk to the Pontardawe Rural District Council, hoped that the sewerage of Cwmllynfell, in the Twrch Valley, would be dealt with by the scheme. The inspector pointed out that this might mean a larger sewer than that provided for in the scheme, and suggested that the council should immediately enter into an agreement in order that the present scheme should not be held up.

APPLICATIONS FOR LOANS.

Bootle T.C.—£1,160 for the provision of a playing field.

Brixham U.D.C.—£2,750 for street works.

Colwyn Bay U.D.C.—£650 for building a showroom and stores for the gas undertaking.

Doncaster R.D.C.—£3,990 for a sewerage scheme.

Dukinfield T.C.—£610 for road improvement works.

Haltwhistle R.D.C.—£4,000 for a water supply scheme.

Hull T.C.—£5,450 for municipal stables.

Manchester T.C.—£11,500 for the purchase of the site of the Hulme Barracks.

Oldham T.C.—£3,000 for an improvement at Rhodes Bank destructor.

Oulton R.D.C.—£300 for hospital extensions.

Poole T.C.—£1,759 for private street works.

Rathdown No. 2 R.D.C.—£230 for works of water supply.

Rickmansworth U.D.C.—£822 for gas supply extension.

Scarborough T.C.—£2,529 for beach shelter and pavilion, £220 for drainage works, and £890 for lavatories.

Seaham P.C.—£400 for a fire station and fire appliances.

Stockport T.C.—£1,485 for road improvements.

Sutton-in-Ashfield U.D.C.—£900 for the erection of a fire station and the purchase of a fire engine and escape.

Teignmouth U.D.C.—£1,100 for the erection of water filters.

Watford U.D.C.—£1,100 for the Watford Heath improvement scheme.

Wednesbury T.C.—£1,300 for the provision of a recreation ground.

Whitehaven T.C.—£1,500 for electricity purposes.

LOANS SANCTIONED.

Aberavon T.C.—£150 for a public convenience.

Aberystwyth T.C.—£4,972 for the erection of fifty workmen's dwellings.

Argyllshire C.C.—£10,000 for road repairs in the Cowal district.

Chelmsford R.D.C.—£5,394 for a water supply scheme.

Dover T.C.—£580 for the widening of Bridge-street.

Fylde Water Board.—£120,000 for the completion of the Grizedale Lea reservoir.

Haworth U.D.C.—£1,350 for works of water supply.

Hazel Grove U.D.C.—£1,660 for private street works.

Hull T.C.—£5,325 for a fishermen's school, and £2,175 for an open-air school.

Larne R.D.C.—£3,060 for labourers' cottages.

Monmouthshire C.C. £3,720 for a new school at Hollybush.

Nuneaton T.C.—£6,150 for the purchase of properties for street improvements.

Sandown U.D.C.—£350 for cement kerbing.

Southgate U.D.C.—£1,530 for street works, and £2,350 for a swimming bath.

Stourport U.D.C.—£1,400 for the purposes of a water supply from Bewdley Town Council.

Upton U.D.C.—£600 for the Kempsey sewage disposal scheme.

Watford U.D.C.—£12,564 for electrical extensions.

FORTHCOMING INQUIRIES.

JANUARY.	£
20.—**Chesterton.** For the provision of working-class dwellings (Mr. H. S. Stewart) ...	3,012
21.—**Bury.** For the purchase of a motor ambulance (Mr. J. R. Hutchinson)	1,025
21.—**Caerphilly.** For the purchase of land for council offices (Mr. F. H. Tulloch) ...	670
21.—**Halstead.** For water supply purposes (Mr. W. O. E. Meade-King)	7,500
21.—**Hinckley.** For works of sewerage (Mr. M. K. North)	5,800
21.—**Maesteg.** For street and walling works (Mr. F. O. Stanford)	2,675
21.—**Walmer.** For works of sewerage (Major J. Stewart)	2,400
22.—**Droitwich.** For the provision of working-class dwellings (Mr. C. H. Eyles) ...	1,700
22.—**Newport (Mon.).** For the provision of a recreation ground (Mr. F. H. Tulloch)	1,300
22.—**Wimbledon.** For hospital purposes (Mr. F. St. George Mivart)	4,000
23.—**Bosmere.** For hospital extension (Mr. S. Monckton Copeman)...	250
23.—**Pontypool.** For refuse destructor and depot purposes (Mr. F. H. Tulloch) ...	1,995
23.—**Spalding.** For the erection of working-class dwellings (Mr. H. S. Stewart) ...	6,200
23.—**Warmley.** For works of sewerage (Mr. F. O. Stanford)	2,500
24.—**Abingdon.** For waterworks extension (Mr. F. O. Stanford)	1,200
24.—**Seaford.** For private street works (Major J. Stewart)	836

Land Redistribution and Town Planning.—Although the Royal Burgh of Inverkeithing is in a favourable position for development as a result of its proximity to Rosyth naval base, it has not been possible so far to put into the building market the greater part of the land on the west of the burgh. This land commands beautiful views of the estuary of the Forth, and is largely suitable for residential houses. The area is called The Roods, because it is divided up into thin narrow plots, each a rood in extent. Nearly every one of these plots belongs to a different owner, the strips of ground being awarded in bygone times by the lord of the manor for fighting service. A meeting of the owners was recently called by Mr. J. R. Menzies, the town clerk, and the engineer for the Inverkeithing town-planning scheme, Mr. J. E. Wilkes, advised that, in his opinion, the best solution of the difficulty was a land redistribution scheme on lines which had been so successful in Germany. Mr. Wilkes was instructed to prepare a scheme of this character.

CAMBERWELL ROADS.

MAINTENANCE COSTS AND OTHER MATTERS.

Asked to report on the additional cost of road maintenance in Camberwell due to motor-omnibuses, and the saving to the borough in respect of the maintenance of tramway tracks and the removal of slop from conduits by the London County Council, the borough engineer, Mr. Wm. Oxtoby, M.INST.C.E., states that, owing to motor-omnibus and other heavy traffic, repairs of wood-paved roads—which were laid in the majority of cases in place of granite setts to obtain quietude and comfort—have risen from 1·87d. per yard super. in 1908 to 4·274d. in 1912. At the present time there are over 202,000 yds. super. of wood paving. The prices quoted are for general maintenance, and do not include loan or other charges.

Mr. Oxtoby points out that another effect motor traffic is having on the wood-paved roads is to reduce very materially the life of the wood, and he adds that in a very short period, if not immediately, the borough council will have to take into serious consideration the relaying with new material of very large areas. He observes: "When these areas are relaid it will be necessary also to consider seriously whether wood is now the most suitable paving, or whether it will not be advisable to revert to the more expensive granite setts. I am inclined to think it will have to be the latter." The borough engineer proceeds to recall his recommendation of two years ago as to the laying of a permanent paving in the thoroughfare known as Peckham Rye (West). At that time he said he was reluctantly compelled to give it as his conclusion that only granite pitching or the best compressed asphalt should be laid, mentioning that the former paving was now being made in specially dressed setts, and that in many parts where it had been laid it had been found to overcome the old objection to granite pitching, being very little, if any, more noisy than wood or asphalt, while it was certainly more durable. The council were now paving this road at a cost of £9,166, and the necessity for this outlay could only be attributed to omnibus and other heavy motor traffic.

In the case of another road which carried a service of motor-'buses and a large amount of ordinary motor traffic this became so bad, despite tar-spraying and other means taken to stay the damage, that the crust of the road was finally removed and relined with tarred macadam at a cost of over £1,900. Mr. Oxtoby says he sees evidence of other roads wearing to such an extent that he fears they will eventually get into a similar condition.

The borough engineer considers that no saving results in consequence of part of the cost of maintenance of the roads being borne by the London County Council in respect of their tramway tracks and margins. He even goes so far as to say that the direct opposite takes place, and that the borough council suffers loss by the presence of the tracks, among the reasons which he quotes for this being the impossibility of a continuous cross foundation owing to the conduits, the constant opening of the tramway margins, the alterations—mostly slight—in the level of the rails, and the great vibration of the heavy cars, together with the fact that the greater part of the other traffic is thrown on to the breasts. All these factors tended to increase the wear and tear, so that in many cases it costs more to maintain the breasts than it would to maintain the whole road with the traffic using it generally over the whole of its surface.

Mr. Oxtoby thinks there is little in the suggestion that any saving is made in the borough's slopping account by reason of the work done by the county council. The borough authorities scavenge the whole area of the road, and very little extra slop would have to be picked up if they were responsible for clearing the tramway conduits. At the same time, the cost to the county council must far exceed any extra it would cost the borough.

Water-waste Prevention at Coventry.—Three additional waste-water inspectors are to be appointed by Coventry Town Council, at an estimated cost of £250 per annum, and three additional Deacon meters provided, at an estimated cost of £215. Alderman Drinkwater, in explaining the reasons for the step, mentioned that with perfect inspection it was reckoned possible to save about £700 per annum in water now wasted.

Municipal Work In Progress and Projected.

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The following are among the more important projected works of which particulars appear below: Buildings—Folkestone £20,000, Hartlepool £9,460, Stepney, West Riding £24,800; housing and town planning—Neath; roads and materials Argyllshire £10,000, Eastbourne, Llantrisant and Llantwit £22,194, Twickenham £6,250, West Riding £7,000; sewerage and sewage disposal — Balby-with-Hexthorpe, Banbury, Hartley Wintney; water, gas and electricity—Garstang; miscellaneous — Hinckley.—Particulars of other works projected will be found on our "Local Government Board Inquiries" pages.

ADMINISTRATION.

Spilsby R.D.C.—The council have referred to the Sanitary Committee a letter received from the Local Government Board requesting the district council to take into consideration the question of making arrangements to secure the adequate discharge of the duties of inspector of nuisances in the district. In the board's opinion this object might be attained by the adoption of the following alternatives: (1) The appointment of a fully qualified assistant inspector of nuisances, to devote his whole time to his duties; (2) the appointment of an additional fully qualified officer, to devote his whole time to the duties of inspector of nuisances and sanitary surveyor for half the rural district, leaving the present officer to act in these capacities for the other half, or (3) the complete dissociation of the offices of inspector of nuisances and surveyor, and the appointment of a fully qualified inspector of nuisances, who would devote his whole time to the duties of that office, and be provided with some satisfactory means of conveyance, such as a motor cycle.

BUILDINGS.

Bognor U.D.C. The surveyor, Mr. O. A. Bridges, has been instructed to prepare plans of bathing cabins which it is proposed to erect westward of the Level Commissioners' groyne No. 23.

Brighton T.C.—The borough surveyor, Mr. H. Tillstone, has been instructed to prepare plans and specifications for providing a new lairage at the public abbattoir, at an estimated cost of £300.

Colwyn Bay U.D.C.—The council on Tuesday decided to carry out the scheme of improvements at Rhos-on-Sea, the work to be put in hand as soon as possible.

East Molesey U.D.C.—Application is to be made to the Surrey County Council for a grant towards the cost of a new bridge in substitution for the present "splash" bridge.

Folkestone T.C.—A scheme has passed the committee stage for the erection of a municipal bandstand on the face of the cliff, at an estimated cost of £20,000.

Hampton U.D.C. With special reference to the new hotel to be constructed on Tagg's Island of steel frame work and concrete slabs, a new by-law has, with the sanction of the Local Government Board, been passed by the council, which exempts such a building from the operation of the present by-laws, under which it could not be constructed.

Harrogate T.C. It has been agreed to erect a shelter, lavatories, and caretaker's house on Harlow Moor, at an estimated cost of £1,200.

Hartlepool T.C. Plans have been approved of a new school at Throston, estimated to cost £9,400.

Lewisham B.C. The Health Committee report that a suitable site for a tuberculosis dispensary has been purchased for £300. The inclusive estimated cost of the scheme is £1,000.

Liverpool T.C. The work of redecorating the town hall is to be proceeded with, at a cost of between £1,000 and £1,600.

Prestatyn U.D.C. The Local Government Board have intimated to the council that they approve generally of the proposals for the erection of public offices and a public hall at Prestatyn, but will defer sanctioning a loan for the purpose until the council have obtained tenders for the execution of the buildings, and have submitted to the board an amended estimate based on the lowest satisfactory tender (which should be provisionally accepted).

Rhyl U.D.C.—The council decided on Monday to extend the marine promenade for 200 yds. at once, and to ask the Local Government Board to sanction its being carried out before the inquiry in order to find work for the unemployed.

Stepney B.C.—The council have referred to a committee the question of the erection of a new town hall.

West Riding C.C.—The council have approved a revised scheme for establishing sanatoria for tuberculosis patients, at an estimated cost of £24,800.

HOUSING AND TOWN PLANNING.

Leamington T.C.—Steps are being taken to prepare a scheme for the provision of workmen's dwellings.

Neath T.C.—It has been decided to proceed with a housing scheme involving the erection of ninety-three additional workmen's dwellings.

ROADS AND MATERIALS.

Argyllshire C.C.—At the meeting of the Cowal District Committee last week consent was notified from the Standing Joint Committee and the county council to the borrowing of £10,000 for the execution of road repairs occasioned by the recent storm. Asked if the expenditure of £10,000 on the roads was absolutely a necessity, the surveyor said it was, and that he could have made it more. They were now forced to put sea walls where there were no walls before, because the roads had been encroached on so much.

Barnstaple R.D.C.—The council have adopted the following resolution, and forwarded it to other municipal authorities for the expression of their views thereon: "That this council submits that, in view of the grave damage which is being done to the roads (both main and district) by motor-lorry and traction-engine traffic, legislation should be immediately introduced whereby the wheels of the engines and vehicles should be of a width varying proportionately to the tonnage drawn by them. By this much of the evil which is now wrought to the roads will be done away with, and a great saving will thereby be effected to the already overburdened ratepayers."

Brighton T.C.—The Permanent Way Sub-Committee of the Tramways Committee recommend that the track in New England-road and Chatham-place be renewed with double and interlacing lines, at an estimated cost of £4,000.

Chard T.C.—The surveyor, Mr. E. W. Hearn, has been instructed to prepare plans and estimates for widenings in Frog-lane and Silver-street.

Chesterfield T.C.—Property is to be purchased to enable the council to construct a new street from the Market-place to Markham-road.

Eastbourne R.D.C.—Representatives have been appointed to attend a meeting of delegates of the town councils of Hastings, Bexhill and Eastbourne to see if any steps can be taken to construct a new coastal road between Eastbourne and Hastings.

Edinburgh T.C. By the offer of land on the part of the George Heriot's Trust the corporation will be enabled to practically double the width of Warrister-road from St. Mark's Bridge to the railway bridge over the Edinburgh and Granton Railway.

Exmouth U.D.C. With respect to the work in connection with the first section of the marine drive, the council have accepted the tender of Messrs. Wilson & Co., of Exmouth, at £2,789, for the construction of the new road, and the tender of the Stoneycombe Lime and Stone Company, at £588, for tar-macadam.

Halifax T.C. The council in committee have decided to give notice on the owners of property on the south side of Bull Green, from Barum Top to Regent-street, that it is intended to widen Bull Green to 60 ft.

Hampton U.D.C. A deputation is to meet, on the 27th inst., a sub-committee of the Highways Committee of the Middlesex County Council to discuss the proposal to wood-pave Thames-street.

Lewisham B.C.—The Works and Highways Committee have reported that the question of the repair

and maintenance of the roadways over certain railway bridges in the borough has been raised. Communications were made to the companies on the subject, and an agreement was completed with the South-Eastern and Chatham Railway Company, but the London, Brighton and South Coast Railway Company not only denied any liability for the maintenance of the roadway over Sydenham railway bridge and its approaches, but claimed that the council were liable to maintain the portion of the bridge constructed at the expense of the Lewisham District Board of Works under an agreement made in 1874 between the board and the company and an adjoining landowner. The matter being one of considerable importance, the committee have obtained counsel's opinion on the whole question, and they report that they are not prepared to recommend the council to accept the liability sought to be imposed upon them by the railway company.

Llantrisant and Llantwit R.D.C.—The tender of Messrs. Johnson Brothers, Gloucester, at £22,194, has been accepted for the construction of the road from Tonyrefail to Llantrisant, 8 miles in length.

Lynton U.D.C.—A new road is to be constructed from the station to Lynton, Colonel Lean, owner of a greater portion of the land (which he has gifted to the council) laying down the condition that the work should be done within four years, thus giving labour through the winters of that period.

Paddington B.C.—Lancaster Gate-terrace, Lancaster Gate, is to be paved with wood at a cost of £1,860.

Teddington U.D.C.—For private street works the tenders of Messrs. J. Mowlem & Co. have been accepted, at £429 for High-street, and £162 for Twickenham-road.

Twickenham U.D.C.—Application is to be made to the Road Board for a grant of one-half of the cost (£6,250) of wood paving St. Margaret's-road, and the Middlesex County Council are also to be asked to contribute for this and a proposed widening of the road.

Wednesbury T.C.—Application has been made to the Road Board for a grant in aid of a proposed expenditure of £1,355 for street improvement purposes in Meeting-street, and for a grant in aid of the expenses of rounding off the corner at the junction of Camp-lane with Holyhead-road.

West Riding C.C.—It is proposed to spend £7,000 in the coming year on tar spraying, and the council hope to recover £2,500 of that amount from the Road Board.

Winchester T.C.—A new roadway is to be constructed between Owen's-road and Cranworth-road, at an estimated cost of £435.

SEWERAGE AND SEWAGE DISPOSAL.

Balby-with-Hexthorpe U.D.C.—Plans have been approved and submitted to the Local Government Board for extending and improving the sewage disposal works.

Banbury T.C.—The scheme of Messrs. Willcox & Raikes, who had been consulted for the provision of new sewerage and sewage disposal works for the borough, has been presented to the council, as well as the report of the special committee appointed to investigate the alleged pollution of the Cherwell, and the observations which the borough surveyor, Mr. N. H. Dawson, had been asked to make on the latter report. The reports are being considered by a committee.

Barnsley T.C.—It was decided at the council meeting on Tuesday to serve notices for the provision of the water-carriage system at sixty-four houses. Alderman Holden, chairman of the Sanitary Committee, said the cause of the high death rate had been repeatedly attributed to the out-of-date ashpits.

Barnstaple R.D.C.—It is proposed to carry out drainage works at Parracombe, at an estimated cost of £150.

Camberwell B.C.—With the consent of the London County Council, the Public Health Committee recommend this council to construct a public convenience on Goose-green, at an estimated cost of £900. The estimated cost of maintenance, including the necessary attendants, is £290 per annum.

Felixstowe U.D.C.—The tender of Mr. H. S. Wallis, of Walton, at £315, has been accepted for the alteration of the Sea-road convenience.

Hartley Wintney (Hants) R.D.C.—On the 9th inst. the council considered the report and plans for improving the existing sewerage system and sewage disposal works, and for extending the latter, submitted by Mr. T. J. Moss-Flower, C.E., F.R.SAN.I., 28 Victoria-street, Westminster, S.W., and Bristol. The work is rendered necessary to meet the complaints of the Thames Conservators as regards the unsatisfactory character of the effluent from the existing sewage works. The work involves the carrying out of a considerable amount of detail drainage in order to exclude from the sewers as much of the rainwater from roofs and paved surfaces as possible, and the construction of detritus and screening chambers, overflow chambers, upward flow tank, circular percolating filters, humus tanks, fine grain filters and modification of the existing septic tanks, the conversion of some of the existing contact beds into storm tanks, the construction of sludge beds, engine-house, sludge and sewage wells, the provision of an engine and pump for raising sludge and for lifting the storm water for treatment, and other incidental works.

Holywell U.D.C.—Plans have been approved of the proposed sewage disposal works, to be erected at an estimated cost of £2,800.

Meriden R.D.C.—Preliminary inquiries are to be made as to contours and levels, with a view of dealing with the sewage of Coleshill.

WATER, GAS, AND ELECTRICITY.

Carstang R.D.C.—It was reported to the council at the last meeting that the engineer of the Fylde Water Board was preparing a scheme for a water supply for Pilling, Winmarleigh, and Cockerham.

Cork T.C.—The city engineer has received instructions to prepare a report with respect to the condition of the water pipes. At the meeting of the Waterworks Committee a section of a water pipe was submitted for inspection, and was found to be completely choked. Answering a question, the city engineer stated that he could not say how many miles of water pipes would require renewal, and how many would stand cleaning. They ought to change 1 or 2 miles of the pipes each year.

East Stirlingshire C.C.—A report is to be obtained as to the practicability of continuing the laying of the 6-in. main into Avonbridge, at an estimated cost of £1,080.

Edinburgh T.C.—The town clerk has been instructed to prepare a report on the general question of supplying electricity to suburban districts, and to have a conference with the military authorities on the subject of supplying electric power to Redford Barracks.

Hampton U.D.C.—As an amendment to the contract with the Hampton Court Gas Company for street lighting, it has been agreed that the amount to be charged or allowed (originally agreed at 1s. 3d.) on each lamp in the event of a rise or fall in the price of gas charged to private consumers shall be 1s. 1d. for each penny rise or fall.

Hayfield and Mellor R.D.C.—For the provision of a water supply for Mellor the council concluded subject to the sanction of the Local Government Board, to purchase the water undertaking of Mr. F. C. Arkwright, of Willersley Castle, a local landowner, and to borrow £7,600 for the purposes of a water supply, including the purchase of those works. But the Local Government Board have written to say that, as matters stand at present, they do not feel justified in giving the sanction asked for, and they will not be in a position to consider the application further unless the owner of the undertaking agrees, under reasonable conditions, to the yielding capacity of the proposed source being tested and found efficient. As Mr. Arkwright declines to do anything further, the matter is considered to be at an end.

Malvern U.D.C.—It was reported at a recent meeting that Sir Corbet Woodall inspected the gas-works on December 14, and expressed himself highly pleased with everything he saw. He said that for an undertaking of its kind it was the best he had seen, and in excellent order. He explained that the council's difficulties in connection with the gas arose from want of pressure, due to the obsolete nature of the mains. Whereas now nothing less than 4-in. mains were ever used, many of the mains in the urban district measured only 3 in., and some only 2 in. Sir Corbet Woodall adds that to put in a new gas-holder, as had been suggested, would undoubtedly solve their difficulties, but it would be a costly solution, and he should not recommend it.

Southmolton R.D.C.—A scheme for the provision of a water supply for Bishopsnympton has been referred to the Bishopsnympton Parish Council.

Stourport U.D.C.—The Local Government Board's sanction has been received to the application to raise a loan to obtain a water supply from Bewdley. For thirty-three years Stourport received its water supply from the Kidderminster Corporation, which strongly opposed Stourport's application to go to Bewdley.

Sutton-in-Ashfield U.D.C.—Messrs. Hodson, of Loughborough, have received instructions to prepare plans and specifications for the duplication of certain waterworks plant and mains.

West Hartlepool T.C.—Progress is being made with the scheme for the generation of electricity from waste heat. It is expected that the plant which has been put down to utilise the exhaust steam at the Seaton Carew Ironworks will be in going order by the end of February. There will then be a great increase in the capacity and output of the corporation's electricity undertaking.

York T.C.—The electrical equipment of the tramways extension to South Bank is to be carried through by the council's own staff, at an estimated saving of £353 over the lowest tender received.

MISCELLANEOUS.

Cheam P.C.—The Local Government Board have informed the council that they are prepared to sanction a loan for a motor fire engine provided a parish meeting support the resolution of the council.

Hinckley U.D.C.—Application has been made by the council to the Local Government Board for sanction to the following loans—viz., £5,800 for a new outfall sewer, and £4,330 for the erection of 18 workmen's dwellings, the laying out of a small recreation ground, and the construction of a new road. The council have instructed the surveyor to put down an experimental trickling filter bed at the sewage disposal works for the purposes of ascertaining the most suitable biological treatment of the town's sewage.

Hampton U.D.C.—Prices are being obtained from various firms for a new horsed fire escape.

Manchester T.C.—The Parks and Cemeteries Committee recommend the council to proceed with the levelling of the old infirmary site, and to sow the ground with grass seed. It was further agreed that two cross paths should be constructed, the expenditure on the whole not to exceed £1,000.

Newcastle-on-Tyne T.C.—A new fire engine, similar to that obtained some time ago, has been purchased. It consists of 50-horse power motor tender, fire escape, and chemical cylinder combined, and was supplied by Messrs. Dennis Brothers, Guildford.

Nottingham T.C.—Property is to be purchased for £850 for the extension of the depot at Bulwell.

Oldham T.C.—At a recent meeting of the Surveying and Building Committee, Mr. Jessop, superintendent of the flag-making department, reported that he had received a communication from the Budapest town authorities asking for certain information with regard to the flag-making department of the corporation, and stating that they intended to send men over to visit and study the workings on the spot, and asking if the corporation would grant facilities to allow them to see the works, &c. Mr. Jessop said he had sent the information, and the committee decided to grant the necessary facilities to the party. Mr. Jessop said he had had a similar request from Johannesburg before.

Paddington B.C.—The Works Committee have reported that they have received replies from the various other committees that they were not able to submit any work for execution by the unemployed. In the case of the Paddington Recreation Ground Committee they were informed that they submitted work to the General Body, but that a reply was received regretting the scheme (paddling banks of the track and alterations in connection with the bowling green) were not such as could properly be added by them. They had considered the representations of the recent deputation, and had directed the borough surveyor, Mr. L. B. B. Newton, ASSOC.M.INST.C.E., to proceed without delay with certain painting and small granite-sett paving works, the cost of which was covered by the annual votes. They had also authorised the chairman and the [illegible] to instruct the borough surveyor to put in hand any other works which could be expedited.

PERSONAL.

Mr. E. J. Lovegrove, borough engineer and surveyor of Hornsey, had his residence broken into and ransacked by burglars during his and his family's absence at Bournemouth lately.

Mr. J. F. Gamble, late pupil to the city engineer of York, has been appointed junior assistant. Having made a special study of cement, he has been placed in charge of the testing department.

Sir George Gibb, chairman of the Road Board, will be among the guests at the annual dinner of the Institute of Sanitary Engineers, to be held at the Holborn Restaurant on Monday, February 3rd.

Mr. W. S. Woodcock, surveyor to the Oakham Rural District Council, has been unanimously voted an increase of his salary to £160 a year, with an allowance of £40 towards his travelling expenses.

Mr. P. C. Woodhall, borough surveyor of Blandford, has been granted an honorarium, equivalent to 4 per cent on the contract, for his extra services in connection with the alterations, additions and repairs to the town hall and municipal buildings.

Messrs. N. McK. Barron, city waterworks engineer, Lincoln, and T. Salkield, chief engineer, Delhi Municipality, have been elected members, and H. J. F. Gourley, Westminster, A. A. McLintock, city engineer's office, Cranbrook, British Columbia, and J. R. Richardson, town hall, Adelaide, associate members of the Institution of Civil Engineers.

Mr. Rowland G. Allanson-Winn, M.INST.C.E., has succeeded to the title of Lord Headley, whose death was announced on Tuesday last. Mr. Allanson-Winn is well known as an authority on coast erosion, and as the author of the excellent book on the subject—"Coast Erosion and Remedial Works"—published by the St. Bride's Press, Limited. He is the first cousin of the late baron.

Mr. T. G. Newcomen, at present on the staff of the engineer and surveyor to the Finchley Urban District Council, has been successful in obtaining an appointment as chief assistant to Mr. H. C. Fread, A.R.I.B.A., surveyor to the Urban District Council of Esher and the Dittons. Mr. Newcomen has passed the examinations of the Institution of Municipal and County Engineers and the Professional Associateship of the Surveyors' Institution.

Mr. J. H. Drew, M.INST.C.E., M.R.SAN.I., engineer and surveyor to the Wath-upon-Dearne Urban District Council, has been appointed engineer for the council's new waterworks and sewage disposal scheme, estimated to cost from £18,000 to £20,000. In recognition of the extra services involved the council have advanced his salary £150 a year for the next four years, and this will not interfere with his usual increase, which will bring his salary to a maximum of £340 in 1915.

Mr. F. J. Marriner, chief clerk in the department of Mr. E. J. Lovegrove, M.INST.C.E., borough engineer and surveyor of Hornsey, has resigned his position, having been offered an appointment with a City company. Mr. Marriner, who is very popular at Hornsey, will be entertained at dinner on the 23rd inst. by his colleagues and friends, when an opportunity will be taken to present him with an illuminated address and a cabinet of plate, which will carry with them his colleagues' united good wishes for success in the new sphere he has chosen.

Mr. H. H. Hyslop, chief clerk to the Camberwell Borough Council, has resigned his position after thirty-three years of service. He has been chiefly concerned with the collection from owners of the charges for making up new streets, and it is an interesting side-light on the extent to which the district is developed that Mr. Hyslop has collected, in his period of service, approximately £322,000 for paving charges, a task involving much litigation. There have been 2,500 summonses, and many actions in the High Court. The streets taken over number 427, and their length reaches 55 miles.

Mr. H. Riding, surveyor to the Croston (Lancs) Urban District Council, read a paper on "The Municipal Works of Croston" recently at a local meeting of the North-Western Centre of the Sanitary Inspectors' Association. Among other things the author of the paper stated that at Croston gas was formerly supplied by a private company at 7s. 6d. per 1,000 cub. ft. The company never paid a dividend.

The original capital was £1,300, and the undertaking came into the council's hands twenty-five years ago for £400. Gas was now supplied at 3s. 9d. per 1,000 cub. ft. for lighting and 3s. 3d. for cooking.

Mr. Edward Sandeman, M.INST.C.E., who has been engaged for the past twelve years on the construction of the Derwent Valley waterworks, which were opened in September last, and who has had altogether over thirty years' experience in municipal work and works of water supply, has commenced private practice at 17 Victoria-street, Westminster, S.W., his intention being to apply himself in particular to works of water supply and drainage, and matters connected therewith. Mr. Sandeman was the designer and constructor of the Burrator masonry dam and works for the water supply of Plymouth. As is well known, he was responsible for the design and construction of the Derwent Valley waterworks, the cost of which amounted to £3,350,000.

The approaching marriage of Mr. R. J. Thomas, the president of the Institution of Municipal and County Engineers, will be the occasion of an interesting function in London on Friday, February 7th, when a presentation, subscribed for by the members of the institution, will be made to him at a dinner to be held on that date. Mr. A. D. Greatorex, borough engineer of West Bromwich, will preside over the gathering.

INSTITUTION OF MUNICIPAL AND COUNTY ENGINEERS.

President—Mr. R. J. THOMAS, M.INST.C.E., County Surveyor, Buckinghamshire.

WEST MIDLAND DISTRICT.

A meeting of the District Committee is to be held at Birmingham on Thursday next, the 23rd inst.

PROGRAMME.

5 p.m.—Meet at the Council House, Birmingham. Consider the recent report of the Departmental Committee of the Local Government Board on Intercepting Traps in House Drains.

The discussion will be opened by Mr. E. B. Savage, ASSOC.M.INST.C.E. (Birmingham), and Mr. A. J. Dickinson (Redditch).

The Executive Committee are desirous of holding evening meetings during the winter months for the discussion of matters of professional interest, and it is hoped there will be a good attendance of members on this occasion.

F. C. COOK, A.M.INST.C.E., *Hon. District Secretary*, Municipal Offices, Nuneaton.

A. T. DAVIS, M.INST.C.E., *District Chairman*, County Surveyor, Shropshire.

EASTERN DISTRICT.

A meeting of the Eastern District will be held in Westminster at the New Middlesex County Council Buildings and Lyon's Victoria Mansions Restaurant, on Friday, February 7th.

EAST MIDLAND DISTRICT.

The East Midland District meeting at Newark, fixed for Saturday, February 8th, has been altered to Saturday, February 15th.

SOUTHERN DISTRICT MEETING.

A meeting of the Southern District will be held at Southampton on Saturday, February 22nd next.

NORTH-EASTERN DISTRICT.

A meeting of the institution will be held in the North-Eastern District at Newcastle-on-Tyne on May 2nd and 3rd next.

ANNUAL MEETING AND TOWN-PLANNING CONFERENCE.

The Fortieth Annual General Meeting and Conference with delegates from local authorities on Housing and Town Planning will be held at Great Yarmouth on July 23rd, 24th, 25th and 26th next. Those desirous of reading papers at either of these meetings are requested at once to communicate with me.

APRIL, 1913, EXAMINATIONS.

The next examination will be held in London at the Examination Hall, Queen-square, W.C., on April 10, 11 and 12, 1913.

Candidates who have received permission from the council to sit for examination, and who are desirous of entering their names for the April examination, should do so at the earliest possible date as accommodation is limited. The latest date for the receipt of entries is February 1st.

Examinations will also be held in India and Africa probably on the same date.

Notice is hereby given that, under the provisions of by-law 14, nominations for the council of 1913-14 must be received by me not later than February 1, 1913.

Each member or Associate member of the institution is entitled to nominate one member or associate member for the council. Nominations must be accompanied by the consent of the nominee.

By order of the Council,
THOMAS COLE,
11 Victoria-street, S.W. *Secretary.*

INSTITUTION OF MUNICIPAL ENGINEERS.

President—Mr. FRANK LATHAM, M.INST.C.E.I., F.S.E., Borough Engineer and Surveyor, Penzance

COUNCIL MEETINGS.

The next council meeting will be held at 39 Victoria-street on Wednesday, January 29th, at 6 o'clock. The following council meetings have been arranged: February 22nd, Newcastle-on-Tyne; March 26th, London; April 30th, London; May 31st, Manchester; June 28th, London; July 30th, London.

SOUTHERN DISTRICT.

A visit will be paid, by kind permission of the authorities, to the Royal Arsenal, Woolwich, on Thursday, January 30th. Members will meet at the main gates of the Arsenal, Beresford-square, at 2 o'clock sharp, and the hon. secretary, Mr. Arthur Palmer, Town Hall, Greenwich-road, Greenwich, S.E., requests that those intending to be present will notify him by the 25th inst., in order that the necessary arrangements as to guides may be made. Members of other districts of the institution are, of course, cordially invited to attend, and the opportunity to visit these colossal workshops is one that should appeal strongly to all.

WESTERN DISTRICT.

A meeting (of which full programme will be issued later) will be held at Birmingham on Saturday, February 8th or 15th.

GENERAL MEETING.

A visit will be paid to the Building Exhibition at Olympia on April 12th, by kind permission of the promoters. Full particulars will be issued later.

B. WYAND,
39 Victoria-street, S.W. *Secretary.*

INSTITUTE OF SANITARY ENGINEERS.

President—Mr. H. PERCY BOULNOIS, M.INST.C.E., F.R.SAN.I.

SESSIONAL MEETINGS.

Sessional meetings of the Institute of Sanitary Engineers, to be held at Caxton Hall, Westminster, have been arranged as follows:—

January 20th.

Presidential address by Mr. H. Percy Boulnois, M.INST.C.E., past-president Institution of Municipal and County Engineers, chairman of council, Royal Sanitary Institute. Mr. A. J. Martin, M.INST.C.E., &c. (past-president), will take the chair at 8 p.m.

February 3rd.

Annual dinner at the Holborn Restaurant. Reception at 6.30. The president will take the chair at 7 p.m.

February 5th.

"Reminiscences of a Municipal Engineer," by Mr.

Cuthbert Brown, ASSOC.M.INST.C.E., Engineer and surveyor, Edmonton Urban District Council.

February 17th.

"A Plea for Scientific Research in the Field of Sewage Purification," by Mr. A. J. Martin, M.INST.C.E., F.G.S.

March 17th.

"The Dwelling House," by Dr. S. C. Lawrence, medical officer of health, Edmonton Urban District Council.

April 2nd.

"Heating and Ventilation," by Mr. Arthur H. Barker, Lecturer on Heating and Ventilation to University College, London, and the London County Council. Mr. A. H. McFerran, chief engineer, H.M. Office of Works, in the chair.

April 21st.

"House Drainage on the Continent," by Mr. Frank R. Durham, ASSOC.M.INST.C.E.

May 19th.

"Micro-Organisms and Public Health," by Dr. H. R. Kenwood, Chadwick Professor of Hygiene and Public Health in the University of London, medical officer of health for the County of Bedford and for the Metropolitan Borough of Stoke Newington.

APPOINTMENTS VACANT.

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BRIDGE AND ROAD SURVEYOR.—January 18th.—Devon County Council. £400 per annum.—Mr. F. Bailey, clerk, The Castle, Exeter.

CLERK OF WORKS.—January 18th.—Corporation of Banbury.—Mr. A. Stockton, town clerk.

ROAD FOREMAN. — January 18th. — Caerphilly Urban District Council. £2 per week.—Mr. William Spickett, clerk.

ROAD FOREMAN.—January 20th.—Stourbridge Urban District Council. 35s. per week, with house. Mr. Fredk. Woodward, surveyor.

FOREMAN.—January 20th.—Corporation of Beccles. 28s. per week.—Mr. C. L. Hamby, borough surveyor.

SURVEYOR AND INSPECTOR OF NUISANCES. —January 20th.—Standish-with-Langtree Urban District Council. £100 per annum.—Mr. J. H. Richards, clerk.

INSPECTOR OF NUISANCES.—January 21st.—Northleach (Glos.) Rural District Council. £80 per annum.—Mr. J. H. Stephens, clerk.

SEWAGE WORKS MANAGER.—January 22nd.—Harpenden Urban District Council. — Mr. C. S. Tuckey, clerk, High-street, Harpenden.

INSPECTOR OF NUISANCES. — January 22nd.—Twickenham Urban District Council. £140 £170.—Mr. H. J. Saunders, town clerk.

SANITARY INSPECTOR.—January 23rd.—Islington Borough Council. £148—£184.—Mr. W. F. Dewey, town clerk.

SURVEYOR'S JUNIOR ASSISTANT. — January 23rd. — Corporation of Worthing. £85—£110 per annum.—Mr. W. Verrall, town clerk.

INSPECTOR OF NUISANCES.—January 24th.—Sevenoaks Rural District Council. £150 per annum. —Mr. F. H. Vibert, clerk.

ENGINEERING ASSISTANT. — January 25th.—Corporation of Swansea. £160 per annum. Borough Engineer.

ENGINEERING ASSISTANTS.—January 27th.—For municipal engineer's staff in a large town in the Midlands. £130—£150.—BOX 1,212, THE SURVEYOR, 24 Bride-lane, Fleet-street, London, E.C.

WORKING SUB-FOREMEN OR GANGERS.—January 27th.—Hampshire County Council. 30s.—40s. per week.—Mr. W. J. Taylor, county surveyor, The Castle, Winchester.

SURVEYOR'S JUNIOR CLERK.—January 27th.—Woking Urban District Council. 25s. per week.—Mr. Robert Mossop, clerk.

ASSISTANT WATER ENGINEER.—January 27th. —Corporation of Richmond (Surrey). £250 per annum. Mr. Henry Sagar, town clerk.

CLERK OF WORKS. — January 27th. — West Suffolk County Council.—Mr. W. Lionel Jenkins, county surveyor.

SANITARY INSPECTOR. -January 27th.—Corporation of the City of London. £150 - £250.—Town Clerk, Guildhall.

ENGINEERING ASSISTANT. — January 27th.—Corporation of Birmingham. £150 per annum.—Mr. Henry E. Stilgoe, city engineer and surveyor.

ASSISTANT INSPECTOR OF NUISANCES.—February 1st.—Corporation of Reading. £80—£100.—Mr. W. S. Clutterbuck, town clerk.

ENGINEERING ASSISTANT. — February 1st.—Watford Urban District Council. £80—£100. — Mr. W. Hudson, clerk and solicitor.

CLERK OF WORKS. — February 3rd. — Alsager Urban District Council. £2 per week.—Mr. H. V. Lynam, surveyor.

ASSISTANT ENGINEERS. — May 1st.—Indian Public Works and State Railway Departments.—Secretary, Public Works Department, India Office, London, S.W.

ASSISTANT ENGINEER.—Public Works Department of the Federated Malay States. £360—£480, with allowances.—Messrs. Gregory, Eyles, & Waring, 12 Dean's-yard, Westminster.

DIVISIONAL ENGINEER.—Public Works Department of the Government of Jamaica. £400—£500. —Crown Agents for the Colonies, Whitehall-gardens, London, S.W. Quote M.5791 on left-hand top corner of application.

SECOND-CLASS OVERSEER.—Public Works Department of Hong Kong. £165—£225.—Crown Agents for the Colonies, 4 Whitehall-gardens, London, S.W. Quote M.5627 on left-hand top corner of application.

SURVEYOR'S JUNIOR ASSISTANT.—No date.—Derbyshire County Council. £80—£120 per annum. County Surveyor, County Offices, Derby.

MUNICIPAL COMPETITIONS OPEN.

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SWAFFHAM.—January 25th.—Plans, specifications and estimates for workmen's dwellings, for the rural district council. A premium of £10 is offered to the selected plan.—Mr. Sydney Matthews, clerk.

JAMAICA.—January 31st.—Plans for municipal buildings to cost £9,000. A premium of £100 is offered. Messrs. Young, Limited, 60 Fenchurch-street, London, E.C.

HEMEL HEMPSTEAD.—January 31st.—Design for a housing scheme, comprising twenty-five houses, for the town council.—Mr. A. E. Usher, town clerk.

HARROGATE.—February 3rd.—Designs for a council school, for 675 children.—Mr. C. E. Rivers, ASSOC.M. INST.C.E., borough engineer.

DUBLIN.—February 6th.—Designs for municipal buildings for the corporation. The proposed expenditure is £50,000, and the author of the design placed first will be appointed to carry out the scheme on a 5 per cent basis. Premiums of £150 and £100 are offered. The assessor is Mr. Albert E. Murray, F.R.I.B.A. —The Town Clerk.

RANGOON.—March 1st.—Designs for municipal buildings. Premiums are offered of £300, £200, and £100.—The Clerk to the Rangoon Municipality.

WINNIPEG.—March 1st.—Designs for city hall. Limited to British architects in Canada. Premiums are offered of 5,000 dols., 3,000 dols., and 2,000 dols.—The Clerk.

MUNICIPAL CONTRACTS OPEN.

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Buildings.

SHERINGHAM.—January 20th.—For the construction of retaining walls, promenade and shelter, for the urban district council.—Mr. Edgar C. Rolfe, clerk.

SOUTHAMPTON.—January 20th.—For extension of retaining wall, for the county council.—Mr. H. Barber, clerk, The Castle, Winchester.

SHEFFIELD.—January 20th.—For works at two public schools, and erection of retaining walls, for the Education Committee.—Mr. G. S. Baxter, secretary.

CHESTER.—January 20th.—For the erection of isolation hospital, for the Committee of Visitors.—Mr. A. Hornby, clerk, Upton Asylum, Chester.

WESTHOUGHTON.—January 20th.—For the erection of steam roller shed and additions to stables, for the urban district council.—Mr. Thomas Partington, clerk.

GLASGOW.—January 20th.—For the erection of bathrooms at Tradeston gasworks, for the corporation.—Mr. J. Lindsay, town clerk.

ST. HELENS.—January 21st.—For the erection of a school, for the Education Committee.—Mr. P. Sharp, secretary, 17 Cotham-street, St. Helens.

CARDIFF.—January 21st.—For the erection of two public conveniences, for the corporation.—The Town Clerk.

KEIGHLEY.—January 21st.—For the foundation masons' work in connection with the erection of a gasholder, for the corporation.—Mr. W. Baillie, gas engineer.

HEREFORDSHIRE.—January 21st.—For the construction of a bridge over the Sapey Brook, for the Roads and Bridges Committee.—Mr. G. H. Jack, county surveyor, Shire Hall, Hereford.

KENT.—January 21st.—For widening a bridge, for the county council.—Mr. F. W. Ruck, county architect, Maidstone.

EAST SUFFOLK.—January 22nd.—For the construction of a temporary bridge, for the county council.—Mr. H. Miller, county bridge surveyor.

HOVE.—January 22nd.—For building boundary wall, for the corporation.—Mr. H. Endacott, town clerk.

BIRMINGHAM.—January 22nd.—For the construction of three bridges, for the corporation.—Mr. Henry E. Stilgoe, city engineer and surveyor.

LEEDS.—January 22nd.—For extensions to certain schools, for the Education Committee.—Education Department, Culverley-street.

WARRINGTON.—January 23rd.—For terrazzo work, for the corporation.—Borough Surveyor.

WEST RIDING.—January 24th.—For alterations and additions to a school, for the Education Committee.—Mr. F. A. Darwin, County Hall, Wakefield.

DARLINGTON.—January 24th.—For the erection of a coal store, retort bench, foundations and retaining walls, for the corporation.—Mr. H. G. Steavenson, town clerk.

HARROW-ON-THE-HILL.—January 25th.—For the erection of public offices, for the urban district council.—Mr. J. P. Bennetts, surveyor.

IPSWICH.—January 27th.—For building concrete intake chamber and other works, for the corporation.—Mr. F. Ayton, Constantine-road.

DUNOON.—January 27th.—For repair of sea wall and promenade, for the town council.—Mr. William Rodger, burgh engineer.

SAFFRON WALDEN.—January 27th.—For the erection of a brick water tower, for the corporation.—Mr. A. H. Forbes, borough surveyor.

SUSSEX.—January 28th.—For the erection of a county high school for girls, for the county council.—Mr. L. Thompson, secretary, Education Committee, High-street, Worthing.

ESSEX.—January 28th.—For the widening of Springfield Bridge at Chelmsford, for the county council.—Mr. Percy J. Sheldon, county surveyor, Chelmsford.

HEREFORD.—January 30th.—For alterations at a public school, for the corporation.—Mr. Arthur Holt, town clerk.

ST. HELENS.—January 31st.—For the erection of a public library, for the corporation.—Mr. W. H. Andrew, town clerk.

EGYPT.—February 1st.—For the erection of pumping station buildings at Kafr el Gamus, for the Public Works Ministry.—Controller-General, Main Drainage Department, Public Works Ministry, Cairo.

MEXBOROUGH.—February 3rd.—For extensions to the electric power station, for the urban district council.—Mr. J. W. Hattersley, clerk.

Iron and Steel.

TADCASTER.—January 18th.—For laying water main, for the rural district council.—Mr. Geo. A. Bromet, clerk.

MANCHESTER.—January 21st.—For the sale by the corporation of scrap materials.—Mr. Thomas Hudson, town clerk.

SOUTHGATE.—January 21st.—For the supply of unclimbable fencing, for the urban district council.—Mr. C. G. Lawson, surveyor.

PLYMPTON.—January 22nd.—For the supply of cast-iron water mains, for the rural district council.—Mr. F. A. Clark, engineer and surveyor, 83 Old Town-street, Plymouth.

MADRAS.—January 22nd.—For the supply of English stoneware pipes and specials, varying from 4 in. to 21 in. internal diameter, and aggregating a length of about 165 miles, for the corporation.—Messrs. James Mansergh & Sons, agents, 5 Victoria-street, Westminster.

MANCHESTER.—January 24th.—For a cast-iron water tank, steel stanchions, girder, and joists, to be erected at the Ancoats pumping station, for the corporation.—Mr. Thomas Hudson, town clerk.

ELLESMERE.—January 31st.—For providing and laying 9,000 yds. of 4-in. and 3-in. cast-iron mains, sluice valves, fire hydrants and air valves, for the rural district council.—Mr. H. R. Giles, clerk.

BOMBAY.—February 18th.—For supplying and laying about 19 miles of 50-in. diameter steel main, for the municipality.—Mr. H. J. Trivess Smith, hydraulic engineer, Municipal Offices, Bombay.

Roads.

HALIFAX.—January 18th.—For private street works, for the corporation.—Mr. J. Lord, borough engineer.

NORFOLK.—January 18th.—For the supply of road-men's tools and implements, for the county council.—Mr. T. H. B. Heslop, county surveyor.

NORFOLK.—January 18th.—For the supply of granite, for the county council.—Mr. T. H. B. Heslop, county surveyor.

HAILSHAM.—January 18th.—For the supply of granite, stone, flints, beach, and cartage, for the rural district council.—Mr. Edmund Catt, clerk.

ESSEX.—January 18th.—For the supply of broken granite, for the county council.—Mr. Percy J. Sheldon, county surveyor, Chelmsford.

FLINT.—January 18th.—For the supply of road material, tar macadam and cartage, for the county council.—Mr. Sam Evans, county surveyor, Mold.

BANBURY.—January 20th.—For the supply of Hartshill stone, for the corporation.—Borough Surveyor.

ROMFORD.—January 20th.—For the supply of blue Guernsey hand-broken granite, for the urban district council.—Mr. T. Turvey, surveyor.

HEBDEN BRIDGE.—January 21st.—For works of paving, for the urban district council.—Mr. T. Waddingham, surveyor.

SALOP.—January 21st.—For the formation of a new road, for the county council.—Mr. F. Crowte, clerk.

SURREY.—January 21st.—For the supply of high-class granites, basalts, limestone, slag, tar-macadam, bitumen, pitch, tar, and tar oils, for the county council.—Mr. A. Dryland, county surveyor.

SKIPTON.—January 21st.—For the supply of highway materials, for the rural district council.—Mr. A. Rodwell, surveyor.

WORTHING.—January 22nd.—For laying wood paving, for the corporation.—Mr. F. Roberts, borough surveyor.

EAST GRINSTEAD.—January 22nd.—For making up a road, for the rural district council.—Mr. F. S. White, clerk.

RHONDDA.—January 23rd.—For the supply of granite or basalt macadam and limestone macadam, for the urban district council.—Mr. W. J. Jones, engineer and surveyor.

NEWPORT (Mon.).—January 23rd.—For the construction of roads and sewers, for the corporation.—Mr. Albert A. Newman, town clerk.

SKIPTON.—January 23rd.—For making up certain streets, for the urban district council.—Mr. Richard Wilson, clerk.

OLDHAM.—January 23rd.—For making up certain streets, for the corporation.—Mr. J. H. Hallsworth, town clerk.

NORTHAMPTONSHIRE.—January 25th.—For the supply of broken granite, for the county council.—Mr. C. S. Morris, county surveyor.

ESSEX.—January 25th.—For the supply of Norway granite kerb and setts, for the county council.—Mr. P. J. Sheldon, county surveyor, Chelmsford.

WANDSWORTH.—January 25th.—For the purchase from the council of a Leyland patent steam motor wagon fitted with interchangeable tipping body and 1,000-gallon tank.—Mr. P. Dodd, borough engineer.

SHEFFIELD.—January 27th.—For the supply of 2,000 tons of Portland cement, and from 8,000 to 10,000 super. yds. of natural flags, for the corporation.—Mr. R. M. Prescott, town clerk.

SLEAFORD.—January 27th.—For the supply of granite and slag, for the rural district council.—Mr. E. Clements, clerk.

PRESTWICH.—January 27th.—For the supply of granite setts, for the urban district council.—Mr. Lewis A. Orford, clerk.

BURGESS HILL.—January 27th.—For the supply of tar for roads, for the urban district council.—Mr. A. F. Hardwick, clerk.

WHITLEY AND MONKSEATON.—January 27th.—For street improvement works, for the urban district council.—Mr. Augustus Whitehorn, 60 Saville-street, North Shields, clerk.

SCUNTHORPE.—January 29th.—For making up a certain street, for the urban district council.—Mr. W. M. Hett, clerk.

BRACKLEY.—January 30th.—For the supply of granite, for the corporation.—Mr. C. E. Barnes, town clerk.

SOUTHEND-ON-SEA.—January 30th.—For the construction of the Western Esplanade extension (section No. 3), for the corporation.—Mr. H. J. Worwood, town clerk.

DOWNHAM.—January 31st.—For the supply of road materials, for the rural district council.—Mr. H. R. B. Wayman, clerk.

WORCESTERSHIRE.—January 31st.—For the supply of 50,000 tons of granite and 10,000 tons of tar macadam, for the county council.—Mr. C. E. Getfings, county road surveyor.

BEXHILL.—January 31st.—For the supply of distilled tar, or Tarvia, for the corporation.—Mr. T. E. Rodgers, town clerk.

SOMERSET.—February 1st.—For steam rolling and scarifying main roads, for the county council.—Mr. H. T. Chapman, county surveyor.

SOMERSET.—February 1st.—For surface tarring on main roads, for the county council.—Mr. H. T. Chapman, county surveyor.

SOMERSET.—February 1st.—For the supply of broken granite or basalt, for the county council.—Mr. H. T. Chapman, county surveyor.

SOUTH STONEHAM.—February 1st.—For the supply of 2,000 tons of granite, for the rural district council.—Mr. E. T. Westlake, clerk, 20 Portland-street, Southampton.

LANCASHIRE.—February 3rd.—For the supply of 11,000 tons of 4-in. by 5-in. granite setts, and 2,000 tons of 4-in. by 4-in. granite cubes, for the county council.—Mr. Harcourt E. Clare, clerk.

WATFORD.—February 4th.—For the supply of distilled tar, for the urban district council.—Mr. D. Waterhouse, engineer.

MIDDLESEX.—February 5th.—For the supply of 12,000 tons of hand-broken basalt, for the county council.—Mr. H. T. Wakelam, county engineer, 63 Victoria-street, Westminster, S.W.

HERTFORDSHIRE.—February 5th.—For the supply of broken granite and slag, for the county council.—Mr. Urban A. Smith, county engineer.

MIDDLESEX.—February 5th.—For the supply of basalt and chippings, and the cartage of road materials, for the county council.—The Clerk, 65 Victoria-street, Westminster, S.W.

CLAYTON (Suffolk).—February 6th.—For the supply of granite, pit, and picked stones, for the rural district council.—Mr. R. M. Cook, clerk, 6 Providence-place, Ipswich.

CORK.—February 13th.—For supplying and laying bituminous or other similar stone-surfacing materials, for the county council.—Mr. F. W. McCarthy, town clerk.

CORK.—February 13th.—For laying certain streets with Trinidad Lake asphalt-macadam, similar to that laid for the London County Council on the Victoria Embankment, for the corporation.—Mr. F. W. McCarthy, town clerk.

LITTLE HULTON.—February 24th.—For the supply of broken granite, grit setts, granite setts, granite and limestone chippings, and grit kerbs, for the urban district council.—Mr. J. H. Heyes, clerk.

TANGIER.—April 10th.—For the construction of a sewer and a road, for the Special Committee of Public Works.—Commercial Intelligence Branch of the Board of Trade, 73 Basinghall-street, E.C.

Sanitary.

HAMBLEDON.—January 18th.—For work of scavenging, for the rural district council.—Mr. F. Smallpiece, clerk, 138 High-street, Guildford.

GRIMSBY.—January 18th.—For the construction of ½ mile of surface-water sewerage, for the rural district council.—Mr. Albert Hobson, engineer.

ESSEX.—January 18th.—For the supply of stoneware pipes, for the county council.—Mr. Percy J. Sheldon, county surveyor, Chelmsford.

DURBAN (Natal).—January 20th.—For the supply of stoneware sewage pipes, junctions and bends, for the corporation.—Messrs. Webster, Steel & Co., agents to the Durban Corporation, 5 East India-avenue, Leadenhall-street, London, E.C.

LUTON.—January 20th.—For the removal of house refuse, for the rural district council.—Mr. W. Austin, clerk.

MANCHESTER.—January 20th.—For the construction of main drainage work (new outfall sewer), for the Rivers Committee.—Mr. Thomas Hudson, town clerk.

LONDON.—January 21st.—For the construction of public conveniences, for the county council.—Sir Maurice Fitzmaurice, County Hall, Spring-gardens.

MADRAS.—January 22nd.—For the supply of English stoneware pipes and specials, for the corporation.—Messrs. J. Mansergh & Sons, agents to the corporation, 5 Victoria-street, Westminster, S.W.

ISLE OF WIGHT.—January 22nd.—For work in connection with an 18-in. sewer outfall pipe, for the rural district council.—Mr. H. Eldridge Stratton, clerk.

HOVE.—January 24th.—For the removal of house refuse, for the corporation.—Mr. H. Endacott, town clerk.

CANNOCK.—January 24th.—For the supply and laying of 8,000 yds. of 12-in., 9-in. and 6-in. stoneware pipe sewers, and construction of manholes and flushing chambers, for the rural district council.—Mr. A. W. Carver, clerk.

STOCKTON.—January 25th.—For the execution of a scheme of sewerage, for the rural district council.—Mr. T. H. Faber.

DOWNPATRICK.—January 25th.—For the construction of a sewer, for the rural district council.—Mr. R. L. Morrow, clerk.

ROMFORD.—January 27th.—For the construction of sewerage works, for the rural district council.—Mr. W. J. Grant, surveyor.

ABERGELE.—January 27th.—For work in connection with sanitary conveniences, shelter, jetty, pumping installation, sewerage works, and cast-iron surface-water drain, for the urban district council.—Mr. E. A. Crabbe, clerk.

HARPENDEN.—January 27th.—For the construction of sewerage works, for the urban district council.—Mr. C. S. Tuckey, clerk.

MIDDLETON.—January 30th.—For deep drainage work at cemetery, for the corporation.—Mr. F. Entwistle, town clerk.

KINGSTON-UPON-THAMES.—January 31st.—For the supply of 300 tons of bauxite for the sewage works, for the corporation.—Mr. Harold A. Winser, town clerk.

SILSDEN.—January 31st.—For the erection of a percolating filter and other works, for the urban district council.—Mr. John Driver, clerk.

ILKESTON.—February 1st.—For laying and jointing cast-iron pipe sewers, concrete tube sewers, stoneware pipe sewers, construction of manholes and flushing

chambers, and construction of engine-house, for the corporation.—Mr. S. F. James, town clerk.

LUTON.—February 1st.—For the supply of concrete and stoneware main and socketed pipes, for the corporation.—Mr. W. Smith, town clerk.

SOUTHEND-ON-SEA.—February 1st.—For the construction of six refuse destructor cells, for the corporation.—Mr. H. J. Worwood, town clerk.

HOLYHEAD.—February 1st.—For the construction of sewers, for the urban district council.—Mr. T. R. Evans, clerk.

DRIFFIELD.—February 4th.—For the construction of a 9-in. pipe-drain, for the rural district council.—Mr. T. Casson Beaumont, surveyor

ALSAGER.—February 5th.—For the erection and completion of sewage disposal works, to include the building of all tanks, beds, and the work in connection therewith, and the supplying and laying of about 400 yds. of 9-in. stoneware pipe sewer, for the urban district council.—Mr. H. V. Lynam, surveyor.

HORSFORTH.—February 10th.—For laying sewers and constructing manholes, for the urban district council.—Mr. J. Davidson, clerk.

AMBLESIDE.—February 11th.—For the construction of sewage disposal works, for the urban district council.—Mr. G. Gatey, clerk.

WINDERMERE.—February 15th.—For laying and jointing stoneware pipe sewers and cast-iron pipe sewers, and constructing manholes, lampholes, sedimentation tanks, bacteria beds, effluent tanks, sludge lagoons, engine-houses, pump wells and roads, for the urban district council.—Mr. J. T. Bownass, clerk.

PORT SAID.—March 1st.—For the construction of drainage works, for the municipality.—Mr. A. L. Webb, C.M.G., Queen Anne's Chambers, Broadway, Westminster.

Stores.

PLYMOUTH.—January 18th.—For the supply of paints, varnish, ironwork, petroleum oil, broomheads, household brushes, iron, steel, carbolic powder, Portland cement, lubricating oils, tar, pitch, painters' brushes, explosives, soap, wood blocks, creosote, road metal, disinfectant fluid, granite kerbs, setts, white lead, refilling machine revolving brooms, benzoline and motor spirit, tools, india-rubber goods, hose, ship chandlers' goods, for the corporation.—Mr. James Paton, borough engineer and surveyor.

MIDDLESBROUGH.—January 20th.—For the supply of annealed scoriæ (broken rough blocks and blocks), bricks, castings, concrete flags and kerbs, Portland cement, pitch and tar, sanitary pipes, gullies, junctions, slag, tarred whinstone, limestone, granite, timber, granite setts, brushes, bolts, nuts, screws, disinfectants, general stores, glass, hardware, india-rubber goods, iron, steel, leather beltings, oils, paints, varnishes, packings, picks, shovels, shafts, polishes, cleaning materials and ropes, for the corporation.—Mr. S. E. Burgess, borough engineer.

CAMBERWELL.—January 20th.—For the supply of timber, harness, varnishes, brooms, shovels, hire of horses, harness, ragstone, broken granite and asphalt paving work, for the borough council.—Mr. W. Oxtoby, borough engineer.

ACTON.—January 21st.—For the supply of Portland cement, ground blue lias lime, stoneware pipes, shoeing horses, manhole covers, granite kerb and channel, artificial stone paving, York stone, cycle repairs, paints, oils, team labour, horses for fire brigade, brooms, disinfectants, wood blocks, tar-paving materials, coke, coke breeze, tools and plant, plumbing, iron, steel, ironmongery and wheelwrights' work, for the urban district council.—Mr. W. Hodson, clerk.

ABERYSTWYTH.—January 21st.—For the supply of ironmongery, oils, paints, disinfectants, coal, drain pipes, and horse provender, for the corporation.—Mr. A. J. Hughes, town clerk.

WEST HAM.—January 24th.—For the supply of paving materials, broken granite and chippings, road flints, sand, tar and pitch, ironmongery, iron castings, lime, plaster, Portland cement, rope and tarpaulins, hardwood, lead, zinc, solder, oils, colours, stoneware pipes, brooms, brushes, boots, sanitary articles, disinfectants, domestic articles, clothing, engine-room stores, and chemicals, for the corporation.—Mr. Fred. E. Hilleary, town clerk.

BIRMINGHAM.—January 25th.—For the supply of lias lime, Portland cement, drain pipes, gullies, gulley pans, brown bricks, timber, drysaltery, castings, iron, steel, lamp glass, enamelling, brooms, hose pipe, rubber goods, incandescent mantles, uniform clothing, granite kerbs, setts, crossing stones, chippings, flags, paving bricks, wood blocks, ragstone, limestone gravel, tarred limestone, gravel, sand and slag, for the corporation.—Mr. Henry E. Stilgoe, city engineer and surveyor.

CROYDON.—January 27th.—For the supply of articles for the roads, sanitary and waterworks departments, for the corporation.—Mr. F. C. Lloyd, town clerk.

CHELTENHAM.—January 30th.—For the supply of Portland cement, forage, stoneware pipes, broken stone, kerbs, setts, disinfectants, oils, colours, ironmongery, timber, indiarubber goods, lead, brass fittings, tools for highways, wrought iron, steel flues, electric light fittings, lias lime, bricks and waterproofs, for the corporation.—Mr. J. S. Pickering, borough engineer.

GRIMSBY.—January 31st.—For the supply of whinstone or columnar basalt macadam, drainage pipes, artificial flags, Yorkshire flags, Yorkshire kerbs, granite setts, kerbs, channel, pitch, tar, Portland cement, lias lime, slag, carbolic acid, carbolised oil, disinfectant fluid and powder, formalin, brushes and oils, for the corporation.—Mr. H. Gilbert Whyatt, borough engineer and surveyor.

HUDDERSFIELD.—February 5th.—For the supply of granite setts, gritstone and Lonkey setts and macadam, furnace slag, broken or unbroken, granite, slag, limestone tar-macadam, flags, landings, kerbs, pitch and creosote oil, cast-iron materials, Portland cement, bricks, lime, river sand, hay, straw, scavenging machine brushes and brooms, earthenware pipes, junctions, bends, coal, team labour, shoeing horses, and oils, for the corporation.—Mr. J. Henry Field, town clerk.

OSSETT.—February 8th.—For the supply of materials, stores and workmen's tools required in the highways, gas, lighting, water, sanitary and educational departments, for the corporation.—Mr. T. W. Wilson, town clerk.

BLACKBURN.—February 8th.—For the supply of miscellaneous materials and labour, for the corporation.—Mr. William Stubbs, borough and water engineer.

GOOLE.—February 19th.—For the supply of road metal (Guernsey granite and chippings), granite setts, slag, hardcore, concrete flags, York flags, kerb, channel, stoneware pipes, Portland cement, tar-macadam, brough gravel, coal and bricks, for the urban district council.—Mr. C. G. Bradley, engineer and surveyor.

Miscellaneous.

POPLAR.—January 20th.—For the supply of iron castings for sewerage and drainage works, stoneware sewer and drain pipes, scavengers' brooms, rotary machine sweeping brushes, paints and varnishes, for the borough council.—Mr. Leonard Potts, town clerk.

TENDERS FOR MUNICIPAL WORKS OR SUPPLIES.

The Editor invites the co-operation of SURVEYOR readers with a view to making the information given under this head as complete and accurate as possible.

* Accepted. † Recommended for acceptance.

EXMOUTH.—Accepted for excavation, sand filling, making concrete footpaths, foundations of carriageways, and supply of tar-macadam for finishing coat of carriageways, for the urban district council.—Mr. Samuel Hutton, engineer:

Contract No. 1.—Excavations, filling, concrete footpaths, foundations of carriageways, &c., Wilson & Co., Exmouth, £2,789.

Contract No. 2.—Supply of tar-macadam, Stoneycombe Lime & Stone Company, Newton Abbot, £5-8.

HARWICH.—The following tenders have been accepted by the town council:—

Portland cement.—W. Bram & Co.
Carting.—J. Everett.
Horse hire.—J. Everett.
Granite.—Lavendar & Bateman.
Flints.—Dan & Stone Co., Ltd.
Steam rolling.—Essex Steam Rolling Association.

HARWICH.—For laying sewers and other works, for the corporation.—Mr. F. H. French, borough surveyor:—

Bennett & Son, Ipswich	£560
James & Ling, Dovercourt	510
E. E. Newton, Harwich	460
Fisher & Woods, Dovercourt*	408

Borough Surveyor's estimate, £403.

HARWICH.—Accepted for the supply of broken granite and granite chippings, for the corporation.—Mr. F. H. French, borough surveyor:

Granite.—Lavendar & Bateman, Sutton Bridge, Penlee Elvan Cornish Basalt. 2-in. gauge, 10s. 9d. per ton; 1½-in. gauge, 10s. 6d. per ton; ¾-in. gauge, 8s 3d. per ton.

Kentish flints.—Dan & Stone Co., London. 2-in. gauge, 4s. 6d. per cubic yd.

HOVE.—For laying wood paving, for the corporation.—Mr. H. H. Scott, borough surveyor:—
Acme Flooring & Paving Company (1904), Ltd., London, £1,918.

PERRY BAR.—For the supply of Rowley tag and blast furnace cinder, for the urban district council:—
Granite.—E. Richards (accepted), Oldbury.
Slag.—Martin & Element, Smethwick.

RAMSGATE.—For the extension of Victoria-parade, including sewering, road and footpath making, for the corporation.—Mr. T. G. Taylor, borough engineer:—

R. E. Hodgman, Ramsgate	£1,382
W. Wilson, Ramsgate	1,416
G. Griggs, Ramsgate	1,319

SALE.—For works of paving and flagging, for the urban district council:—
H. Bethell & Sons, Sale.

SUNBURY-ON-THAMES.—For the supply of 4,000 gallons of refined tar, for the urban district council.—Mr. H. F. Coales, surveyor:—

Forbes, Abbott & Lennard, London	4½d. per gallon.
Catchpole & Sons, Rotherhithe	4¾d. ,,
Grindley & Co., Poplar	4¾d. ,,
Standard Tar Company, Holborn	4¾d. ,,
T. Clayton, Ltd., Brentford	4¾d. ,,
Smart & Son, London	4½d. ,,

MEETINGS.

Secretaries and others will oblige by sending early notice of dates of forthcoming meetings.

JANUARY.

20. Royal Institute of British Architects: Mr. F. S. Baker, Toronto, on "Canadian Architecture." 8 p.m.
20.—Institute of Sanitary Engineers: Mr. H. Percy Boulnois, M.INST.C.E., delivers his presidential address, Caxton Hall, Westminster, 8 p.m.
23. Institution of Municipal and County Engineers: West Midland District Meeting at Birmingham.
29.—Institution of Municipal Engineers: Council Meeting, 39 Victoria-street, S.W. 6 p.m.
30.—Institution of Municipal Engineers: Visit to Woolwich Arsenal.

FEBRUARY.

3.—Royal Institute of British Architects: President's address to students; presentation of prizes.
3.—Institute of Sanitary Engineers: Annual Dinner, Holborn Restaurant. 7 p.m.
5.—Institute of Sanitary Engineers: Paper by Mr. Cuthbert Brown, ASSOC.M.INST.C.E., engineer and surveyor, Edmonton U.D.C., "Reminiscences of a Municipal Engineer."
7.—Institution of Municipal and County Engineers: Eastern District Meeting, New Middlesex County Council Buildings and Lyons' Victoria Mansions Restaurant.
8.—Royal Institute of British Architects: President's Address to Students; Presentation of Prizes.
15.—Institution of Municipal and County Engineers: East Midland District Meeting at Newark.
17.—Institute of Sanitary Engineers: Paper by Mr. A. J. Martin, M.INST.C.E., F.G.S., "A Plea for Scientific Research in the Field of Sewage Purification."
17.—Royal Institute of British Architects: Messrs. A. Saxon Snell and Wm. Milburn, on "Modern Hospitals." 8 p.m.
22.—Institution of Municipal and County Engineers: Meeting at Southampton.

APPOINTMENTS OPEN.

Official and similar advertisements received up to 4.30 p.m. on Thursdays will be inserted in the following day's issue, *but those responsible for their dispatch are recommended to arrange that they shall reach* THE SURVEYOR *office by noon on* **Wednesdays** *to ensure their inclusion in the weekly list of summaries. Such advertisements may, in cases of emergency only, be telephoned* (*No.* 1359 *Holborn*), *subject to later confirmation by letter.*

CITY OF BIRMINGHAM.

The Public Works Committee are prepared to receive applications for the appointment of Engineering Assistant in the City Engineer and Surveyor's Department at a salary of £150 per annum.

Preference will be given to those candidates who have had special experience in works of sewerage, and are Associate Members of the Institution of Civil Engineers or hold the Testamur of the Institution of Municipal and County Engineers.

Age not to exceed 35 years.

It will be a condition that the person appointed shall subscribe to the Superannuation Scheme, and shall devote the whole of his time to the duties of his office.

Applications, in the candidates' own handwriting, stating age, qualifications, present and past experience, together with copies of not more than three recent testimonials, and endorsed "Appointment of Engineering Assistant," to be sent to the undersigned not later than Monday, the 27th instant.

Canvassing, either directly or indirectly, will be considered a disqualification.

HENRY E. STILGOE,
City Engineer and Surveyor.

The Council House,
Birmingham.
January 10, 1913.

ENGINEERING ASSISTANTS. Required on a Municipal Engineer's staff in a large town in the Midlands, two Engineering Assistants, who must have good general engineering experience and a knowledge of bridge work (steel and masonry construction), and who must be good draughtsmen and expert levellers. Salary commencing at £130, and rising by £10 per annum to £150 per annum. Applications, stating age, qualifications, and experience, together with copies of at least three recent testimonials, to be sent not later than Monday, 27th January, 1913, addressed Box 1,212, office of THE SURVEYOR, 24 Bride-lane, Fleet-street, London, E.C.

BOROUGH OF RICHMOND (SURREY).

ASSISTANT WATER ENGINEER.

Applications are invited for the appointment of Assistant Water Engineer for the Borough of Richmond (Surrey).

Salary £250 per annum, payable monthly.

Applicants must be between 25 and 30 years of age.

The person appointed must be prepared to reside in the Borough within reasonable distance of the Waterworks, and must possess a knowledge of electrical, steam and deep well pumping machinery, and general engineering work as applied to waterworks and water distribution, and have special experience in the prevention of waste. His duties, under the direction of the Water Engineer, will comprise general assistance in all the work of the Water Department.

Applications, on Forms to be obtained from the undersigned, together with copies of three recent testimonials, must reach the Town Clerk on or before Monday, the 27th day of January, 1913.

Personal canvassing is strictly prohibited.

HENRY SAGAR,
Town Clerk.

Town Hall,
Richmond (Surrey).
January 7, 1913.

WATFORD URBAN DISTRICT COUNCIL.

ENGINEERING ASSISTANT.

The Watford Urban District Council invite applications for the appointment of an Assistant in the Engineer's Department.

The applicant should be a good draughtsman, and have a practical knowledge of municipal engineering generally.

Salary, £80 per annum, rising by annual increments of £10 to £100.

Applications, stating age, qualifications and experience, accompanied by copies (originals, if sent, will not be returned) of not more than three recent testimonials, to be sent to Mr. D. Waterhouse, Engineer to the Council, not later than Saturday, February 1st, 1913.

Canvassing, directly or indirectly, will be a disqualification.

W. HUDSON,
Clerk and Solicitor.

Council Offices,
High-street,
Watford.

WEST SUFFOLK COUNTY COUNCIL.

COUNTY SURVEYOR'S DEPARTMENT.

APPOINTMENT OF CLERK OF WORKS.

Applications are invited for the post of "Clerk of Works" for a period of about 18 months during the reconstruction of certain main roads in the county.

Applicants should possess a thorough knowledge of modern methods of road construction, and be able to set out the work, and be prepared to keep the same hours as the workmen.

Applications, endorsed "Clerk of Works," to be made in candidates' own handwriting upon forms to be obtained from the undersigned (together with particulars of the duties), stating wages required and the date upon which the duties could be taken up, accompanied by copies of three testimonials, to be sent to the undersigned not later than the 27th January, 1913.

W. LIONEL JENKINS, ASSOC.M.I.C.E., P.A.S.I.,
County Surveyor.

Shire Hall,
Bury St. Edmund's.
January 8, 1913.

BOROUGH OF WORTHING.
SURVEYOR'S JUNIOR ASSISTANT.

Applications are invited for the post of Junior Assistant in the Borough Surveyor's Office. Salary £85 per annum, rising, on satisfactory service, by annual increments of £5 to a maximum of £110 per annum.

Candidates must have had Municipal experience, and must not be more than 24 years of age.

Applications, on Forms which must be obtained from the Borough Surveyor, endorsed "Surveyor's Junior Assistant," to be sent in to me not later than 12 noon on Thursday, January 23rd, 1913.

Canvassing, in any form, will be considered a disqualification.

(By order)
W. VERRALL,
Town Clerk.

Municipal Offices,
Worthing.
January 7, 1913.

HAMPSHIRE COUNTY COUNCIL.
MAIN ROADS.

The County Council are about to engage six Working Sub-foremen or Gangers, to take charge of general Road Repairs, Steam Rolling and Surface Tarring. Applications are invited from persons who have had a sound practical experience in road making and maintenance, and the control of workmen. Age not to exceed 35 years. The Sub-foremen will be required to reside where directed in the county, and be prepared to take up their duties within one month on being appointed. Wages 30s., rising to 40s. per week, to include the provision and upkeep of a bicycle. Applications (on forms which will be supplied), in candidate's own handwriting, stating age, &c., and accompanied by copies of three recent testimonials (which will not be returned) to be sent to me on or before January 27th, 1913, endorsed "Road Foreman."

W. J. TAYLOR,
County Surveyor.

The Castle, Winchester.
January, 1913.

THE URBAN DISTRICT COUNCIL OF WOKING.
SURVEYOR'S JUNIOR CLERK.

The Council require a clerk in the Surveyor's Department.

Applicants should be good penmen, should have had experience in the keeping of accounts, should have a knowledge of shorthand, and should be not less than 18 years of age.

Preference will be given to applicants who have had previous experience in a surveyor's office.

The salary will be 25s. per week.

Applications, in the candidates' own handwriting, giving rate of speed in shorthand, and accompanied by not more than two recent testimonials, to be sent to me, at the Council Offices, Woking, so as to reach me not later than 10 a.m. on Monday, the 27th of January, 1913.

Dated this 15th day of January, 1913.

ROBERT MOSSOP,
Clerk to the Urban District Council of Woking.

ALSAGER URBAN DISTRICT COUNCIL.
SEWERAGE AND SEWAGE DISPOSAL WORKS.
CLERK OF WORKS.

The above council require the services of a duly qualified Clerk of Works to take charge of the above, under the direction of their surveyor. The appointment will be temporary and will last about six months. Whole time services will be required. Salary £2 per week.

Applications, stating age, experience and qualifications, with copies only of three recent testimonials, and endorsed "Clerk of Works," to be delivered to the undersigned not later than Monday, February 3, 1913.

H. V. LYNAM,
Surveyor to the Council.

Council Offices,
Alsager.
January 15, 1913.

DERBYSHIRE COUNTY COUNCIL.

Junior Assistant Wanted. Must be good draughtsman, surveyor and leveller. Salary at the rate of £80 per annum, payable monthly, rising by £10 per annum to £120, subject to the recommendation of the County Surveyor. Write full particulars of experience, age and references to the County Surveyor, County Offices, Derby. Copies only of testimonials to be sent.

PUPIL.—The Borough and Waterworks Engineer of Leamington (A.M.I.C.E.) has a vacancy in his office for a Pupil.—Address, Town Hall.

PUPIL. Civil Engineer, Westminster, engaged on Main Drainage and Sewerage, has vacancy for a Pupil (office and out-side). To one who has previous knowledge of office work, or completed college course, moderate premium.—Box 1,215, office of THE SURVEYOR, 24 Bride-lane, Fleet-street, E.C.

THE Borough Surveyor and Waterworks Engineer to a town in the West Riding, having important works in hand, has a vacancy for a well-educated youth as articled pupil. Moderate premium.—Box 1,216, office of THE SURVEYOR, 24 Bride-lane, Fleet-street, E.C.

APPOINTMENTS WANTED.

ASSISTANT (20), Stud.I.M.E., served Articles in large Rural District, seeks post; five months Clerk-in-Charge of large Tar-spraying Contract; excellent credentials. Surveying, Levelling, Building Construction; neat Draughtsman.—Box No. 1,214, office of THE SURVEYOR, 24 Bride-lane, Fleet-street, E.C.

PUPIL (18), just completing 3 years with Architect and Surveyor, desires Articles for 3 years with Borough Surveyor and Engineer, A.M.I.C.E.; London or suburbs preferred.—Brown, 5 Queen-street, Deal, Kent.

(Continued on p. xxiv.)

EX-PUPILS AND ASSISTANTS.

ASSISTANT (21) requires berth. Articled. Expert in Surveying and Levelling, Sewerage and Sewage Disposal, Water Supply; smart Draughtsman. Student Surveyors' Institution; Student Municipal and County Engineers; six Certificates Building Construction (Honours); Quantities; Machine Construction.—"Worker," care of THE SURVEYOR, 24 Bride-lane, Fleet-street, E.C.

(Continued on p. xxx.)

TENDERS WANTED.

COUNTY BOROUGH OF CORK.
TO STREET-SURFACING SPECIALISTS AND ROAD CONTRACTORS.

The Council of this County Borough is prepared to receive Tenders from experienced Paving Contractors or Manufacturers of Bituminous or other similar Street-Surfacing Materials for the supplying and laying of such materials in the surface of certain lanes.

The contractors, in their Tenders, are to state the price per super. yard for the laying of approximately 20 000 super yds., and also to specify the type of paving quoted for, their guarantee, and the term of years for which they are prepared to enter into a contract to maintain such paving when laid.

Tenders will only be considered from employers of regular labour who pay Trade Union wages.

Sealed Tenders, endorsed "Tenders for Surfacing Lanes," must be delivered at my office not later than 4 p.m. on Thursday, the 13th day of February, 1913.

The Tenderer whose offer is accepted shall be held to have bound himself to an agreement, and may be compelled to carry out the obligation arising from his Tender, even though he may not have signed a formal contract.

The lowest or any Tender not necessarily accepted.

F. W. McCARTHY,
Town Clerk.

Town Clerk's Office,
City Hall, Cork.
January 10, 1913.

ALSAGER URBAN DISTRICT COUNCIL.

WORKS OF SEWERAGE AND SEWAGE DISPOSAL.

TO CONTRACTORS.

The above council is prepared to receive Tenders for the construction of the following:—

CONTRACT No. 1.

Erection and Completion of Sewage Disposal Works, to include the building of all tanks, beds, and the work in connection therewith complete.

CONTRACT No. 3.

The supplying and laying of about 400 yds. of 9-in. stoneware pipe sewer at Linley, with manholes complete.

Sealed Tenders, on prescribed forms only, to be forwarded to me not later than first post on Wednesday, the 5th of February, 1913, endorsed "Sewage Disposal."

Neither the lowest nor any Tender necessarily accepted.

Copies of the Specifications and Bills of Quantities with Forms of Tender may be obtained at the office of the Surveyor upon receipt of a cheque for £2 2s., which will be returned upon receipt of a *bonâ-fide* Tender for Contract No. 1.

Particulars for Contract No. 3 may be obtained free of cost.

Plans and sections, &c., may be seen at my office, and contractors are advised to make an appointment before calling.

H. V. LYNAM,
Surveyor to the Council.

Council Offices,
Alsager.
January 15, 1913.

CONTRACTS FOR BUILDING MATERIALS AND TOOLS.

The Prison Commissioners are prepared to receive Tenders for the supply of the above to any of H.M. Prisons, State Inebriate Reformatories and Borstal Institutions in England and Wales.

Forms of Tender and all necessary particulars can be obtained at any of the prisons, &c., or at the Prison Commission, Home Office, Whitehall, London, S.W.

Tenders must be delivered at the Prison Commission not later than noon on Tuesday, the 4th February, 1913.

ESSEX COUNTY COUNCIL.

HIGHWAYS COMMITTEE.

WIDENING OF THE SPRINGFIELD BRIDGE, CHELMSFORD.

Tenders are invited for the execution of the necessary works involved in widening the Springfield Bridge at Chelmsford.

Drawings may be seen, and Bills of Quantities obtained, at the County Surveyor's Office, Chelmsford.

Sealed Tenders, addressed to the undersigned and endorsed "Springfield Bridge," are to be delivered not later than the first post on Tuesday, the 28th inst.

The lowest or any Tender not necessarily accepted.

PERCY J. SHELDON, M.INST.C.E.,
County Surveyor.

Chelmsford.
January 13, 1913.

BOROUGH OF OSSETT.

The Corporation of Ossett invite Tenders for the supply of Materials, Stores, Workmen's Tools, &c., required in the Highways, Gas, Lighting, Water, Sanitary and Educational Departments for one year from the 31st March, 1913, to 31st March, 1914.

Specification and Forms of Tender may be obtained at the Borough Surveyor's Office on application.

Sealed and endorsed Tenders to be delivered to me, the undersigned, at the Town Hall, Ossett, not later than 10 a.m., the 5th day of February, 1913.

The Corporation do not bind themselves to accept the lowest or any Tender.

T. W. WILSON,
Town Clerk.

Town Hall
Ossett.
January 7, 1913.

BOROUGH OF LUTON.

CONCRETE AND STONEWARE PIPES.

The Corporation of the Borough of Luton invite Tenders for the supply of the undermentioned concrete and stoneware pipes:—

1,086 yds., or thereabouts, of concrete main, 4 ft. internal diameter, in 9-ft. lengths.
1,086 yds., or thereabouts, of concrete main, 2 ft. 6 in. internal diameter, in 9-ft. lengths.
1,086 yds. stoneware socketed pipes, 2 ft. 6 in. internal diameter.

Specification and Form of Tender may be obtained on application to Mr. J. W. Tomlinson, Borough Engineer, Town Hall, Luton.

The Corporation reserve the right to accept a Tender for any one or more of the above items separately, and a Tender for any one item only will receive consideration.

Tenders, in sealed envelopes, endorsed "Pipes," must be delivered to the Borough Engineer not later than Saturday, 1st February, 1913.

W. SMITH,
Town Clerk.

Town Hall, Luton.
January 15, 1913.

CITY OF SHEFFIELD.

DEPARTMENT OF HIGHWAYS AND SEWERS.

The Highway and Sewerage Committee of the City Council are prepared to receive Tenders for the supply of the undermentioned materials during the year ending 25th March, 1914:—

Portland cement (about 2,000 tons).
Natural flags (8,000 to 10,000 super. yds.).

Particulars and Forms of Tender may be obtained at the office of Mr. W. J. Hadfield, Surveyor of Highways, Town Hall, Sheffield, on payment of the sum of 10s., which will be returned on receipt of *bonâ-fide* Tender. All applications for and correspondence relating to Tender Forms should be addressed as above. Tenders, enclosed in official envelope provided, and accompanied by samples, addressed to the Chairman of the Highway and Sewerage Committee, to be delivered at the Surveyor of Highways' Office not later than 10 o'clock a.m. on Monday, the 27th day of January, 1913. Persons wishing to Tender for Cement are requested to send in a sample at the earliest possible date.

The Committee do not bind themselves to accept the lowest or any Tender, and reserve the right to divide the quantities between various Contractors.

By Order,
R. M. PRESCOTT,
Town Clerk.

Town Hall, Sheffield.
January 10, 1913.

The Contract will comprise the Fair Wages and Conditions of Labour Clause which has been adopted by the Sheffield Corporation, particulars of which will appear in the Conditions of Contract.

BOROUGH OF SOUTHEND-ON-SEA.

WESTERN ESPLANADE EXTENSION (Section No. 3).

TO CONTRACTORS.

The Corporation of Southend-on-Sea is prepared to receive Tenders for the Construction of the above Esplanade Works.

Plans may be seen, Specification and Bill of Quantities and Form of Tender obtained, on application to Mr. Ernest J. Elford, M.INST.C.E., Borough Engineer, Municipal Buildings, Southend-on-Sea, on and after Thursday, the 16th inst., on payment of a deposit of Five Guineas, which will be returned on receipt of a *bonâ-fide* Tender and the return of all documents.

Sealed Tenders, endorsed "Tenders for Western Esplanade Extension, Section No. 3," to be delivered at my Office not later than 9 a.m. on Thursday, January 30th, 1913.

The Corporation do not bind themselves to accept the lowest or any Tender.

(By order)
H. J. WORWOOD,
Town Clerk.

Town Clerk's Office,
Southend-on-Sea.
January 7, 1913.

BOROUGH OF SOUTHEND-ON-SEA.
REFUSE DESTRUCTOR CELLS.

The Corporation of Southend-on-Sea is prepared to receive Tenders for the construction of six refuse destructor cells.

General Conditions, Specification, Form of Tender and Drawing may be obtained on and after Saturday, January 11th, on application to Mr. Ernest J. Elford, M.INST.C.E., borough engineer, Municipal Buildings, Southend-on-Sea, on payment of a deposit of Two Guineas, which will be refunded on receipt of a *bonâ-fide* Tender and the return of all documents.

Tenders, endorsed "Refuse Destructor," must be delivered not later than 9 a.m. on Saturday, February 1st. The Corporation do not bind themselves to accept the lowest or any Tender.

(By Order)
H. J. WORWOOD,
Town Clerk.

Town Clerk's Office,
Southend-on-Sea.
February 9, 1913.

COUNTY BOROUGH OF HUDDERSFIELD.
TO CONTRACTORS.

The Corporation of Huddersfield invite Tenders for the Supply and Delivery of the following Materials, for a period of 12 months ending March 31st, 1914—namely:—

HIGHWAY MATERIALS.

Form No.
1.—Granite Setts, Gritstone and Lonkey Setts and Macadam.
2.—Furnace Slag (Broken and Unbroken) for Highway Purposes.
3.—Granite, Slag, and Limestone Tar-macadam.
4.—Flags, Landings, Kerbs, &c.
5.—Pitch and Creosote Oil.
6.—Cast-iron Materials.
7.—Portland Cement.
8.—Bricks, Lime, and River Sand.
9.—Hay, Straw and Provender.
10.—Scavenging Machine Brushes and Brooms.
11.—Earthenware Pipes, Junctions, Bends, &c.
12.—House Coal for Highways Department.
13.—Team Work (for all Districts).
14.—Shoeing Horses.
15.—Oils (Engine, Cylinder, Gas Engine, Heavy Bearing and Petroleum).

The successful Tenderer will be required to execute a Contract, the draft of which may be inspected at the Town Clerk's Office, Town Hall, between 10 and 4 o'clock (except Saturdays).

Specification and Forms of Tender may be obtained on application at the Offices of Mr. K. F. Campbell, M.INST.C.E., M.I.E.E., Borough Engineer and Surveyor, 1 Peel-street.

Please state the number of Tender Form required.

Sealed Tenders, endorsed "Tender for Granite Setts," or as the case may be, signed in the handwriting of the Tenderer or his Agent, and addressed Town Clerk, Town Hall, Huddersfield, must reach him not later than Wednesday, 5th February, 1913.

The Corporation do not bind themselves to accept the lowest or any Tender.

J. HENRY FIELD,
Town Clerk.

Town Hall, Huddersfield.
January 7, 1913.

SOMERSET COUNTY COUNCIL.
SURFACE TARRING ON MAIN ROADS.

Tenders are invited for Surface Tarring on Main Roads at various places in the County during the year 1913.

The work will be done partly under direct contract with the County Council and partly through the Rural and Urban District Councils, and probably from 60 to 70 miles will be treated.

Forms of Tender, General Conditions and Specifications may be obtained from the undersigned, to whom Tenders, endorsed "Surface Tarring," must be delivered not later than 1st February, 1913.

The lowest or any Tender will not necessarily be accepted.

H. T. CHAPMAN,
County Surveyor.

County Surveyor's Office,
Wells, Somerset.
January 10, 1913.

SOMERSET COUNTY COUNCIL.
TENDERS FOR ROAD MATERIALS.

Tenders are invited for the Supply of Broken Granite or Basalt required for the main roads in the Long Ashton Rural District, delivered to the various Stations and Docks in the neighbourhood of Bristol during the year ending 31st March, 1914.

Forms of Tender and Specifications may be obtained from the undersigned, and they must be delivered at the County Surveyor's Office, Wells, endorsed "Tenders for Road Materials," not later than the 1st February, 1913.

The Council do not bind themselves to accept the lowest or any Tender.

H. T. CHAPMAN,
County Surveyor.

County Surveyor's Office,
Wells, Somerset.
January 10, 1913.

COUNTY OF SOMERSET.
STEAM ROLLING.

Tenders are invited for Steam Rolling and Scarifying required on Main Roads in the Long Ashton Rural District during the year ending March 31st, 1914.

Specifications and Form of Tender may be obtained from the undersigned, to whom Tenders, endorsed "Steam Rolling," must be delivered not later than 1st February, 1913.

The lowest or any Tender will not necessarily be accepted.

H. T. CHAPMAN.
County Surveyor.

County Surveyor's Office,
Wells, Somerset.
January 10, 1913.

BOROUGH OF KINGSTON-UPON-THAMES.
BAUXITE.

The Corporation invite Tenders for the Supply, during the ensuing 12 months, of 300 tons of Bauxite for their Sewage Works.

Further particulars and Forms of Tender may be obtained of the Borough Surveyor, Mr. R. Hampton Clucas, at the Municipal Offices.

Sealed Tenders, endorsed "Bauxite," to be delivered at this Office not later than Friday, the 31st inst.

The lowest or any Tender will not necessarily be accepted.

HAROLD A. WINSER,
Town Clerk.

Municipal Offices,
Kingston-upon-Thames.
January 15, 1913.

GOOLE URBAN DISTRICT COUNCIL.

The Highways and Sewers Committee of the above Council are prepared to receive Tenders for the Supply of the undermentioned Stores and Materials, the Contract to commence on the 1st of April next and terminate on the 31st March, 1914.

(1) Road Metal (Guernsey Granite and Chippings).
(2) Granite Setts.
(3) Slag (Broken and Unbroken).
(4) Hardcore (Broken and Unbroken for Foundations).
(5) Concrete Flags.
(6) York Flags.
(7) Kerb.
(8) Channel.
(9) Stoneware Pipes, Bends, &c.
(10) Portland Cement.
(11) Tar-macadam.
(12) Brough Gravel.
(13) Coal.
(14) Bricks.

Forms of Tender, Specifications, and all other necessary information may be obtained by applying to the undersigned.

The Committee will not consider any Tender except those on the authorised Form, which must be sent to the Chairman of the Highways Committee not later than 12 o'clock noon on Wednesday, the 19th day of February, 1913.

The lowest or any Tender will not necessarily be accepted.

C. G. BRADLEY,
Engineer and Surveyor.

Council Offices,
Goole.

LANCASHIRE COUNTY COUNCIL.
TENDERS FOR GRANITE SETTS.

The Main Roads and Bridges Committee are prepared to receive Tenders for the Supply of about 11,000 tons of 4-in. by 5-in. Granite Setts, and about 2,000 tons of 4-in. by 4-in. Granite Cubes, delivered at Chorley and Adlington Railway Stations.

Forms of Tender may be obtained on application to Mr. W. H. Schofield, ASSOC.M.INST.C.E., County Offices, Preston, to whom the same must be returned on or before Monday, February 3rd next, endorsed "Granite Setts."

The County Council do not bind themselves to accept the lowest or any Tender.

(Signed) HARCOURT E. CLARE,
Clerk to the County Council.

BOROUGH OF BRACKLEY.
TENDERS FOR GRANITE.

The Town Council invite Tenders for the Supply of Granite for the year ending 31st March, 1913.

Particulars and Forms of Tender may be obtained on application to the Borough Surveyor, Mr. A. A. Green, Surveyor's Office, Market-place, Brackley.

Tenders to be sent in to me, the undersigned, not later than 30th January.

The Council do not bind themselves to accept the lowest or any Tender.

C. E. BARNES,
Town Clerk.

Brackley.
January 14, 1913.

COUNTY BOROUGH OF WEST HAM.
TENDERS FOR SUPPLIES, &c.

The Council hereby invite Tenders for the Supply of—

Paving Materials,
Broken Granite and Chippings,
Road Flints,
Sand for Tramways,
Tar and Pitch,
Ironmongery, &c.,
Iron Castings,
Lime, Plaster, &c.,
Portland Cement,
Rope and Tarpaulins, &c.,
Hardwood,
Lead, Zinc and Solder,
Oils and Colours, &c.,
Stoneware Pipes, &c.,
Brooms and Brushes,
Boots,
Sanitary Articles and Disinfectants,
Domestic Articles,
Clothing,
Soaps.

Forms of Tender and further particulars may be obtained at the Borough Engineer's Office, Town Hall, West Ham, E. (where the Standard Samples may also be seen).

For the Supply of—

News-papers and Periodicals,
New Books, and for
Bookbinding

for the Public Libraries and Technical Institute.

Forms of Tender and further particulars may be obtained at the Central Public Library, Water-lane, Stratford, or at the Central Public Library, Barking-road, Canning Town, E.

For the Supply of—

Meat,
Fish,
Ice,
Bread and Flour,
Dragg'st's Sundries,
Groceries,
Tea and Coffee,
Linen,
Drapery, Boots and Slippers,

for use in the Council's Hospitals.

For the Supply of—

Bread and Flour,
Meat,

to the Council's Convalescent Home, The Grange, Harold Wood, Essex.

Forms of Tender and further particulars may be obtained of the Medical Superintendent, at the Hospital, Sandringham-road, Plaistow.

For the Supply of—

Engine-room Stores,
Chemicals,
A.C. House Service Wattmeters.

Forms of Tender and further particulars may be obtained of the Electrical Engineer, 84 Romford-road, Stratford, E.

A deposit of £1 will be required in respect of each Form of Tender, which will be returned on receipt of a *bonâ-fide* Tender.

NOTE.—No Tender will be considered unless the same is delivered at the office of the Town Clerk, Town Hall, West Ham, E., in the envelope supplied, by registered post, not later than 12 o'clock noon on Friday, January 24th, 1913.

The Tenders will be opened at the Town Hall, West Ham, on Friday, January 24th, at 6.30 p.m., and persons tendering may be present if they so desire, but no guarantee is given that any information, beyond the names of persons tendering, will be read out.

The Council do not bind themselves to accept the lowest or any Tender. The Contractor will be required to enter into a bond, with sureties, for the due performance of the Contract, and no goods, materials, &c., will be ordered under the Contract until such bond has been duly executed.

The Contractor whose Tender is accepted, and with whom a contract is entered into, will be required to pay to the whole of his workmen such rate of wages and observe such hours of labour as are recognised by the Workmen's Trade Unions, and in force at the time of signing the Contract. In the event of any breach of such agreement, the Council will enforce the penalty clause in its entirety.

(By order of the Council)

FRED. E. HILLEARY,
Town Clerk.

Town Hall,
West Ham, E.
January, 1913.

COUNTY BOROUGH OF GRIMSBY.
TO CONTRACTORS.

The Corporation are prepared to receive Tenders for the Supply of the following Materials, in such quantities as may from time to time be required, between April 1st, 1913, and March 31st, 1914:—

1. Whinstone or Columnar Basalt-macadam (100 tons per fortnight or 200 tons per month).
2. Drainage Pipes, &c.
3. Flags, Artificial.
4. Flags Yorkshire.
5. Yorkshire Kerbs, &c.
6. Granite Setts, Kerbs, and Channel.
7. Pitch.
8. Tar.
9. Portland Cement (6 tons per month). The Cement to be in accordance with the British Standards Specification).
10. Lias Lime.
11. Slag (Lump, Macadam, and Screenings, 500 tons per month).
12. Bottles and Corks.
13. Carbolic Acid.
14. Carbolised Oil.
15. Disinfectant Fluid.
16. Disinfectant Powder.
17. Formalin.
18. Formalin Tabloids.
19. SO_2 Tubes.
20. Brushes: (*a*) Miscellaneous; (*b*) Scavenging.
21. Drysalteries, &c.
22. Oils (except lubricating).
23. Oils, Lubricating.
24. Paints.

Specifications, Forms of Tender (in duplicate), and all requisite information, may be obtained at my Office; applications to be accompanied by addressed foolscap envelopes (unstamped).

Sealed Tenders, addressed to the Chairman of the Highways Committee, and endorsed "Tenders for Annual Supplies," must be delivered at the Office of the Town Clerk, West St. Mary's-gate, Grimsby, not later than noon on Friday, January 31st, 1913.

(By order)
H. GILBERT WHYATT, ASSOC.M.INST.C.E.,
Borough Engineer and Surveyor.

Municipal Buildings,
170 Victoria-street,
Grimsby.
January 11, 1913.

The Surveyor

And Municipal and County Engineer.

Vol. XLIII. JANUARY 24, 1913. No. 1,097.

Minutes of Proceedings.

Cornish Road Organisation; The County Surveyor's Proposals.

In our issue of November 29th we referred to the proposals which Mr. A. E. Brookes recently put before his council with regard to the organisation of the principal roads of that county. As will be seen from a report in our issue last week, the council have decided not to entertain the question of forming secondary or subsidised roads, but have agreed to main and recommend for dismaining the roads in the schedules of Mr. Brookes' second report—that is to say the roads which the county surveyor recommends for maining and dismaining on the assumption that no subsidised roads are to be created. The council have, however, without committing themselves to any definite policy, admitted the principle of forming a second class of main roads. This has, of course, been done, in effect, in those counties in which the mileage of county roads is much more than sufficient to include all the main roads which are such in fact; but there are features of the present case which demand special attention. When a council takes over main roads which have been maintained as such for many years, it may not be necessary for the district council to expend any considerable sums of money in order that these roads may be fit to become official main roads; but when changes in traffic conditions have led, as they have in Cornwall, to such a state of affairs that a considerable amount of dismaining is necessary as well as of maining in order to create a system of county roads, it is clear that a considerable mileage of the roads to be mained is likely to demand large expenditure per mile before these roads can be taken over by the county council.

Mr. Brookes mentions £500 a mile as the probable cost to the district councils of preparing the roads for maining, and he points out that the Road Board will be prepared to give favourable consideration to applications for advances by way of loan to the district councils for this purpose. Considering that it is exceedingly unlikely that the Local Government Board would interfere with any arrangements with regard to Cornish roads made with the approval of the Road Board, we venture to suggest, and we strongly recommend, to the county surveyor of Cornwall, that he bring this suggestion to the notice of his council—namely, that the roads shall be mained without the expenditure of a single penny by the rural district council, provided that the Road Board will be prepared to assist the county council instead of the district council, and to exactly the same extent. It cannot fail to be much more economical and much more satisfactory for the county surveyor to carry out the work of reconstruction, with the assistance if necessary of a consulting engineer, than to leave this work to be done, here a little and there a little, by the district council. Considering that the total mileage to be mained will be more than seventy, an expenditure of £500 a mile amounts to £35,000. The lighthearted manner in which the local authorities contemplate such expenditure, and the way in which they seem to assume that officials whose time is fully occupied with their ordinary duties can economically spend an extra £10,000 a year or so, is a matter to astonish those who have been concerned with the expenditure of private capital or departmental funds.

Looking at the report as a whole, we are bound to say that Mr. Brookes' original proposal seems to be the best under the circumstances. If, however, no secondary roads are created, but two classes of main roads, it may be suggested that, having regard to the nature of traffic developments in Cornwall, the shape of the county, and the trend of public opinion towards the creation of a class of trunk roads subsidised by the State, it would be as well to consider the possible future advantage of such a division of the main roads as will make the first class of these roads a probably suitable portion of a national trunk road system. Looking at the matter from every point of view, it seems likely that the best solution will be obtained if the county surveyor be instructed to draw up a further report reviewing the whole situation, not only in the light of Cornish circumstances, but also with a view to the economical expenditure of possible Road Board grants, and the present tendencies of administrative developments.

* * *

The Road Board's Cash Balance.

There has recently been a good deal of criticism of the Road Board's alleged "policy" of "hoarding" its funds, and the matter was the subject of discussion in the House of Commons on the 20th of last month, when, as reported in our issue of December 27th, Mr. Masterman effectually disposed of the bulk of the criticism by showing that the real balance was much smaller than was supposed. It must also be remembered that the Board was keeping in hand a large sum in case it should be wanted for an important scheme of road improvement in the London area. In our own view the Road Board is a body sufficiently responsible to be entrusted with the spending, at its own discretion, of a much larger balance. We consider, moreover, that the accumulation of a substantial reserve is desirable. In the first place, we regard it as good economy to undertake the more costly works of reconstruction which are needed on so large a mileage of country roads, before expending on crust or surface improvement considerable sums, the full value of which cannot be obtained, on roads which are lacking in important elements of stability and of economical maintenance. We do not want to see the board putting the cart before the horse. To deal adequately with such work the individual grants should be large, and in some cases the Road Board will have to contribute the bulk of the sum required if the work

is to be done at all. Secondly, looking at the board's activities as a whole, it can hardly be denied that the central department will be in a better position as regards the intelligent distribution of grants when a suitable technical staff has been appointed capable of furnishing independent and authoritative reports as to the needs of the different areas claiming attention, and of ensuring the carrying out of important works of reconstruction in a manner which will adequately embody the local knowledge of the surveyors. To put this aspect of the matter in a nutshell, the surveyors to local authorities ought not to be subject to financial control by a central department, unless that department be served by skilled engineers who will see that engineering considerations are not subordinated to finance and procedure. On the occasion already referred to the Financial Secretary of the Treasury stated that it was hoped to accumulate £1,000,000 in anticipation of a period of unemployment; and if this means that important road improvement works will be carried out with the help of able-bodied and properly trained navvies, the men from the shires who are employed on large engineering contracts, the prospect is favourable. We cannot help looking with suspicion, however, on the expression "more or less unskilled work" which was used by Mr. Masterman on this occasion, and we provisionally enter a protest against the employment on the roads of the normally unemployed.

Mr. Masterman's statement that the Road Board had been called into existence to meet the transition from one sort of traffic to another, and the remarks made by the Parliamentary Secretary to the Board of Trade with regard to dealing with road maintenance questions in a comprehensive and systematic manner (p. 723, November 22nd), are suggestive of the consideration that local authorities had better decide now whether they would like to see the Road Board's scope and authority extended, or would prefer to see the present system brought to a sudden termination.

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The Institute of Sanitary Engineers.

On Monday evening last Mr H. Percy Boulnois inaugurated his term of office as president of the Institute of Sanitary Engineers by the delivery of a characteristic address. The institute is singularly fortunate in the men whom it secures from time to time to preside over its fortunes. Mr. Boulnois' qualifications for the office which he has just assumed are so well known as to be beyond dispute. He succeeds another eminent sanitary engineer, Mr. A. J. Martin, who has held office for two years, and to whom the new president paid a very warm tribute. We have ventured to describe Mr. Boulnois' address as "characteristic;" and a perusal of it reveals those qualities of humour and sound common sense which will justify that epithet in the eyes of all who know the author. In seeking at the outset for a definition of the term "sanitary engineer," the president was unable to light upon anything which was adequate to describe the profession in its modern development. He was consequently constrained to make a definition of his own, which we think will be found sufficient for a long time to come. It is this: "A sanitary engineer is a man who, having fully qualified himself as a civil engineer, eventually specialises in the direction of sanitary works." In the light of this excellent definition, Mr. Boulnois later in his address proceeded to consider what form of special training and education is best calculated to fit a man to succeed in the sanitary engineering profession. Having shortly reviewed some of the best opinions which have been expressed on this subject, he went on to lay down certain guiding principles rather than to deal with those matters of minor detail which too frequently are the sole topics of so-called educational discussions. In his opinion it is of the utmost importance that there should be a thorough scientific grounding and that the intelligence and general capacity of the student should be expanded. To quote his own words: "One of the most difficult things to learn is the knowledge of how to learn, and how to apply that knowledge when acquired. . . . The mere successful passing of an examination does not always mean that a young man is sure of success in the battle of life." Mr. Boulnois' plea for the retention of the pupilage system will be noted with interest, and there are few who will disagree with him in his assertion that practical training is only to be found under actual professional and commercial conditions, which obviously cannot obtain in educational establishments. Education in sanitary matters is required not only by experts, but also in a lesser degree by the general public, if the best results are to be achieved. There is a very widespread ignorance in regard to personal and domestic hygiene, which must speedily be overcome. To this end we agree that much good may accrue from the "National Health Week" which was inaugurated last year, the idea emanating from Mr. Boulnois' predecessor in the chair. Mr. Boulnois' address will be found in another column, and is well worthy of perusal. We cordially wish him a very successful year of office.

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Pollution of Water in Mains.

A curious case of the pollution of water in city mains is given by Mr. H. L. Lucas in the annual report of the Department of Public Works, Chicago. The quality of the water proving to be bad, an inspection was made, and the discovery made that a greenhouse pump at times forced water of very impure quality into the city service pipe. This pump drew water from a manure tank which was also used to drain a privy. It forced this water at 60-lb. pressure into a hose connection, where it was sprayed on to the plants in the greenhouse. The city service pipe was connected to the rising main from the pump, so that, when necessary, a valve could be opened admitting clean water to the pump delivery pipe in order that it also could be sprayed on to the flowers. It is to be gathered that there was also some ingenious device by which the flow of water through the manure water pipe was stopped, or partially stopped, while the water from the city main was being delivered. It was thus quite a simple matter, by leaving the valve on the city main open, to pump the water from the manure tank into the city main at 60-lb. pressure. Of course the intention was that whenever the cistern pump was started the city service pipe valve should be shut off, but, like other good intentions, it apparently failed. But this was not all; it was found that there were twenty-four other greenhouses with manure tanks, pumps, and cross connections to the city main complete, similarly arranged, while forty-eight factories had cross connections to the mains from pumps drawing water from the river. As some of these connections were 6 in. in diameter, and as the pumps in all cases produced greater pressure than was maintained in the city mains, and as positive proof was afforded of these pumps forcing river water into the city mains, it was clear that some cause existed for the complaints received as to the quality of the water. In yet another case, a river connection in a tannery was found to have a cross connection open to the house pumps, so that whenever the pump was started, it forced river water into the public mains.

These simple devices for augmenting the water supply of Chicago deserve serious attention. It is a serious reflection that such wholesale gross pollution of water in the public mains of a great city should be possible, and it demonstrates the importance of keeping all services under regular observation. The householder or factory owner or other consumer is able to do practically whatever he likes

with the main connected with his building, and unless proper supervision is given he may not only waste the water, but, as facts show, may pollute it grossly. The report referred to provides a further example of the kind quoted recently by Dr. Thresh in his paper read before the Institution of Water Engineers showing how easily a water supply, pure at the source, may come under suspicion owing to causes which have nothing to do with the efficiency of the methods in use to ensure its purity and to effect its proper distribution. It is not only in Chicago that inspections are necessary.

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Results of Water Sterilisation.

We give elsewhere in these pages particulars relating to a number of towns where sterilisation of the water supplies by means of hypochlorite has been adopted, showing the remarkable decrease in the typhoid disease and death rates which has followed the treatment of the water in every case. These are practically the first statistics which have come to hand, and it is to be hoped that they will be followed by many more which will prove still further the enormous advantages of adopting sterilisation when the quality of water is open to question. It is clear, from the figures given, that reductions of from 40 to 50 per cent in the typhoid rates have followed the introduction of hypochlorite in the worst cases, while in others we hear of complete immunity from the disease. It is not, however, to be supposed that the most polluted water could cause typhoid if the process of purification were thorough, and if no subsequent contamination took place ; for, assuming that the disease is due to the presence of typhoid germs in water, it is clear that there can be no infection where the germs have been removed. It is, therefore, certain that the only reason why the death-rate from typhoid did not fall to *nil* where water was sterilised was that there were sources of contamination, such as private water supplies untreated, dust, flies, rubbish-heaps, and so forth.

One may well imagine that in any city which has endured an annual typhoid epidemic of considerable magnitude for many years there must of necessity exist a large number of sources of contamination outside the water supply, and that the number of carrier cases must also be large. It is therefore surprising and gratifying to find that in some instances epidemics appear to have been practically stamped out at once, while the very large percentage of reduction obtained in the city of Toronto under most unfavourable conditions is certainly remarkable. The same may be said in the case of Baltimore, where there were 1,964 cases of typhoid in the year ending May 31st, 1911, and where the reduction in the number of cases was 41 per cent. It is certainly to be anticipated that there will be a further decrease in the future. The figures, where they are available, appear to show a steady reduction in the typhoid rate, as may be seen in the case of Evanston, Illinois, where there were forty-nine cases in December before sterilisation was adopted, twelve cases in January after its adoption, and nine in February. It would be still more interesting if the total number of cases of diseases of all kinds and of deaths were available, for the reason that it is believed that the sterilisation of water not only prevents typhoid fever, but also causes a marked reduction in the number of cases of other diseases not generally considered as being water-borne.

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Exeter and the Royal Sanitary Institute.

The claims of the higher hygiene and sanitation are to find fitting expression this year at Exeter under the auspices of the Royal Sanitary Institute, and the people of the city, with the Mayor at the head of the movement, last week appointed a Reception Committee, together with the customary officials, to make the necessary arrangements antecedent to and during the sitting of the congress in July next. The omens would certainly appear to be favourable for the success of the gathering, for the Reception Committee is not only conspicuous for the strong individuality of its constitution, but also for the spontaneity with which its members sought to assume service in what must certainly prove to be an onerous as well as a self-imposed task. There was something peculiarly appropriate in the presence at the meeting held at the Guildhall of Mr. H. Percy Boulnois, chairman of the Council of the Royal Sanitary Institute, for it happens that among other important municipal posts previously held by that gentleman was that of city surveyor of Exeter. In his speech Mr. Boulnois insisted that legislation in sanitary matters had gone far enough for the present, and that what was wanted was more education. It is to be expected that the welcome extended to the Royal Sanitary Institute by the citizens of Exeter will be all the more cordial because the institute stands for the educative factor in a progressive science that touches so closely the well-being of all who constitute the State.

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Mechanical Haulage.

At a recent Northern District meeting of the Institution of Municipal Engineers, held at Newcastle, a very instructive paper on "Light Mechanical Haulage" was read by Mr. John Robinson, the surveyor to the Darlington Rural District Council. Mr. Robinson, who is a whole-hearted advocate of mechanical traction, explained that the conditions which obtain in his district are rather exceptional, owing to inadequate railway accommodation. Some description of mechanical haulage is therefore almost imperative if the work of his department is to be carried out in a satisfactory manner. The experience which he has gained has consequently been very large and varied, and the surveyors to other authorities who are contemplating the adoption of mechanical traction will much appreciate the value of his paper. We have on former occasions dealt with the subject generally, and we cannot repeat now what we have already said. We may, however, direct attention to the advantage of direct working as against hiring, as pointed out in the paper. It is possible for a Council using direct labour to ensure that the least possible damage will be done to the roads, by insisting upon the men continually crossing their tracks as they are coming and going. Moreover, during the wet months the engine may be converted and used as a roller.

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The Road Board and the Carpeting System.

In our issue of January 3rd we published a letter which Sir George Gibb, chairman of the Road Board, addressed to the *Times*, pointing out that the "scientific work of the Road Board" had, in a previous issue of that journal, been improperly associated with special references to the carpeting system. Sir George Gibb made it quite clear that the board have not given precedence to one method over another, and have no present intention of doing so. This was, of course, well understood by our readers, who know that the board will consider recent developments strictly on their merits; and surveyors pay little attention to the implied reflections on their own competence which so frequently appear in the lay Press under such headings as "Automobilism." The special attention which, it is understood, the board's consulting engineer is giving to the carpeting system is the natural consequence of the uncertainty which exists as to the range of application of the principle to highways generally, and the success which has followed its adoption in the case of city streets.

The Effect of Hypochlorite Sterilisation of Water upon the Death-Rate.

By H. C. H. SHENTON.

Bacteriologists have shown the efficiency of small quantities of chlorine for the removal of coli from clear waters. It was therefore to be inferred that the disease and death rates from typhoid would show a marked decrease where polluted supplies have been dealt with by this method. In order to obtain these figures, however, time must elapse, facts must be gathered, tabulated and published. Thus the actual results whereby any useful comparisons and conclusions may be arrived at are only just beginning to come to hand. These, again, must be received with due caution, for in many instances the application of hypochlorite has been effected by very crude methods, it has been intermittent and partial, and while the water supply may have been the chief source of the disease, there may have been other causes dealt with at the same time, or left to spread the disease. It stands to reason that sterile water cannot cause typhoid, and that, having sterilised the water sufficiently and continuously, one source of danger must have been removed. Where, however, from any cause sterilised water was reinfected, or where the process was partial or intermittent, the results of sterilisation would be poorer than in cases where the process provided the consumer with pure water at the tap.

DR. THRESH'S WORK.

In the first place, it is to be noted that Dr. Thresh, in his paper read before the Institution of Water Engineers, tells of a town drawing its supply from a river polluted with the crude sewage of another town during a typhoid epidemic. Yet the consumers drank this water without harm after it had been treated with hypochlorite, and not a single case of typhoid occurred. Evidently no other source of supply was available, and it is to be concluded that Dr. Thresh's method saved many lives. It is doubtful whether anyone will maintain that the natural purification afforded by the passage of *crude* sewage along 10 miles of river would remove the typhoid germs. Such a contention is possible, but, assuming that typhoid germs were drawn out of the river in the drinking water, it is abundantly clear that Dr. Thresh's process killed them, and the good results were to have been expected.

MR. KEMNA'S STATEMENT.

Mr. Adolph Kemna, at the same meeting, stated that "in one case, exactly ten days after starting the application of chlorine, an epidemic" (of typhoid) "was suddenly arrested, and the diagram showing the number of cases fell abruptly to zero"—the number of water consumers in this case being 300,000.

AMERICAN STATISTICS—NORTH YAKIMA.

The following statistics relating to the prevalence of typhoid fever before and after the introduction of hypochlorite for the sterilisation of water were given in a paper read at the International Congress of Applied Chemistry by Mr. C. A. Jennings:—

At North Yakima, Washington, there was an epidemic of typhoid in 1910. Water sterilisation began on July 9, 1911, and during the period from September, 1911, to June, 1912, there was not a single death from typhoid fever, and only one case was reported between December 22, 1911, and June 1, 1912. It should be noted that the chief source of contamination was also cut off, when discovered; but, at the best, the source of supply is a mountain stream open to contamination, and the freedom from typhoid since sterilisation was adopted points to its value.

COUNCIL BLUFFS.

At Council Bluffs, Iowa, a typhoid epidemic, starting in the autumn of 1909, ended with the introduction of hypochlorite in April, 1910. In the ensuing twenty-five months up to June, 1912, there were only five deaths from typhoid fever in a population of 30,000, and one of these was that of an imported case. For the eight months following the introduction of hypochlorite there was not a single death from typhoid fever.

CLEVELAND.

At Cleveland, Ohio, there was a remarkable reduction in the disease and death rate from typhoid following the introduction of hypochlorite sterilisation in September, 1911; 159 cases and 19 deaths were reported in September, while for the following eight months there were in all 180 cases and 28 deaths. Typhoid had been prevalent to a great degree previously, as may be gathered from the following figures: From October 1, 1907, to June 1, 1908, there were 290 cases and 46 deaths; during the same period ending June 1, 1909, there were 311 cases and 52 deaths; to June 1, 1910, there were 343 cases and 66 deaths; to June 1, 1911, there were 347 cases and 65 deaths; but from October 1, 1911, to June 1, 1912 (during which period the water was sterilised) there were 180 cases and 28 deaths, a reduction of 44 per cent in the number of cases and 50·8 per cent in the number of deaths on the four preceding years. It is only reasonable to conclude that this reduction was due to the sterilisation of the water.

ERIE.

At Erie, Pennsylvania, an enormous decrease in the typhoid rates is shown in comparing the twelve months ending May 31, 1911, with the following twelve months ending May 31, 1912. In the first year the number of cases was 1,140, and the number of deaths 136, while in the following year the number of cases was 92 and the number of deaths 11. It is to be noted that hypochlorite was applied to the water first on March 15, 1911, so that the fall in the typhoid rate is claimed to be due to the sterilisation of the water after that date. There seems, moreover, to be no question as to the immense improvement effected, for, comparing the figures with preceding years, it appears that in the twelve months ending May 31, 1910, there were 202 cases and 29 deaths, and in the twelve months ending May 31, 1909, there were 153 cases and 16 deaths. This water supply is drawn from Lake Erie, and it seems obvious, first, that this polluted water caused typhoid at a rapidly increasing rate, and, secondly, that this rate was reduced enormously directly the water was sterilised.

TORONTO.

At Toronto, Ontario, the circumstances are evidently peculiar, and it is apparent that the authorities were driven to extremities. One might have expected a worse typhoid rate and a greater fall after the introduction of hypochlorite, but, as far as may be gathered from the Canadian Press, the emergency treatment of the water was very crude. Also it is probable that the typhoid had taken such a strong hold upon the city that for some time following the sterilisation of the water there were plenty of sources of infection besides the water supply. It is to be noted, in the first place, that Dr. George Nasmith reported on the water supply of Toronto as follows: "I may say that last year our intake plugged with sand, and we were forced to short circuit our water supply and take it from the bay, into which all our sewage empties. We had the makings of the largest typhoid epidemic ever known on this continent, but, fortunately, we had hypochlorite to depend on, and we came through with a typhoid death-rate of 20 per 100,000 in 1911 as compared with 45 per 100,000 in 1910." During the first two months of 1910 there were 723 per cent more cases and 450 per cent more deaths from typhoid than the average for the same two months during the preceding five years. Hypochlorite treatment was started in March, 1910, and an immediate reduction in the number of cases was effected. This happened, however, before the conditions related by Dr. Nasmith occurred. This extra pollution of the water apparently caused a rise in the typhoid rates for two consecutive months in 1911. This fact suggests either that the water was not sufficiently sterilised or else that some of the consumers managed to get it in an unsterilised condition, and the information is not as clear a proof of the absolute efficiency of the process as one could desire. There probably were other causes of infection. It is, however, fairly clear, taking everything into consideration, that the addition of hypochlorite to the water effected a remarkable change for the better. Although the water was polluted with sewage known to be typhoid-infected, the disease and death rates were

lower than in former years. The first four months of 1912 also show 64 per cent fewer cases than occurred in the same period in 1911, and 65 per cent fewer cases than the average for the same periods from 1905 to 1910 inclusive, and 50 per cent fewer deaths.

BALTIMORE.

At Baltimore, where there is an annual typhoid epidemic, there has been a considerable decrease in the number of cases since hypochlorite was applied at the beginning of June, 1911. From June 1, 1910, to May 31, 1911, there were 1,964 cases and 233 deaths, while in the following twelve months, ending May 31, 1912, while using hypochlorite, there were 1,155 cases and 160 deaths. While these figures show reductions of 41 per cent and 31 per cent respectively, it might have been hoped that such an appalling number of cases might have been prevented, and it would be interesting to know a little more of possible causes of infection other than the water. However, here again it is apparent that a marked decrease in the disease and death rates followed the use of hypochlorite.

EVANSTON.

At Evanston, Illinois, sterilisation was started on December 19, 1911. The effect would, of course, not be apparent for ten days, the period of incubation. Thus the number of cases in December would not be appreciably affected, while the January returns would show the result of the water treatment. It is therefore interesting to note that there were 49 cases in December, 12 cases in January, and 9 in February.

WAUKEGAN.

At Waukegan, Illinois, a total of 82 cases in March was reduced to 66 in April and 26 in May, hypochlorite having been used for the first time on April 16, 1912.

MINNEAPOLIS.

At Minneapolis there were 39 typhoid deaths in the ten months before hypochlorite was used, and 2 deaths in the ten months following. There was an abnormal amount of typhoid fever in the years 1909-10, the use of hypochlorite being started late in 1910 and having since been continued without interruption.

OMAHA.

At Omaha, Nebraska, hypochlorite has been used since May, 1910. The death rate from typhoid fever was 16 per 100,000 in 1908, 26 in 1909, 67 in 1910, and 13 in 1911.

JERSEY CITY.

At Jersey City hypochlorite treatment was started in September, 1908, the average typhoid death-rate for the three preceding years being 18·5 per 100,000, and this was reduced to an average of 9·6 per 100,000 for the three years following the use of hypochlorite —a reduction of 48 per cent.

KANSAS.

At Kansas City, Missouri, the number of typhoid deaths reported during 1910, without sterilisation of the water, was 197, while for 1911, with hypochlorite treatment in use, the number was 61, a reduction of 43 per cent; but although the main supply is sterilised, many people use spring water, which has been shown to be highly contaminated, and which has not been sterilised, otherwise the reduction would no doubt be greater.

Ottawa Water Supply.—The Municipal Council of Ottawa have decided to cable to Lord Strathcona to secure the services of an eminent engineer to investigate and report on the best method of securing a supply of pure water for the city at the earliest possible date. This action is taken in consequence of an adverse popular vote upon a filtration scheme recommended by a New York engineer.

Effect of Motor-Omnibus Traffic.—Replying to a communication from the London County Council with regard to the effect on roadways of motor omnibuses and tramcars, the Westminster Works Committee state that it cannot be said that as a result of motor-omnibus traffic in Westminster there has been any increase in the cost of maintaining wood-paved roads originally laid on present approved methods. The use of the middle of the roadway by the tramcars, though reducing the area to be maintained by the road authority, tends to drive the greater portion of the general vehicular traffic to the other portions, thus increasing the cost of maintaining these.

CONCRETE IN ITS LEGAL ASPECT.

MR. VALENTINE BALL AT THE CONCRETE INSTITUTE.

The advent of reinforced concrete as a material in common use in building and engineering works has, like most new things, brought in its train a number of legal problems, and it was therefore a happy idea on the part of Mr. W. Valentine Ball to submit a paper on "Concrete in its Legal Aspect" at the last meeting of the Concrete Institute. The contribution was one of great interest, and the author gave a very able exposition of the law relating to many matters affecting the rights of the parties concerned in the execution of concrete work. It must be pointed out, however, that the statement which he made at the outset to the effect that there is no statute law which is specially applicable to the subject is not strictly accurate. It will be remembered that by sec. 23 of the London County Council (General Powers) Act, 1909, that authority were empowered to make regulations "with respect to the construction of buildings wholly or partly of reinforced concrete, and with respect to the use and composition of reinforced concrete in such construction." These regulations have now been made, and are in force throughout the county.

Mr. Ball's paper, however, was not directed to technical matters affecting the actual construction of works, but rather to those broader legal questions, many of which are by no means peculiar to concrete or reinforced concrete practice. For example, he dealt at some length with the various controversies which are liable to arise owing to the employment of a sub-contractor. The general rule of law in regard to this matter, as stated by Mr. Ball, appears to be peculiarly applicable to reinforced concrete work; for, although sub-contractors may be freely employed if there is no stipulation in the contract to the contrary, this is not the case if the work is of a highly special character, so that the employer reasonably and naturally looks for the personal service and attention of the contractor.

The paper further dealt with other questions arising in the employment of a sub-contractor, such as the party to whom he is to look for payment, and the contractor's liability or otherwise for his delay.

In regard to the use of materials on the site, the author of the paper pointed out that an obligation upon a contractor to clear away old materials does not necessarily vest those materials in him. The same rule applies to excavated materials—*e.g.*, ballast—and if a contractor makes use of such materials, the employer may, in the absence of any stipulation to the contrary, set off their price against the amount due under the contract. The appearance of defects after the completion of the work is another matter from which disputes not infrequently arise. The effect of the acceptance of the work by an employer and approved by his architect is to prevent any liability of the contractor in respect of patent defects. As regards latent defects, however, Mr. Ball expressed the view that, apart from the contract, in the case of a defect which ought to have been noticed and put right while the work was in hand, the contractor would be held liable. The legal aspect of constructional work of all kinds is of the greatest possible interest and importance to those who are engaged in it, and Mr. Valentine Ball will receive the thanks of a very wide circle for his extremely interesting and valuable paper.

Stockton Rural Council and Railway Demurrage Charges.—The question of the North-Eastern Railway Company's demurrage charges was discussed at some length at a recent meeting of Stockton Rural District Council. The road surveyor alleged that the railway company, to suit their own convenience, had detained the council's supply of stone by putting the wagons into a siding, and then placing as many as fourteen wagons into the station in one day. It was impossible to deal with large supplies in the time allowed by the company, and he therefore declined to pay demurrage charges. Mr. R. Ropner said complaints were general in the district against the North-Eastern Railway Company's demurrage charges, and he was afraid there would be no improvement until the North-Eastern Railway Company had some serious opposition to contend with. It was decided to refuse to pay the charges, and to communicate with the railway company authorities at York.

Sanitary Engineering.

By H. PERCY BOULNOIS, M.INST.C.E., F.R.SAN.I.

[Mr. Boulnois, who is the chairman of council of the Royal Sanitary Institute and a past-president of the Institution of Municipal and County Engineers, on Monday evening last delivered his inaugural address—which we reproduce herewith as president of the Institute of Sanitary Engineers, in succession to Mr. A. J. Martin, M.Inst.C.E.]

The initial difficulty which presents itself to all presidents when they approach the question of their presidential address is the subject which they shall choose, or on what lines the address should be given. This difficulty is aggravated by the fact that former presidents always appear to have monopolised all the available subjects. In my own case I feel that the task is even more difficult than usual, as I follow a president who has, on two occasions, presented to you addresses which were models of style and original thought. Mr. Arthur Martin has been an ideal president; he has worked hard for the institute; he has, I believe, attended every meeting during his two years of office; he has taught us that a man can take a keen interest in his profession and at the same time find opportunities for extending his field of usefulness in many other directions. Such a president is difficult to follow, and I feel it the greater compliment that you should have asked me to succeed such a brilliant man as my friend Mr. Martin.

I can only say that during my term of office I will endeavour, to the best of my ability and energy, to maintain the high standard of this institute. I am very proud of my profession, that of a sanitary engineer, and am still more proud at having been selected to fill the exalted position of president of the Institute of Sanitary Engineers.

THE SANITARY ENGINEER.

The above sentence leads me at once to the important question as to what really constitutes the profession of a "sanitary engineer." Many attempts have been made to define the profession of a sanitary engineer, but they have failed. A plumber may, and often does, call himself a sanitary engineer. I know some medical officers of health who consider themselves also sanitary engineers, but I think that the term is generally understood to mean any man who, having fully qualified himself as a civil engineer, eventually specialises in the direction of sanitary works.

Here we are met with another difficulty as to the meaning of the word "sanitary." An encyclopædia which I consulted does not give the word at all, and only gives a definition of "sanitation" as follows: "Sanitation, roughly speaking, is a branch of hygiene, or the science of public health. Specifically the word is used to denote the branch of hygiene which deals with the sanitary arrangements of dwelling-houses, such as the nature and position of soil pipes, water-closets, kitchen sinks, ventilation, and lighting." This definition is in favour of a plumber calling himself a sanitary engineer. I will therefore turn to some definitions given in some modern dictionaries:—

"Sanitation. The adoption of sanitary measures conducing to preserve the health of a community."

"Sanitary, from Latin 'Sanitas,' health, has the general meaning of pertaining to health."

"Sanitarian, a promoter of, or one versed in, sanitary measures or reforms."

I am afraid that neither encyclopædias nor dictionaries are of much help as to the word "sanitary," nor does the general use of the word give us much assistance, for it is used to express a "sanitary authority," a "sanitary act," a "sanitary dustbin," a "sanitary locality," &c. We must, therefore, I fear, content ourselves with the definition of the profession of that of a sanitary engineer in the way I have already suggested, and assume that we know, in our minds, what it really means.

It is equally difficult to trace how the profession of a sanitary engineer first started. Moses may very rightly be claimed as the first "sanitarian" of whom we have ever heard, but it may be questioned if he could rightly have claimed to be a "sanitary engineer." It may be, however, that the tradition of his having struck a rock with his staff and thus produced water may have really been his engineering skill in parting the waters of the Red Sea to allow himself and his followers to escape from the Egyptians. But beyond this, it is evident, if we read our Book of "Exodus," that Moses must have been an engineer, for towards the end of that great history of the Jews' flight out of Egypt we come across a veritable specification of the construction of the Tabernacle, with detail dimensions and particulars of the materials employed. Further than this, we find that Moses appointed two "master workmen," whose names are recorded, to act as clerks of works to superintend the building. This looks as if Moses may have considerable claims to be the first sanitary engineer of whom we have any authentic record.

AN ANCIENT PROFESSION.

Passing to later times, there can be no doubt that there were many eminent sanitary engineers in the time of the Romans; unfortunately their names are lost to us, but the remains of the great sewers and water supply conduits testify to the magnitude of these works, of which any sanitary engineer of the present day might well be proud. They left many traces also of sanitary engineering skill in this country, but with their departure all questions of sanitary knowledge or work seem to have disappeared, and this and other countries were for many hundreds of years plunged into an abyss of filth and dirt. Michelet, the historian, tells us that "for a thousand years there was not a bath taken in Europe after the fall of the Roman Empire." Personal and public sanitation became non-existent.

There are no allusions that I can find as to the existence of any laws relating to health for a long number of years succeeding the withdrawal of the Roman rule; all that appears seems to be of a negative character. For instance, a State paper of the time of William Rufus, in describing the staff or household of that monarch, incidentally mentions that there were 100 "servitors" in the King's kitchen, and four "servitors" in the laundry, thus, I think, showing that washing, at all events, was not of much account in those days. Even so late as the reign of Charles II. Pepys enters in his diary, as a fact worthy of record, that on February 24, 1664, his wife took a bath!

So far as I can ascertain, the first sanitary Act framed in this country was in 1388, when Richard II. imposed what was then an enormous penalty of £20 upon any person who cast animal filth or refuse into "ditches, rivers, and waters." Here we see the beginning of the "Prevention of Pollution of Rivers Act." If this early Act had not been repealed, it would be interesting to see the legal wrangles which would take place on what was filth or refuse, or what was a "ditch, river, or water."

A few Acts seem to have followed, dealing principally with the water supplies of various towns, but in 1531 Henry VIII. appointed certain Commissioners of Sewers, whose duties were not very well defined. They were directed to proceed "by such ways and means, and in such manner and form," as to them "shall seem most convenient to be ordained and done," also "to reform, repair, and amend the said wells, ditches, banks, gutters, sewers, gotes, calcies, bridges, streams, and to cleanse and purge the trenches, sewers and ditches in all places needful"; and beyond this no one seemed to think the question of the public health of sufficient importance to be worthy of legislation.

Even so late as the year 1831, when this country was visited by a severe epidemic of Asiatic cholera, the Government seem to have been unable to devise better legislation than the following Order in Council: "It may become necessary to draw troops, or a strong body of police, around infected places so as to utterly exclude the inhabitants from all intercourse with the country"—a method of quarantine which was certainly drastic, but was an evident confession of weakness and incapability to deal with an epidemic on sanitary or scientific lines. Another Order in Council of the same date recommended "Copious effusions of water and strong 'ley' are recommended for dealing with the clothes and furniture of all infected persons." These orders were, however, soon

followed by another which was far more sensible, and was really the beginning of the formation of local sanitary authorities as we now know them, for this Order really constituted the first local boards of health: "Each to consist, if possible, of a resident clergyman and a number of substantial householders, and of one medical man at least." An exceedingly good nucleus for the formation of boards of health, and this really marked a new era in the growth of the sanitary legislation which immediately followed. The duties of the boards were, among others, to appoint inspectors, who were to "visit daily and to enquire carefully into the health, means of subsistence, cleanliness and comforts of the inmates of the house." An excellent suggestion, but I fear quite impracticable, unless an army of inspectors had been appointed, and even then I fear they would often have had some difficulty in ascertaining what were "the comforts of the inmates of the house."

However, as an outcome of these Orders in Council came the Municipal Corporations Act, the first Public Health Act of any importance, and in 1836 the appointment of a Registrar-General of Births, Marriages and Deaths. It seems almost incredible that the appointment of such an evidently desirable officer should have been overlooked until such a comparatively recent date, but it points to the apathy which must have existed during the "dark ages" upon the subject of public health or the sanitary condition of the people.

TWO ROYAL COMMISSIONS.

In 1843 there seems to have been a further awakening, for a Royal Commission was appointed to inquire into the sanitary condition of towns and populous places in this country. The then Duke of Buccleuch was chairman, and this marks the real revival of the question of sanitation since the days of the Romans.

There was no sanitary engineer on the commission, and only a very few witnesses who could in any way be styled sanitary engineers were called to give evidence before the commission. A large number of doctors, employers of labour, and those interested in poor law gave evidence, but among those who might come under the category of engineers who knew something of sanitary matters the following may be mentioned: Mr. John Roe, then surveyor to the "Holborn and Finsbury District of the Commissioners of Sewers," who gave some evidence upon the desirability of flushing sewers; Mr. Thomas Hawkesley, then the resident engineer on the Nottingham waterworks; Mr. Thomas Wicksteed, a water engineer, and Messrs. W. C. Mylne, Joseph Quick and Robert Anderton, all of them water engineers; Mr. Richard Kelsey, surveyor to the Commissioners of Sewers for the City of London, who contended that large house drains and sewers were essential in order that men might enter them and cleanse them; Mr. W. D. Guthrie, who devoted himself chiefly to house drainage and who advocated smaller drains; Mr. James Dean, an advocate of subsoil drainage of land and also of the irrigation of land with sewage; and Captain Vetch, Royal Engineers, who was also a strong advocate for the disposal of sewage on land, and who, later in life, designed a scheme for the sewerage of London, which, however, came to nothing.

It will be seen from the above that not many of these engineers could claim the title of what is now understood to be a "sanitary engineer," except, perhaps, Mr. Roe, Mr. Kelsey and Mr. Guthrie. Mr. Thomas Hawkesley, who afterwards rose to great eminence as a water engineer, was a water engineer, and not what we now call a sanitary engineer.

PIONEERS OF SANITARY ENGINEERING.

In the year 1847 another Royal Commission was appointed to inquire into the health of the metropolis. Lord Robert Grosvenor was chairman, and we find the well-known name of Edwin Chadwick as one of the commissioners. This commission heard evidence from Mr. John Philips, the chief surveyor to the Westminster Court of Sewers, evidently a sanitary engineer of considerable knowledge and experience. The designs which he submitted for the construction of sewers in the future are beyond all praise, and he had evidently studied the subject with great care. His evidence could be read at the present day with great profit to the reader, as he seems to have been the first engineer to have studied carefully the scientific construction of sewers and drains. I feel that I may safely call him the real pioneer of the profession of that of a "sanitary engineer." Mr. John Roe, already mentioned, also gave evidence, and shares to some extent the proud position of Mr. John Philips as a pioneer of sanitary engineering. It is not generally known that Mr. Roe was the first engineer to introduce earthenware pipes instead of brick drains. I find that "he got some earthenware glazed tubes manufactured, and introduced them specially as house drains in the year 1843, thus keeping the drains clear of decomposing solids." He was a very strong advocate of smaller-sized house drains and sewers, and it is stated in some evidence given elsewhere on the subject that, owing to the large size of house drains, they retained more than one-half the solids which should have gone to the sewers, and that from their large size all sorts of "things" had been found in them, some of the "things" mentioned being as follows: "Coffins, tombstones, bedsteads, and even the beadle of a parish," this last "foreign" body being evidently regarded as exceeding the limit of even the best regulated house drain.

A considerable number of other engineers and architects appear to have given evidence before this commission, including: Mr. Edward I'Anson, Mr. John Newman and Mr. Henry Austin, all of them surveyors to the Kent and Surrey Division of Sewers, Mr. James Beck, surveyor to the Tower Hamlets Division, and Mr. William Baker, surveyor to the Commissions of Sewers of Poplar Marsh; also Mr. Gwilt, the author of "Gwilt's Encyclopædia of Architecture" (a standard book of reference to this day) and Mr. Edward Cressy, the author of "Encyclopædia of Civil Engineering," a book which I regret to say I have not seen, and which is probably no longer a book of reference.

How many of the above names are still remembered among sanitary engineers? I am afraid very few. *Sic transit gloria mundi.*

Coming to some of the later pioneers of sanitary engineering we find the following well-known names:—

	Born.	Died.	
Thomas Hawksley ..	1807	1893	well-known water engineer.
Robert Rawlinson ..	1810	1898	chief engineering inspector of the Local Government Board.
Joseph Bailey Denton	1814	1893	advocate of sewage on land.
Joseph Bazalgette ...	1819	1891	chief engineer of the Metropolitan Board of Works.
William Haywood ..	1820	1894	chief engineer of the City of London.
Rogers Field	1831	1900	well-known sanitary engineer.
Col. Jones, v.c.	1832	still living.	
Baldwin Latham .. .	1836	still living.	

Sir Edwin Chadwick, not an engineer, but whose name is world renowned as the pioneer of modern sanitation, was born in 1800 and died in 1890.

This gives an average life of the seven deceased sanitarians of very nearly eighty years. It is evident that the study of sanitation leads to a prolonged life! The above list may not be by any means complete, but no doubt many of you will be able to fill up the omissions.

The question as to what constitutes the profession of that of a sanitary engineer not only seems to be exercising the minds of the engineering and other professions of this country, but also of America, for quite recently there appeared in the columns of THE SURVEYOR an article on the subject by Mr. George Whipple, Professor of Sanitary Engineering at Harvard University, as follows:—

"Within the last quarter century a new profession has come to the fore—sanitary engineering. It represents the application of a new science to a new product of civilisation. The new science is bacteriology; the new product of civilisation is the modern city. How important sanitary engineering is to the world to-day is scarcely realised, so gradual has been its evolution, but its importance may be appreciated by comparing the conditions of life in our cities to-day with the conditions that existed in ancient days or even a few generations ago. . . .

"The problems of the sanitary engineer are so vast and so varied, they bring him into contact with so many branches of science and with so many classes of people, that an exceptionally broad education is demanded. . . . Unlike other branches of engineering, sanitation is concerned not alone with iron and stone, and other inert building materials, but with organic matter and living things. The purification of water and sewage is due largely to biological action, and the knowledge of bacterial processes is scarcely less important to the sanitary engineer than that of the laws governing the flow of water in pipes and the strength of materials.

"While this is acknowledged, it is also true that first and foremost the sanitary engineer must be an engineer, and the collateral sciences must be subordinated. Hence, the student must be trained primarily in engineering, and secondarily in sanitation.

"But sanitary science is becoming so important that there is room not only for the constructing engineer but for the sanitary specialist . . . and in him the ideal course would give less attention to civil engineering features and more attention to mechanical and laboratory work. . . .

"In the pursuit of the elements of sanitary science the sanitary engineer, the sanitary specialist, and the health officer meet on common ground, and to a certain extent their education may be appropriately conducted together. But for the most part their work, although mutually helpful, lies apart, and their education in the main should follow separate channels. . . ."

Mr. Whipple then proceeds to describe the special training at Harvard University, in which he says that sanitary engineering is considered to be a branch of civil engineering, that all the civil engineering students are expected to take the general course in sanitary engineering, and that the same course is open to candidates for the degree of doctor of public health in the medical school; but for those who intend to engage in sanitary work after leaving the University, during the last term there is a special course in water supply and sewage engineering, which is not given as "class-room" exercise, but as individual work "carried on as it would be in the office of a practising engineer."

SANITARY ENGINEERS' TRAINING.

This latter course appears to me to try and supersede the practice in this country of "pupilage," which, personally, I consider gives a better final tuition than any that could possibly be given at a University. Otherwise the above remarks by one so eminent in educational systems as Mr. Whipple are worthy of our earnest and careful consideration. The whole question of the training of an engineer, irrespective of the special branch he decides to eventually follow, is an exceedingly difficult one.

So long ago as the year 1866 the late Sir John Fowler, in his presidential address to the Institution of Civil Engineers, gave it as his opinion that up to the age of fourteen the ordinary routine of school tuition was the best, and that then for the next three or four years the intending engineer should undergo a special education as a preparation for future technical knowledge. He included in this special education, mathematics, natural philosophy, surveying and levelling, drawing, chemistry, mineralogy, geology, strength of materials, mechanical motions, and hydraulics. He thought also that French and German should if possible be learnt. He was strongly of opinion that only in the pupilage or apprenticeship could the essential practical training be obtained. He suggested three years as the minimum period for pupilage whatever the previous training might have been. He also considered that one or two years should be passed in the workshop, even though the youth was about to follow the profession of a civil engineer.

It must, I think, be conceded that if any young man could start in life equipped with this knowledge, he would have a fair chance of success in any special line of engineering that he might select. In the year 1903 the council of the Institution of Civil Engineers appointed a committee of experts to consider and report as to the best methods of training for all classes of engineers. The committee's recommendations followed somewhat on the lines of Sir John Fowler's remarks. Again, in June, 1911, a conference on the education and training of engineers was held at the Institution of Civil Engineers, which included professors, schoolmasters, and engineers representing all branches of the profession. No definite resolutions were passed, nor indeed would it appear to be possible to do so, but the matter was very ably and exhaustively discussed. The danger of "coaching" or "cramming" was pointed out, it being insisted also that the training should reach the average student, and not merely the exceptional youth or "genius," and that practical training was of the utmost importance.

My own view is that with regard to early training it is of the utmost importance that there should be a thorough scientific grounding, and that the intelligence and general capacity of the student should be expanded. One of the most difficult things to learn is the knowledge of how to learn, and how to apply that knowledge when acquired. The importance of evoking interest in a scholar cannot be overestimated, as that should be the object of all teaching. The mere successful passing of an examination does not always mean that the young man is sure of success in the battle of life; something more is required than that.

The only practical training is to be found under the actual professional and commercial conditions which cannot be taught in educational establishments. The drawing office and the works are an absolute necessity. Designing, specifying and estimating in the office, and setting out, measuring up, and general administration on the works are where the actual practical training is acquired. There is also the danger that too much scientific training may tend to cripple originality, and in the engineering profession it is essential that a man should be original and intuitive. If we all followed precedent there would be no advance. It is not possible to standardise the training of students, as, after all, the personal equation has to be dealt with, and sometimes a well-educated young man may prove a failure when the rough and tumble of earning his living has to be faced; there are certain qualifications such as observation, tact, power of expression, behaviour as a witness, knowledge of human nature, and other qualifications which cannot be taught in the "schools." But there can be no doubt that an early scientific training must be of immense value in the engineering profession if the student has taken advantage of it, and the youth of to-day has considerable advantage over his predecessors inasmuch as there are now methods of learning the engineering profession which did not exist a few years ago.

WORK OF THE SANITARY ENGINEER.

Having thus far attempted to sketch the growth of the sanitary engineer's profession and his training, I arrive at another difficult problem as to what are the limits or definition of his work.

It has often been stated that a sanitary engineer is inclined to attribute too much importance to such works as water supply, sewerage, sewage disposal and house drainage, and that he considers these subjects are the beginning and end of all public sanitation. Such a statement is very far wide of the truth; important as such works are in the direction of public health, there are many other problems and factors which are included in the health of a community. Take, for instance, "scavenging," or the removal of our dry waste products, the importance of which has lately been accentuated by the discovery that flies are a fruitful source of disease. There are still a number of improvements in this direction to be carried out, for although considerable advances have been made in the temporary storage of house refuse, and its ultimate disposal by burning, the method of collection is practically the same as it was forty or even fifty years ago, and no one would have the temerity to say that the method in vogue—viz., the tipping the contents of open receptacles into open carts—is the highest form of sanitary procedure. The proper housing of what one may call the "lower classes" is still an unsolved problem, though there have been many praiseworthy attempts at a solution. Many of these efforts have been thwarted by the dirty habits of those whom we desired to benefit, and there is still a large field open for work in this direction. The air we breathe is of vital importance, and although the ventilation of our dwellings and public buildings has been greatly improved, there is still plenty of scope for investigations and advances in this branch of sanitary engineering. The same remarks apply with regard to smoke abatement, which still demands our attention.

Time will not allow me to mention many other subjects to which the sanitary engineer might usefully direct his attention, but I cannot refrain from making a few remarks on that somewhat debatable question as to who is the right man to deal with town planning. We hear that the medical officer of health, the architect, the land surveyor, the landscape gardener are the experts that should be employed. I venture to think that the sanitary engineer is of equal, if not of more, importance than any of these experts, and that, as a rule, the town surveyor is the proper official to deal with this question in all cases where he is capable of doing so.

The first principles of town planning are, to my mind that the water supply and sewerage should be properly designed. This involves very careful levelling and contouring. The proper width and construction and alignment of the roads is next in importance, and the provision of light railways or tramways must not be lost sight of. Then comes the question of open spaces, such as recreation grounds and so forth. Housing of the working classes is surely also a question for the sanitary engineer; also the number of houses per acre that should be allowed.

The provision of schools and the space that should be allowed for these require consideration, as also the space required for cemeteries, conveniences, public baths, sanatoria or hospitals, abattoirs, and many other provisions are all matters that come within

the scope of the sanitary engineer. It thus appears to be important that his expert knowledge of these requirements should be used in any town-planning scheme.

Much has been done in the past by the sanitary engineer; much still remains to be done in the future. It behoves us to keep pace with the times, and to be up and doing. In the words of the poet:—

> Take the spade of perseverance,
> Dig the field of progress wide,
> Every rotten root of error
> Harrow up and cast aside.

It is these "rotten roots of error" that hamper sanitary progress. Personal cleanliness and care of the health among individuals is still far from perfect. The ignorance in matters of health displayed by the masses is lamentable. Quite recently I read in a newspaper of a medical officer of health who, reporting to his council as to the desirability of providing baths at the elementary schools for washing the dirty pupils, said that one of the mothers had been to him and said: "I hope you won't be putting baths to the school Tommy goes to, for I've sewn him up for the winter!"

Sanitary legislation may do what it can, but without education it is hampered in every direction. I believe that the suggestion of national health week, which emanated from your past-president, Mr. Arthur Martin, will, if persevered in, result eventually in a marvellous change of public thought with regard to sanitation. We are a long way off the ideal "Salutland" so wonderfully predicted by the late eminent sanitarian, Benjamin Ward Richardson, in his presidential address to the Royal Sanitary Institute at Croydon in the year 1879, but let us, one and all, strive towards that ideal, and in the progress of years it will come.

May I, in conclusion, tell you a short story which has but very little application to this address? An old man was cleaning out a very filthy-looking drain. A passer-by stopped, and, looking down into the trench, remarked, "That looks like rather a hard job." "Aye, aye," said the old man, "it is a hard job—there's such a powerful lot of sentiment at the bottom of it."

In introducing Mr. Boulnois at Monday night's meeting, Mr. A. J. MARTIN, the retiring president, said the executive head of the Institute of Sanitary Engineers was by no means a mere figurehead. On the contrary, he had a great many duties to perform, and, speaking for himself, he was pleased to say he had always found them pleasant ones. But he had never had to undertake a more pleasurable duty, or one that was likely to be more productive of benefit to the institute than the one that fell to him that evening, which was to welcome Mr. Boulnois and ask him to take his place as their president for the ensuing year. He was sure it was quite unnecessary to say much about Mr. Boulnois. His ability as an engineer was a household word; his geniality was also well known. But there was one noteworthy point in his career he could not pass over—there was scarcely an engineer living who had served his Empire and profession in a greater number of capacities than Mr. Boulnois. He had acted as the chief engineer of two ancient towns and of one of our most important boroughs, and afterwards became the deputy chief engineer to the Local Government Board. At the present time he was chairman of council of a kindred body—the Royal Sanitary Institute—and was carrying on practice as a consulting engineer. Such a variety of experience gave him a view of the profession from many standpoints, and he was sure his ripe experience and the charm which distinguished him qualified him in an exceptional degree for the position to which they had elected him.

Mr. BOULNOIS said he would like to say how deeply gratified he felt at finding himself in the position he did that evening, and to acknowledge the kindly words with which Mr. Martin had introduced him to the members.

VOTES OF THANKS.

At the close of Mr. Boulnois' address a vote of thanks was proposed to him by Mr. BALDWIN LATHAM. Mr. Boulnois, Mr. Latham remarked, seemed to have gone back a good many years, and, looking at the state of things which existed in those early days, it was surprising what had been accomplished by sanitarians in recent times. The mortality in many of our towns had been reduced to one-third of what it was, and that had been brought about simply as a result of sanitary science and work earnestly and properly carried out, and he thought they would live to see many other places which at present were not quite up to the mark also vastly improved if they would only persevere in the matter of sanitary reforms. Mr. Boulnois' address had been extremely interesting, popular in character, and one that appealed to them all.

Mr. CHILVERS seconded the vote of thanks.

Mr. H. P. MAYBURY, county surveyor of Kent, said it gave him great pleasure to support the vote of thanks, because it had been his privilege to know Mr. Boulnois, in a good many capacities, for nearly a quarter of a century. When as a very young man he (Mr. Maybury) obtained his first public appointment, Mr. Boulnois was city engineer of Liverpool. He had occasion to approach him more than once, and he had never experienced at his hands anything but geniality, and had always received from him the best possible advice. Later he knew him in his capacity as a distinguished member of the Local Government Board engineering staff, and he had very pleasant recollections indeed of the occasions on which he had held inquiries into schemes for which he (the speaker) had been responsible. He was always most courteous, and invariably went out of his way to say something nice to the official in charge of the scheme, a policy as they knew, not always pursued by the members of the board's engineering staff. Latterly he had been brought into contact with him as a colleague on the Road Board, and in that, as in other connections, Mr. Boulnois had maintained an unbroken record of kindness, courtesy and geniality.

Mr. MARTIN, in putting the vote of thanks, which was carried with acclamation, said he must express the pleasure with which he had listened to the thoughtful and suggestive address they had heard that evening, an address distinguished by its keen common sense and frequent flashes of humour. He had learnt a lesson, too, for in the matter of brevity, at any rate, Mr. Boulnois had set an example to at least one of his predecessors in the chair. (Laughter.)

Mr. BOULNOIS, in returning thanks, said he felt sure that, with the help of the council of the institute and Mr. Hasluck, their worthy secretary, he would not fail in his duties.

A vote of thanks to the retiring president afterwards brought the meeting to a close.

School Building at Twickenham.—The Education Committee have approved the plans and estimates of their surveyor, Mr. F. W. Pearce, for a new building at Orleans school, to provide places for 540 children, at an estimated cost of £8,000, which will bring the cost of the whole building to £11,600, or approximately £13 per head of accommodation provided. The approval of the Board of Education and the Local Government Board is to be sought for the erection of the buildings and the raising of a loan of £8,000.

The "Marshall" Firebox Top.—Messrs. Marshall, Sons & Co., Limited, Britannia Ironworks, Gainsborough, are directing attention to a new patent firebox top, which is now being embodied in the construction of their portable engines, traction and other self-moving steam engines, and locomotive multitubular boilers. The merits of this new design are detailed in the firm's list (No. 634). A firebox with this patent crown was recently sent to Prof. von Bach, director of the Testing Laboratory for Materials for Construction, at the Royal Technical High School, Stuttgart, who submitted it to a series of exhaustive tests. The firebox was put under pressures varying from 5 to 30 atmospheres, and at each imposition of the load exact measurements were taken to show the deflections of the crown, both the temporary deflections and the permanent deflections being recorded. The tests demonstrated that the firebox did not begin to yield until a pressure of about 20 atmospheres was reached, and that it would be quite satisfactory for a working pressure of 14½ atmospheres. The firebox was designed for a working pressure of 12 atmospheres, so that it was proved to possess an ample reserve of strength. The design was further investigated by Prof R. Baumann, of Stuttgart, who determined its strength mathematically, and found that the results of his calculations very closely agreed with the observed results of the experiments made by Prof. von Bach. Both these high authorities commented most favourably on the new design.

Office Conversations.

MORE OR LESS IMAGINARY.

[*Contributed.*]

II.—The Tempter Tempteth.

Come home early? I'll try my level best, my dear; but—— It's of no use pouting—business is business, and has to be done. My life all business? Yes, there is a lot too much of it, and I've got a fairly big day to-day, too. Let me see. Seventeen calls booked and thirteen special appointments—two committees to attend—that's about all, I think, with, of course, the usual routine work. Six o'clock 'll be the earliest, and you'd better say dinner at seven. Yes, half-past 'll be safer. Who? Mrs. Badger! Then I'm sorry to hear it—yes, sorry. Of course, we're bound to receive her now, and she wouldn't be so bad if it weren't for her precious husband. Is he coming with her? No? It's not quite so bad then, and I really will try to be home in time. Yes, honest injun. Why do I so dislike Badger? Well, he's vulgar and common, isn't he? (Do you know, I couldn't accept even salvation from a man who dropped his aitches?) And he doesn't eat—not what can be called eating. He stokes himself—and he's not even good at that, for he throws all his food right back, and no good stoker 'd do *that*.

* * * *

I've overheard some very unpleasant things about my friendship with Badger. Choose my own friends? Of course, I can; but in the case of Badger I didn't choose him—Mrs. Badger chose him for me. Really, I think it's a mistake after all for the wife of the surveyor to mix herself in the life of the town. She inevitably makes what I regard (officially) as undesirable acquaintances. Would I have you always stop at home? No, I couldn't expect that, and I suppose it can't be helped; but it comes hard on the husband. Nothing wrong, no; but that doesn't matter. Badger's a member of a firm that has dealings with the council, and the clever ones put what they call two and two together and make about nineteen and a-half out of them. I have to superintend Badger's work, to inspect the materials he uses, to pass his accounts; and he spends the evening at my house. Say it's Mrs. Badger? Good heavens, woman, the fat *would* be in the fire then! My friend Mrs. Badger! No; come what may, we mustn't work the Codlin and Short dodge. Badger's my friend and Mrs. Badger's yours—reverse the order and there'd be a charge of immorality brought against me at the next meeting. Well, good-bye, I must be going. Half-past seven at the latest.

* * * *

Mr. Badger! Whatever can he want at this time of the day? Show him up. Confound the man—he'll talk for hours. Ah, good-morning, Badger; this is an unexpected pleasure. Sit down. Now what can I do for you? You'll excuse my coming to business so abruptly, but I'm overwhelmed with work and—— In trouble—in great trouble? I'm sorry to hear that. The Dampwell job? Oh, about that, is it? Six hundred pounds? It's a big lump, certainly; but if Mr. Walker has condemned the work there's an end of it. The job was placed in his hands, to act for the council, and although I can, of course, exercise my discretion, I am convinced beforehand that he's right, and you'll have to do the work over again. Friendship? Old acquaintance? They can't enter into a case of this kind. Besides, there are two sides of the question. Why shouldn't friendship have led you to do your work properly?

* * * *

No, I can do nothing in the matter. Could it if I liked? But I don't like. I've a character at stake, and — I don't quite understand you. Don't beat about the bush so—speak plainly what you have to say. Oh, that's it, is it? A hundred pounds spot cash, and fifty for Mr. Walker. Of course, I can only speak for myself, and I tell you straight out that what you offer me is not nearly enough. Like every other man, you see, according to the old saying, I have my price. How much do I want? It's difficult to say right off—let me think a bit. Let me see—eight and ten's eighteen and six is twenty-four. Twenty-four thousand—well, I tell you what, make it a round sum and call it twenty-five thousand. Pounds? Of course—twenty-five thousand pounds! Mad? Oh, no, Mr. Badger, I'm particularly sane at this moment, and I solemnly undertake that in consideration of your paying me the sum of twenty-five thousand pounds I, for my part—I can't answer for Mr. Walker, although he might be disposed to take half the sum—will pass the exceedingly bad work you have put in at Dampwell, and will duly certify payment in full for it—eighty per cent now, ten per cent on completion, and the remainder three months after, all according to the terms of your contract.

* * * *

Oh, you may laugh, Mr. Badger; but I can assure you that I'm quite serious. You'll give two hundred? You've had my final offer, and it's for you to take it or leave it. You'll humour me? Well, as you please; and you'd like to know how I make the amount up. I'll tell you then. In the first place my salary here is, as you know, £400 a year. Now, we'll take that at twenty years' purchase, which works out at £8,000. But you're not asking me to give the job up? Quite so; but I should have to give it up. I certainly couldn't stay on and look after those who would then be my fellow rogues and scamps. Then there enters the question of moral damage. Let's put this at £10,000—not a penny less could I estimate it at. Of course, there are men whose moral worth nothing could lower, having regard to its existing level. I've had clean hands now for a good many years, and I'm not going to soil 'em "for nowt." So far, we've reached £18,000; but we haven't considered the wife. She's been decently brought up, and couldn't live on a penny less than £200 a year, and I estimate this also at thirty years' purchase, equal to £6,000. You're not asking me to leave my wife? You're not—— My dear sir, I ask you, could I possibly look an honest woman in the face again? No; parting would be imperative, and even if I didn't leave her, I feel pretty convinced that so strong would be her contempt for me that she'd leave me. That makes £24,000 in all, and I've just added the cool thou. to arrive at a nice round sum. £25,000! That's my price, and if you're not prepared to pay it—get out!

* * * *

Hum—exit Badger with a vengeance! And now to make a start. Tell Miss Bruce to come in at once with her book. Ready, Miss Bruce? Write to Lorrimer—"Dear Sir, I shall be pleased if you can arrange to meet me at——' Oh, hang the 'phone! Yes? Eh? Two men, do you say? I'll come at once. That'll do, Miss Bruce, for the present—we must have another try later. Bad news? Yes, very bad; two poor fellows injured at Landon End—explosion in sewer—you'll explain to anyone who calls, won't you? Yes, all appointments must be off, for the morning at least. Ask Phipp to ring up to those he can at once. Say I'll be back as soon as possible, and please tell Mr. Smith to follow on as soon as ever he comes in. Now, I wonder what the cause of this is? Petrol, I'll swear. (Looks like getting home early to-night with a vengeance.) Removed to the hospital—much hurt? No? Well, I'm glad to hear that. Oh, here you are, Mr. Smith. A pretty mess, isn't there? Half the road gone, and what's worse, two poor fellows damaged. Get a gang to work at once, and make everything good temporarily as soon as possible. Send to the station and ask if they can send a man to divert the traffic at the corner of John-street. By-the-bye, we can plug the main sewer there, and divert the flow into the John-street supplementary. Yes, plug at the outgo of the manhole—we've got a plug big enough, haven't we? Well, there's no time to argue it out now—if we haven't, wire to town for a couple. Ask for them to be sent by special messenger; we're bound to have them then. They're things we ought to keep in stock. But there, I can't waste time talking now—I'll just run up to the hospital and see how the men are—I shan't be above half-an-hour.

* * * *

Let's see, I was writing to Lorrimer. "Dear Sir, I shall be pleased if you can make it convenient to call upon me at——" Did I say "to meet me"? Well, it doesn't matter—he may as well call here as not.

"——to call upon me on Wednesday next at four o'clock. We can then——" Yes? That's right—you're speaking to him. Can I what? Can I see you if you run across now? Well, it's not—— You're going away to-day for the rest of the week, and if you don't see me now—— Very well. It's of no use, Miss Bruce; put your book away—I've a committee in half-an-hour, and I'm quite sure that I shan't get rid of Purser in under that. You'd better come in between committees, and I'll see what can be done then. Eh? Mr. Who? Mr. Wharton? Say I'll see him in ten minutes, and—— Oh, I really shan't be able to manage it. Most particular? Oh, well, he'll have to wait until I've done with the other two. Now, Mr. Purser, I'm at your service——

* * * *

Awfully sorry, dear, but can't possibly get home. Had the usual day, and am only starting my correspondence. Let's see—its just gone six—say nine; I'll really be home then, unless, of course—— Horrid? No, really I'm not—it's no fault of mine. By-the-bye, you won't see Mrs. Badger to-night. How do I know? Has she been to see me? Good heavens, no! but her husband has, and—— Oh, it's too long a story to tell now. I'll have to wait until I get home. Good-bye. Yes, nine o'clock at latest, unless—— Good-bye!

INSTITUTION OF MUNICIPAL AND COUNTY ENGINEERS.

SCOTTISH DISTRICT COMMITTEE MEETINGS.

At a joint meeting of the Roads, Housing and Town Planning and General Purposes Committees of the Scottish District of the Institution of Municipal and County Engineers held in the City Chambers, Edinburgh, on Friday, the 10th inst., there were present sixteen members. The secretary intimated apologies for non-attendance from Messrs. Allan Stevenson, J. Lee, Thomas Aitken, James Thomson, Charles Massie, W. L. Gibson and A. Watt Allison.

It was unanimously agreed to add Mr. J. R. Findlay, burgh surveyor, Leith, to the Housing and Town Planning Committee in order to bring the number of members up to nine, in terms of the "minute" of December 21st last.

BY-LAWS.

The secretary read a letter, dated December 20th, from the secretary of the Local Government Board intimating that they had disposed of the Model By-laws, and that the Secretary for Scotland had them now under consideration. The secretary was instructed again to write the Secretary for Scotland urging him to consider and approve of the by-laws as early as possible, and to urge the further revision and completion of the remainder of the by-laws relating to building construction, streets, &c.

NOMINATIONS TO COUNCIL.

It was agreed that Mr. A. H. Campbell and Mr. J. E. Wilkes should be put forward as nominees for election as members of council. These gentlemen expressed their willingness to serve on the council if elected.

NOMINATIONS OF DISTRICT OFFICERS.

It was agreed to hold a general meeting, on a date to be arranged, to consider nominations for the offices of vice-president, chairman, district representative and hon. district secretary.

ROADS COMMITTEE.

At a meeting of this committee there were present Messrs. J. Walker Smith, A. H. Goudie, G. Donaldson, A. A. Turiff and David Ronald.

Mr. J. Walker Smith was unanimously elected convener of the committee, and Mr. W. H. Wainwright, city engineer's office, Edinburgh, was elected committee secretary.

It was agreed that meetings should be held in Edinburgh or Glasgow on Fridays, at 2.30.

The secretary was instructed to write Mr. Cole as to the expenses of holding meetings and printing, &c., being defrayed out of the funds of the institution.

It was remitted to the convener and Mr. Ronald to draw up a programme of business for the next meeting of the committee.

GENERAL PURPOSES COMMITTEE.

"Minute" of meeting of the General Purposes Committee held in the City Chambers, Edinburgh, on Friday, January 10, 1913.

Messrs. A. H. Campbell, John Bryce, John Young, F. G. Holmes, William Ballantine, A. Forbes, W. Forbes, W. Watson and David Ronald were present at a meeting of this committee.

Mr. A. H. Campbell was unanimously elected convener of the committee, and Mr. David A. Ronald, burgh surveyor, Grangemouth, was elected committee secretary.

The secretary was instructed to write Mr. Cole as to the expenses of holding meetings and printing, &c., being defrayed out of the funds of the institution.

Committee correspondents were appointed to collect, digest and tabulate up-to-date information on the following matters—viz., superannuation (Mr. J. hn Bryce), main drainage (Mr. W. Forbes), tramways and transit (Mr. J. Young), water (Messrs. Charles Massie and W. Watson), hospitals and sanatoria (Mr. A. Stevenson), statistics, general (Messrs. J. Young and A. Forbes). The information so collected is to be sent to the committee secretary by March 31st, and to be submitted to a meeting of the committee to be held in April. After the information has been submitted and considered by the committee it is to be kept by the hon. district secretary, and to be available for the use of Scottish members on application to the hon. district secretary. A copy of the information will be sent to the general secretary of the institution in London for the general use of the members of the institution.

HOUSING AND TOWN PLANNING COMMITTEE.

At a meeting of the Housing and Town Planning Committee Messrs. J. Bryce, A. H. Campbell, F. G. Holmes, J. L. Lumsden, P. C. Smith, John Young and J. E. Wilkes were present.

Mr. John Bryce was unanimously elected convener of the committee. It was also agreed that W. A. Macartney, Johnstone, and J. E. Wilkes, Dunfermline, should be elected committee secretaries.

Mr. Wilkes was instructed to attend at the Local Government Board and offer to place at their disposal the experience of the committee in framing further regulations relative to town planning.

It was agreed to accept the invitation of Mr. Wilkes to visit Dunfermline on Saturday, February 1st, to inspect town-planning schemes in connection with Rosyth development.

TOWN-PLANNING COMPETITION: REVISED CONDITIONS.

The revised conditions in connection with the institution's town-planning competition have now been issued, but apart from the deletion of the conditions which in the original notice demanded details of works and a bird's-eye view of the town and required sewers, tramways, markets, baths, destructor, &c., to be shown, the announcement is identical with the one published in our issue of November 22nd last and need not, therefore, be repeated.

Road Foreman Fined.—A road foreman in the employment of the Darfield Urban District Council has been fined 20s. and costs by the Barnsley magistrate for leaving a road excavation insufficiently lighted.

Dermatine Valves for Air Pumps.—The Dermatine Company, Limited, 93 and 95 Neate-street, Camberwell, S.E., write: In June, 1911, we supplied for an air pump manufactured by Messrs. W. H. Bailey & Co., Limited, of Manchester, some air-pump valves, which were put into work at Messrs. Martineau's sugar refinery, Whitechapel, in November, 1911. The pump is now undergoing its annual inspection, and the valves have been taken out. They have been remeasured, and it is found that, although the pump has been maintaining a vacuum of over 29 in. night and day for eleven months, the valves have worn on one side less than 3/64 in., and we have every reason to believe that a period of at least twice as long as they have already lasted will elapse before the valves are worn out and unfit for use. The good result attained has been to a large degree due to the fact that the valves were fitted with the patent Anchor bush, which absolutely eliminates any tendency of enlargement in the central hole, thus maintaining a high vacuum, avoiding expense of early stoppage of machinery, and the possibility of spoiling the material in process of manufacture. The guards and grids were designed by ourselves for Messrs. Bailey. The natural corollary is, therefore, if a high vacuum and freedom from breakdown are wanted, use Dermatine valves fitted with the patent Anchor bush.

CORRESPONDENCE.

"In every ill beneath the sun
There's some remedy or one;
If there be, resolve to find it,
If not, submit, and never mind it.
— ANON., *circa* 1813.

INSTITUTION OF MUNICIPAL AND COUNTY ENGINEERS: PROPOSED DEFENCE FUND.

To the Editor of THE SURVEYOR.

SIR,—For some time past the council have had under consideration a draft scheme for establishing and administering a "Defence Fund" so as to afford members, associate members, and students help at law if prosecuted, libelled, or otherwise defamed, and further to take mediative or protective steps in the interests of members unjustly dismissed or professionally harassed.

The council in undertaking this effort are persuaded that such a policy is a wise policy, an eminently desirable one, and necessary in the interests of the general body of members.

Having taken legal opinion upon the subject, the council are advised that the present Articles and By-laws prohibit the enforcement of a compulsory levy for such a purpose, as under the terms of the Memorandum of Association proceedings are strictly limited to those affecting the general interests or rights or professional status of municipal engineers and surveyors as a class. It is therefore impossible as the Memorandum now stands to undertake out of the general fund of the institution the enforcement of the rights of members, or the defence of such rights, unless some general principle is involved affecting municipal engineers and surveyors as a collective body.

To alter the terms of the Memorandum would involve an application to, and the sanction of, the Board of Trade, together with a subsequent confirmation by the Court, which we are advised it is extremely improbable we should obtain. The only other suitable method open to the council to enable them to afford support to individual cases is to establish a "Voluntary Defence Fund," similar to the "Orphan Fund," to be controlled and worked independently.

The council are extremely anxious to give valuable and effective support to all deserving cases, individually or collectively, but for such a fund to become a real source of usefulness it is necessary, before proceeding further, for them to ascertain to what extent the members are voluntarily prepared to financially support the scheme they have in view.

It is possible that many members who feel themselves secure in their appointments may not be disposed to make common cause in defence of the common rights and in the maintenance of the common interests of municipal engineers generally; the council nevertheless earnestly hope that the whole of the members may be animated by one spirit, determined to stand together as one man, and thus furnish the council with pecuniary resources to carry out successfully the object they have in view.

It is suggested that the annual subscription of members be fixed at a minimum of 7s. 6d., associate members 5s. students 2s. 6d., and that the benefits of the fund be limited to subscribers thereto. . . .

In making this appeal, we desire it to be clearly understood there is no compulsion upon individual members to subscribe to the fund, and anyone preferring not to do so retains in other respects his full rights and privileges of corporate membership of the institution. Yours, &c.,

R. J. THOMAS, M.INST.C.E.,
President, Institution of Municipal and County Engineers.
W. H. PRESCOTT, M.INST.C.E.,
Hon. Sec. and Treasurer.

Town Hall,
Tottenham.
January 21, 1913.

REFUSE DESTRUCTION.

To the Editor of THE SURVEYOR.

SIR,—I have read with interest your excellent [illegible] birthday number, on which please accept my hearty congratulations.

Will you permit me also to make one or two observations about the special article on refuse destructors, which constitutes an interesting survey of the subject from early times, but which is by no means an [illegible] matter.

I am most concerned with the references to modern practice, though I submit that, in the historical part, more might have been said about the first destructor to be combined with a public electric supply station. It was put up by the Horsfall Company at Oldham in 1892, and, like yourselves, has now come of age.

However, I do not care half as much about getting credit for my firm for early pioneer work (such as, for instance, the introduction of the "back-fired, hand-fed furnace," described by your contributor as though it were a novelty, on p. 79) as I do about the references to the present standard designs.

I must really ask leave to meet the criticisms of the Horsfall "Tub-feed" furnaces, on the same page.

I am grateful to the author of the article for describing this arrangement as "clever and ingenious," but the delicious taste of those adjectives is quite spoilt by the statement that: "The complicated mechanism leads sooner or later to trouble."

I beg to assure you that the mechanism is not complicated, but extremely simple; and has not, under fair treatment, led to trouble anywhere, but can be seen working satisfactorily at Leeds, Greenock, Liverpool (Mersey Dock and Harbour Board), Poplar and Zürich. I can confidently refer you to the authorities at those places. Like all other machinery, it requires sympathy, and, occasionally, a little oil, and then it works well. Each furnace on this system will destroy 1 ton per hour, and there is a very important saving in labour over hand-feeding for any plant burning 50 tons per day and upwards. That a prejudice exists against it in some quarters is undeniable; but it may be remembered that other useful innovations, including the roundness of the world, have had the same difficulty to overcome.

As to the theory that a big charge practically banks the fires, I can only inform you that with the instantaneous mechanical feed the loss of temperature in the flue is less than with any hand-firing system, and the steam raising results are second to none. There is no time for cold air to be drawn in.

Your contributor's remarks on air heaters are worthy of close attention, and I agree with him that air heaters will not form a prominent feature in future installations, except where wet material is to be burned. The more that dry daily collection from bins becomes the fashion, the less are preheaters required for the blast. But the dustiness of the "dust" so collected increases from day to day, and calls for careful consideration.—Yours, &c.,

G. WATSON, M.INST.C.E., M.I.MECH.E.

Atlas Works,
Pershore.
January 20, 1913.

BITUMINOUS MATERIALS.

To the Editor of THE SURVEYOR.

SIR,—In reply to the letters of Messrs. Nathan and Dussek, notwithstanding their remarks, I still adhere to the word "asphalt" as representing bituminous concrete. The natural asphalt, if analysed, will show how closely it conforms to ordinary concrete if cement is substituted by bitumen; this is indicated in my book on "Modern Road Construction." From a manufacturer's point of view it may be a good policy to adhere to the present nomenclature, and if the terms had consistently been applied for many years to a material, there would be good reason for support on these lines; but it is well known that engineers ask for, say, Trinidad Lake *bitumen*, and they get what some term "asphalt" and what others term "bitumen" —*i.e.*, the same material. Vary rarely do electrical engineers ask for "asphalt" or "asphaltum." I have no doubt Mr. Dussek has seen a circular issued by a certain firm which described their bitumen as containing 99 per cent asphalt. Then a representative of another firm was heard to describe ordinary asphalt as containing 10 or 12 per cent bitumen, "but *our* asphalt contains 99 per cent bitumen, therefore, &c. &c. . . ."

While there is such a possibility of misusing the terms, it is obviously time for a change, and for the words "bitumen" and "asphalt" to be placed to their proper spheres.—Yours, &c.,

FRANCIS WOOD.

Town Hall,
Fulham, S.W.
January 20, 1913.

THE PRESENTATION TO MR. R. J. THOMAS.

To the Editor of THE SURVEYOR.

SIR,—It has been arranged to invite the president, Mr. R. J. Thomas, to dinner on Friday evening, February 7th, at Messrs. Lyons', Victoria Mansions Restaurant, Victoria-street, London, S.W., at 6.30 o'clock, when the wedding present subscribed for by members of the institution will be presented to him.

Application for dinner tickets (3s. 6d. each) should be made to Mr. Thomas Cole, secretary of the institution, 11 Victoria-street, London, S.W., not later than the 31st instant, in order that the necessary arrangements may be made.

I take this opportunity of thanking all who have subscribed to the wedding present, and to ask those who have not yet replied to my circular, but desire to join in this token of their appreciation of the services rendered to the institution by the president, to communicate with me not later than the 24th instant.—Yours, &c.,

ALBERT D. GREATOREX.

Town Hall,
West Bromwich.
January 20, 1913.

EXPERIMENTAL ROAD SECTIONS, SIDCUP.

To the Editor of THE SURVEYOR.

SIR,—At the meeting of the South-Eastern District of the Institution of Municipal and County Engineers held at Sidcup last Wednesday, I find I made a mistake in giving the cost of repairs to Section No. 11 (Tarmac) as £11 13s. This should have been £6 6s. 6d.

The error crept in owing to the cost of surfacing, amounting to £5 6s. 6d., being entered twice.

I shall be much obliged if you will, in the interests of accuracy and of the Tarmac Company, kindly make this correction through the columns of your paper.—Yours, &c.,

H. P. MAYBURY.

County Surveyor's Office,
St. Peter-street,
Maidstone.
January 14, 1913.

[It will be seen that we were able, before going to press with last week's issue, to make the necessary correction in Mr. Maybury's summary of the cost of repairs on the trial sections.—Ed., SURVEYOR.]

SERVICE TRIALS OF ROAD CRUST MATERIALS.

INTERIM REPORT OF THE ADVISORY COMMITTEE OF THE ROAD BOARD.*

While the excellent report before us may be regarded as made by the Road Board to the public, it is in actual form a report of the Engineering Advisory Committee of the board made to the board itself. The report is a unanimous one, the omission of Mr. John Brodie's signature being merely due to the fact that he was absent in India when it was signed. It is mentioned, however, in the introduction that Mr. Brodie approved of the report in substance before he left England. In this introduction it is pointed out that the object of the trials of road materials on the Eltham-Sidcup road was explained in a pamphlet issued in July, 1911. The trial lengths of roadway were laid down under the general direction and supervision of the Advisory Engineering Committee of the board. Each length was made and is maintained in the same manner as road-surface work laid down under normal service conditions, the cost of the work being defrayed by the Road Board. It was stated in the pamphlet already referred to that it was desired to get a road on which the experience gained might be practically applicable to any macadam road having to carry a fairly heavy traffic, whether in town or country. This obviously impossible condition was not, of course, obtainable, nor is one surprised to learn that "it was difficult to find a road of what may be described as average conditions." The road actually selected is one the traffic on which is much above the average; but most local surveyors will probably agree that in any trial of this character it is better to test the materials more severely rather than less severely than under average conditions. It cannot, however, be admitted that the traffic on this road can be recorded as in any sense representing modern road traffic generally, and the conditions are in many respects somewhat widely divergent from average conditions, if an average of conditions as regards roads be in any way conceivable.

The length of road under test at Sidcup is altogether 2,430 yds., and has a surface area of 18,230 sq. yds. A summary of statistics of traffic for the week ending September 15, 1910, showed that the total estimated weight of traffic passing over the road was 2,518 tons per day. Another census for the week ending August 21, 1912, a summary of which is given in the report before us, shows an aggregate estimated weight of 3,547 tons per day, which is described as an increase of about 41 per cent. Considering the position of the road, however, it seems reasonable, as suggested in the report, to suppose that a large part of this difference is due to a difference in date. In this connection the following figures may be noted: In the first fortnight of September, 1910, the average number of ordinary cycles per day was 1,497 and motor cycles 89; and in the week from August 15th to 21st the figures were respectively 750 and 53. The motor cars and the motor vans numbered 131 per day in September, 1910, and in the third week of August, 1912, these vehicles totalled 192 per day. The figure for motor-omnibuses in 1910 is 105 per day, and in 1912 331, which is probably a genuine increase due to the development of this traffic.

It is stated in the report that the road was one which subjected the trial surfaces to a very severe test, which is evidently the case; and it is recognised by the committee that the materials under trial on most of the sections would not be suitable for ordinary country roads without considerable modification. As comparative tests, however, these trials will no doubt furnish very useful data. The committee recommend that the further trials which it is intended to make in Buckinghamshire on a road of moderate traffic shall be proceeded with as soon as possible.

As regards the Sidcup trials themselves, it is pointed out that the costs per square yard are, except in the case of the lengths laid by the Kent County Council, reckoned on amounts paid to the contractors for small lengths laid under expensive conditions. This does not, of course, affect the issue in any way, since all that a surveyor has to do, in estimating the merits of a particular road crust, is to consider its qualities as shown by the trials, in the light of its cost to himself at the time.

The test in Wandsworth was made on a length of 210 yds. of carriageway which forms a part of the London-Portsmouth road. A traffic census taken in June, 1911, showed an estimated tonnage of 5,700 per day, and an autumn census towards the end of September, 1912, showed an estimated tonnage of 5,081 per day. Of this traffic about one-third consisted of motor cars and cabs, about one-fifth of the heavier motor traffic, such as motor lorries and tractors of all sizes, and less than half was in the form of horse-drawn traffic. This road averages over 30 ft. in width. In order to make some comparison between the rates of wear on this road with those observed at Sidcup, one length of double pitch-grouting was laid by the same contractor and in exactly the same manner as one of the lengths at Sidcup.

The twelve test lengths at Fulham were put down by the Fulham Borough Council by arrangement with the Road Board, the work being done by direct labour under the supervision of the borough surveyor. The estimated tonnage in Bagley's-lane was 2,171 per day, a large part of this traffic being in the form of the heavier class of horse-drawn vehicle. As suggested in the report, this fact should provide us with some useful comparative data.

We hope to deal in forthcoming issues with the separate reports on the trial lengths, and to review the results as far as it is proper to do so at the present stage of the tests.

* London: Waterlow & Sons. Price 2s. nett.

An Attractive Road Board Appointment. We draw special attention to the announcement in our advertisement columns of the appointment to be made by H.M. Road Board of a temporary junior engineering assistant, at a salary of £250 a year, with travelling expenses. Candidates must have obtained, under a municipal and county engineer, practical experience of road engineering.

Assistants' and Students' Section.

Conducted by SYDNEY G. TURNER, assoc.m.inst.c.e.

All communications in regard to this page must be addressed to The Editor, St. Bride's House, 24 Bride-lane, Fleet-street, E.C. *Envelopes must be marked "Assistants' Section" in the top left-hand corner. Correspondents are invited to submit questions for consideration and answers to the questions which appear. For the contributions considered to be the most meritorious, one or more premiums in books will be awarded monthly. Diagrams must be drawn to scale on separate sheets, ready for reproduction.*

QUESTIONS.

This week answers are invited to the following questions:—

380. Retaining Wall.—A retaining wall is required to support a roadway having no footpath, and consequently heavy vehicles such as steam rollers, &c., will seriously surcharge the wall. The height of the roadway above the adjoining ground is 8 ft., and the filling will be good clay. Design a suitable wall in mass concrete, and show calculations. (D. G. B., *Darlington.*)

381. Waterworks.—Two pumping engines deliver water at the rates respectively of 1,620 and 1,150 gallons per minute together into three pumping mains 10 in., 11 in. and 12 in. diameter. What is the velocity in and the discharge of each main? (D. G. B., *Darlington.*)

382. Hydraulics.—By fixing a short tube to the orifice in the side of a vessel a considerable increase in the discharge is obtained. Explain why this is so, and give the comparative "coefficients of contraction" with and without the tube. (E. S. M., *Luton.*)

383. Reinforced Concrete.—Give sketches of the metal forms of fake-work for reinforced-concrete construction, showing how the moulding is arranged at the junctions, such as between the column and principal rafter, a column and cambered roof, &c. (T. H., *Leicester.*)

384. Geodesy.—What is meant by reducing a horizontal measurement to mean sea level? (Perplexed.)

[The Editor is at all times glad to hear from readers who desire to submit questions regarding matters of general interest, points of daily practice, &c., for insertion in the "Assistants' and Students' Section." Questions which are published are taken into consideration, as well as other matter, in awarding the Monthly Premium.]

REPLIES TO QUESTIONS.

293. Surveying.—Will some reader kindly give a sketch and description of Colby's Compensation Bars for the accurate measurement of base lines? (Student.)

The compensation bars invented by Major-General Colby with a view to eliminating errors resulting from the varying temperature of the measuring rods at different times are constructed on the following principle:—

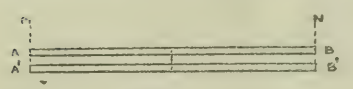

FIG. 1

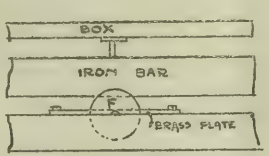

FIG. 2

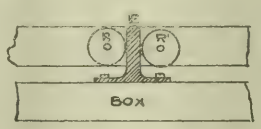

FIG. 3

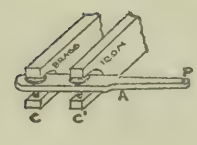

FIG. 4

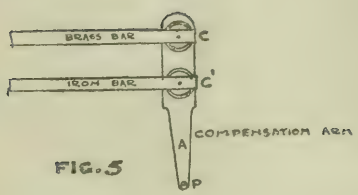

FIG. 5

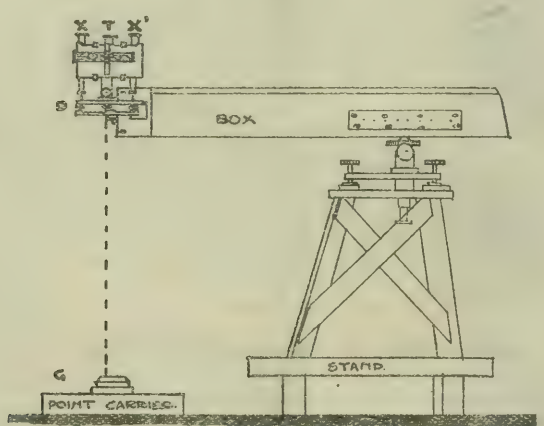

FIG. 6

Details of Colby's Compensation Bar.

Two bars of different metals and different rates of expansion are laid parallel and close to each other (Fig. 1, A B and A' B'). They are fixed at the centre from and to which point they are free to expand and contract. At a given temperature they are taken of the same length, and in this condition suppose the lines A' A M and B' B N (Fig 1) to be drawn through their extremities and perpendicular to their lengths, so that A M = B N; make also the ratio of A M to A' M or of B N to B' N equal to the ratio of the expansion of the bar A B to the bar A' B'. Suppose both bars to receive an equal positive or negative increment of temperature, and if in this position lines are drawn through their extremities, these lines will evidently pass through the points M and N as already determined. This is not mathematically correct, but the difference, being very slight, may be neglected. In actual construction the bar A' B' is of brass, and the bar A B is of iron, and A' M and B' N are flat steel tongues at the extremities of the bars (Figs. 4 and 5) moving freely on conical pivots (C C') of brass allowing them to be inclined at small angles with the lines perpendicular to A B and A' B'. At a temperature of 62 deg. Fahr. the bars are assumed to be of the same length, and hence the tongues are at right angles to them.

The compensation bars are each made 10 ft 1·5 in. long at 62 deg. Fahr., 5 in. broad and 1·5 in. deep. Fig. 2 shows a side elevation of one rod; Fig. 3, side

elevation of rod supports, Fig. 4, per-spective view of metal tongues at ends of rods, and Fig. 5, plan of metal tongues fixed to ends of rods.

The rods are placed edgeways at a distance of 1·125 in. apart, and are supported in the middle upon rollers (Fig. 2, F) and are firmly fixed together at their centres by transverse steel cylinders (Fig. 3, R, R¹), which are 1·5 in. in diameter, each rod being left free to expand or contract from or to the centre or neutral axis.

This neutral axis is formed of a T-piece (Fig. 3, E) fixed firmly on the bottom of the box in which the bars are fixed. At the extremity, and at right angles to these bars, is a flat steel tongue (Figs. 4 and 5, A) 6·2 in. long, 1·1 in. broad, and 0·25 in. in thickness which projects 3·25 in. from the side of the iron bar. The tongues are jointed by double conical brass pivots at C and C' (Figs. 4 and 5), which form axes perpendicular to the surface of the tongue, allowing it to be inclined in the direction of the bars at slightly different angles according to contraction or expansion due to temperature.

The pivots are 0·5 in. diameter, and are placed 2·3 in. from the end of the tongue next the brass bar. On the tongue at P, flush with its upper surface, a small platinum wire is inserted, upon which a small dot is struck to form the standard of measurement.

The bars are placed in a strong wooden box to the bottom of which are fixed brass plates holding the rollers, by which the bars are supported (Fig. 2, F) and the centre stay (Fig. 3, E), which prevents any displacement of the bars when the rods are held by the rollers R R¹ (Fig. 3).

To protect the tongue (A) which projects beyond the box there is a special covering nozzle which has a hole and cover over the dot which is thus made visible. A level is placed on one of the bars which is seen through a glass in the lid of the box. At the ends of the box plates are fixed for supporting the tripod of the double compensated microscopes (Fig. 6, X and X¹), which is employed to observe the standard measurement points of one pair of rods brought by adjustment into true position. A pair of sight vanes which shut down are placed on the ends of the box for ranging the rods approximately in position or in line.

Two rigid tripod stands (Fig. 6) are used to each rod. These tripods carry a universal slide rest by which the rod may be adjusted to position both in a horizontal and vertical direction.

The interval between two adjacent compensation points of two bars lying in a true line is brought to exactly 6 in. by means of a compensation microscope constructed in the following manner:—

Two microscopes (Fig. 6, X¹ and X) of 2 in. focal distance, lying parallel to each other and 6 in. apart, are connected by two bars, one of brass and one of iron, in such a manner that the outer foci of their object glasses are compensated points at exactly 6 in. apart. Through the centre of these two bars passes a telescopic microscope (Fig. 6, T) parallel to the other two, with adjustment for reading a point on the ground perpendicular to the measuring rods. The microscopes revolve on the axis of this centre telescopic microscope in a vertical tube attached to the upper surface of a tripod, with levelling screws and screws for communicating motion in a longitudinal or transverse direction. The tripod of the microscopes rests on a three-armed grooved stand carried by a brass plate fastened to the end of the box. To the brass bar of each compensation microscope is attached the level, and on the other side is a small telescope movable in a vertical plane for the alignment of the rods. The measurement of the 6-in. interval is effected by bringing one of the outer microscopes of the compensation microscope, when in perfect adjustment, alignment and level, to bisect the compensation point of one of the bars, and then bringing the compensation point of the other bar (by tangent screw motion) to be bisected by the other microscope.

It should be understood that the compensation microscope is a separate instrument.

The distance between the compensation microscopes of the first and last of a complete set of bars (six) arranged in true alignment is 63 ft.

The end of each series of bars when used in measurement is transferred to the ground by means of a point carrier. This apparatus (Fig. 6, G) consists of a triangular cast-iron plate with a flat hollow cylinder of brass screwed to the centre of its upper side, enclosing a movable disc having a fine point engraved on its surface. This point is adjusted to the required position by means of three small equidistant screws. The point carrier is placed under the telescopic microscope, so that the fine point shall be nearly in line of its optical axis, and the final adjustment of the dot will then be made by means of the three adjusting screws. This dot forms the initial point for the next set of bars.

In measuring base lines a piece of fairly level ground is selected, and the bars are supported on the tripods or trestles about 3 ft. from the ground. The heights of the uppermost surfaces of the tripods are arranged by the theodolite for all intermediate points between the two ends of the line.

The Colby system of measuring base lines has been largely adopted on the Continent and in America for large surveys in those places. (Mountain Spa.)

ROAD BOARD GRANTS.

STAFFORDSHIRE COUNTY COUNCIL'S PROPOSAL.

At the quarterly meeting of the Staffordshire County Council on Tuesday last the Main Roads and Bridges Committee recommended that a communication should be sent to the County Councils Association urging that an application should be made to the Road Board that instead of making grants in aid of improvements to the extent of approximately 50 per cent as at present, the Road Board should be asked to pay the whole cost of improvements desired by county councils and approved by the Road Board, the work to be carried out to be limited to the amount which the Road Board were willing to grant.

Sir Reginald Hardy moved the adoption of the report, and remarked that when the Road Board was instituted it was intended to relieve the local rates, but the actual effect of the policy of the board had been to increase them, as in order to get a grant the local authorities had to raise an equal amount from the rates. In 1912 the Road Board had accumulated a sum of over £2,000,000, so they had got plenty of money. The county had not taken the amount they were entitled to because they did not want to increase the ratepayers' contributions.

Mr. J. C. Wedgwood, M.P., moved that the paragraph should be sent back to the committee, as he regarded the condition laid down by the Road Board as an admirable and a useful one. It was only right and fair that the ratepayers should contribute towards these road improvements.

Mr. Chilton seconded the amendment, but on a division it was lost by a large majority, and the recommendation of the committee carried.

Blackburn Town Planning.—Mr. Thomas Purvis Ritzema, a Blackburn magistrate, has deposited with the Mayor plans for improving Central Blackburn. Because of the probability of the council's seeking Parliamentary powers for a town-planning scheme the time is considered opportune for including central improvement proposals. Mr. Ritzema has alternative schemes involving total expenditures of £49,000 or £300,000. He declares both can be made profitable to the corporation.

Sir John Macdonald and "Potholes."—Sir J. H. A. Macdonald, K.C.B., president of the Scottish Automobile Club, and a member of the Road Board, addressed a meeting of members and friends in the smoke-room of the club last week on the subject of "The Road—Past, Present and Future." In the course of his address he remarked that to a certain extent the use of the steam roller had not been satisfactory. After showing specimens of large and unsuitable stones which he personally had gathered from parts as far distant as Dundee and Surrey, he said that it was a fallacy that the motor car produced potholes in the road. The best proof was that the Trossachs-road, on which motors were not allowed, was full of potholes. The pothole was not caused by any sucking action of the motor. Some people probably thought that he went there to say that the road surveyors were a set of blockheads. Far from that being the case, a great deal of the information had been derived from splendid road surveyors of this country, men who did their duty with imagination, not just following in the rut of the past.

"THE SURVEYOR'S" COMING-OF-AGE.

SOME FELICITATIONS.

With considerable gratification we acknowledge the following kindly comments on the recent attainment of our majority. We have to tender our cordial thanks to the writers:

I heartily congratulate you on achieving your majority. THE SURVEYOR has steadfastly maintained its position in upholding the status of the profession, and its contents are a veritable compendium of municipal engineering. You have my best wishes for the future.—Mr R. J. Angel, borough engineer, Bermondsey.

My very cordial congratulations both on the event and on the issue celebrating it. The review of the years covered is most interesting, and will be useful for easy reference.—Mr. William Blair, borough engineer, St. Pancras.

Mr. A. H. Campbell, city engineer, Edinburgh, has pleasure in joining in the congratulations to THE SURVEYOR upon the attainment of its 21st anniversary, expressing his appreciation of the continued growth, usefulness and progress of this valuable paper, and wishing for it many years of continued benefit to the members of the profession of municipal and county engineers.

Very heartily do I congratulate THE SURVEYOR on its "coming-of-age." I send my best wishes for its continued progress. Long may it live to carry out its useful and very valued work!—Mr. Thomas Cole, secretary, Institution of Municipal and County Engineers.

My staff join with me in congratulations on the great value of THE SURVEYOR as an educational instrument for municipal engineers, on its reaching its majority and in hopes for its continued success.—Mr. A. E. Collins, city engineer, Norwich.

I beg to congratulate you on your "coming-of-age" number, which is full of interest to me as a most readable history of the engineering developments of the past twenty years. Of course, to me the road question has been studied with the closest attention. But the whole of the other questions are dealt with in an eminently convenient and readable form.—Colonel R. E. Crompton, consulting engineer to the Road Board.

In response to the invitation expressed in the quotation at the head of your "coming-of-age" article I "give you my hand" and heartily congratulate you on attaining your majority. As a member of the profession in whose interests you have all along devoted yourself, I can truly say that I have derived much pleasure and profit from your columns. From the very first number it has been one of my weekly pleasures to peruse your journal, and I seize this opportunity of expressing my hearty appreciation and cordial thanks, with best wishes for continued prosperity.—Mr. A. T. Davis, county surveyor, Salop.

I well remember the interest excited by No. 1 of THE SURVEYOR. It was felt that a new era was opening for the benefit of those connected with and affected by municipal works. The general advance made during the twenty-one years in all that makes for the welfare of the citizen and the citizen's representative is largely due to THE SURVEYOR. Hearty congratulations and all good wishes.—Mr. J. W. Dugdale-Bradley, city engineer, Westminster.

As one who has experienced much assistance from the perusal of THE SURVEYOR for many years past, I should like to express my appreciation of the manner in which it has been conducted, and my sincere good wishes for its future success.—Mr. E. J. Elford, borough engineer, Southend-on-Sea.

One trusts that THE SURVEYOR, having attained its majority, will still continue its efforts (always appreciated) towards the instruction and enlightenment of the members of the profession, the youngsters of which can always find in your columns instruction and inspiration, while the fossils find food for reflection. Best of all wishes.—Mr. A. Gladwell, engineer and surveyor, Eton Rural District Council.

Mr. Percy Griffith [secretary, Institution of Water Engineers] sends hearty congratulations to the Editor of THE SURVEYOR upon the "coming-of-age" of this very useful and excellent journal. Its future (as its past) will depend upon its intrinsic merits, and now that these have been so fully tested and proved by experience, it may confidently be hoped and expected that the future will amply justify the hopes and wishes which are undoubtedly shared by all readers of this indispensable handbook of municipal engineering.

As one of your very first supporters I heartily congratulate you on your "coming-of-age," and wish you every success in the future. I cannot say you have improved with age, for you have so very consistently maintained your first high standard of excellence.—Mr. E. Purnell Hooley, county surveyor, Notts.

Very hearty congratulations upon THE SURVEYOR'S "coming-of-age." May its "years of maturity" be marked by ever-increasing success, and its "declining years" prove to be far beyond the ken of any of its present readers. You may well take pride that THE SURVEYOR has no rival as a high-class technical journal whose sole aim is to serve and advance the interest of British municipal engineers in all parts of the world. All such will, I am sure, agree that the profession as a body is very greatly indebted to you for establishing and so ably conducting a journal which unfailingly champions their interests, and keeps them *au courant* with up-to-date professional information. In fact, so necessary has it become to us that it seems incredible that only a generation ago there was no SURVEYOR. Which of us would like to be without it now?—Mr. W. J. Howard-Smith, ASSOC.M. INST.C.E.

On your birthday your readers extend to you the right hand of fellowship. They congratulate you on twenty-one years of useful work. They count with confidence on your continued co-operation with public servants in all parts of the country to improve those conditions on which the well-being of the public depends—housing and health, sanitation and lighting, roads and transport.—Mr. W. Rees Jeffreys, secretary, Road Board.

All good wishes in connection with your "coming-of-age." May your future progress be still more successful, and in every sense of the word all you can desire.—Mr. Charles Jones, borough engineer, Ealing.

My very hearty congratulations. I hope you will continue your useful work for many years to come.—Mr. W. T. Lancashire, city engineer, Leeds.

I congratulate THE SURVEYOR upon its "coming-of-age." As the senior past-president of the Institution of Municipal and County Engineers, I have fully realised the good work done, and I wish THE SURVEYOR continued prosperity.—Sir James Lemon, Southampton.

Congratulations on the "coming-of-age" of THE SURVEYOR, and best wishes for its future prosperity. Of late years I have often noticed how quickly the years roll by, and events of twenty years ago seem only like ten. In the case of THE SURVEYOR, however, my first impression was that it was more than twenty-one years since its first number, and this I must attribute to the interest and great variety of its editorials, accounts of meetings, and other valuable contents in each weekly issue, year by year.—Mr. Joseph Lobley, Stoke-on-Trent.

Mr. E. George Mawbey [borough engineer, Leicester] sends his hearty congratulations on the "coming-of-age" of THE SURVEYOR, together with his great appreciation of the valuable services rendered to municipal and county officers in particular, and local government administration generally. He also wishes long life and continued prosperity to the paper and to all readers enjoying the advantages and facilities afforded by this admirable journal.

I congratulate you most warmly upon attaining your majority. Have been a subscriber for the entire length of your existence, and have been pleased with your improvement and progress. Long may you thrive.—Mr. H. P. Maybury, county surveyor, Kent.

It gives me much pleasure to express my hearty congratulations on your "coming-of-age." I well remember the advent of your first number with articles on land surveying, by Curtis, as I think its chief feature. One little thought then that it would be the potent force in municipal engineering it afterwards became. I trust its success has bestowed rewards on its owners commensurate with the advantages it has given municipal engineers. I wish it many more years of success, prosperity and utility.—Mr. E. B. B. Newton, borough engineer, Paddington.

Heartiest congratulations and all good wishes for a prosperous and bright future.—Mr. Sydney Perks, city surveyor, London.

Heartiest congratulations upon your "coming-of-age." My especial thanks are due to you for the

The Surveyor
And Municipal and County Engineer.

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generous and useful aid that you have given to the Orphan Fund of the Municipal and County Engineers from its inception. Long may your good work in this and other directions continue.—Mr. O. Claude Robson, engineer and surveyor, Willesden Urban District Council.

May I, on the occasion of the "coming-of-age" of THE SURVEYOR, express my best wishes for the future prosperity of your newspaper, and the hope that the engineering and surveying profession as a whole will give the support which the high character of your publication in the interest of municipal engineering so rightly merits?—Mr. Norman Scorgie, borough engineer, Hackney.

Congratulations on the "coming-of-age" of THE SURVEYOR.—Mr. E. Shrapnell Smith.

Permit me to congratulate you on the attainment of your majority, and may your strength and power increase with growing years.—Mr. W. J. Steele, city engineer, Newcastle-on-Tyne.

Congratulations upon attaining your majority, and upon your efforts to advance the interests of our profession.—Mr. R. J. Thomas, county surveyor, Buckinghamshire; president, Institution of Municipal and County Engineers.

Hearty good wishes to THE SURVEYOR on attaining its majority, and for its future welfare. I trust it will live long to continue the valuable information it has already disseminated among engineers and surveyors since the date of its birth.—Mr. H. T. Wakelam, county engineer, Middlesex.

Permit me to offer you my hearty congratulations on THE SURVEYOR attaining its majority, and to express the hope that this most valuable and useful publication may have a vigorous and flourishing existence for many generations to come.—Mr. J. Paget Waddington, borough engineer, Marylebone.

Please accept our congratulations upon the "coming-of-age" of THE SURVEYOR, and our best wishes for its future success. Although we cannot (except perhaps in the spirit) be present to celebrate its centenary, I trust in due course it may reach that ripe old age full of honour and advertisements. The profession then will probably be in the clouds designing aerial roads, needing no macadams; but what the trade can do to eke out their existence one cannot foretell. At any rate, we hope the controversies on bitumens and corrugations will by then have concluded. With kind thoughts, many happy returns, long life and prosperity to THE SURVEYOR.—Messrs. Western Bros., Limited.

Accept my congratulations and good wishes on the "coming-of-age" of THE SURVEYOR. You have aided greatly in stimulating public interest in municipal works and matters, and in raising the status of our profession.—Mr. Wm. Hy. White, city engineer, Oxford.

Allow me very heartily to congratulate THE SURVEYOR on attaining its 21st birthday. I hope it will continue to have an increasing value as a journal containing the best information (and scientific matter) from the best sources.—Mr. Francis Wood, borough engineer, Fulham.

May I be allowed to wish you the customary many happy returns of the day? The wish is usually accompanied by a present, but in this case the order has been reversed, I having been a recipient of one of the presents "specially issued" by you. I am in the fortunate position of being able to congratulate you in a threefold capacity: (1) As a one-time municipal engineer I have been a reader of your paper for the last twenty years, so I have not missed many issues, and I believe I am correct in saying that such an important event as my first appointment was duly recorded in its columns; (2) As one of your staff for several years, and as an occasional contributor for the last fourteen years, I have had the pleasure, not only of assisting in the success and improvement which have marked the progress of the paper, but of endorsing quite a number of cheques; (3) As an official engaged by a well-known municipal engineering body I—but I can say nothing on this score, as the last thing I would wish you to do is to take this letter as anything but quite an informal (and therefore quite an unofficial) communication.—Mr. B. Wyand, secretary, Institution of Municipal Engineers.

May your services to the municipal engineer be as valuable during the next twenty-one years as they have been in the past and as honourable to yourself.—Mr. T. H. Yabbicom, Bristol.

The "coming-of-age" of THE SURVEYOR reminds me of the song "I'm Twenty-one To-day," and the limerick "There was a young lady of Wantage," but I fear that any doggerel I might evolve from these classics would not look dignified in cold print, and I can therefore only use hackneyed phrases: (1) I wish you all success—go ahead and prosper; (2) Do right and fear no man; don't write and fear no woman.—E. F. S.

The special "coming-of-age" number of THE SURVEYOR is before us, dated January 17th. Our contemporary has accomplished its first twenty-one years of existence. We wish it most heartily many prosperous years to come. Conducted on the best journalistic lines, with great ability and excellence, it deserves the success it has attained. Its "coming-of-age" number is worthy of the traditions of the paper. It is one of very special value to every surveyor and county engineer in the country and abroad. Our advice is: Buy it.—*The Contractors' Chronicle.*

CONCRETE INSTITUTE.

At a general meeting of the Concrete Institute, to be held at Denison House, 296 Vauxhall Bridge-road, Westminster, S.W., on Thursday next, at 7.30 p.m., a paper entitled "The Settlement of Solids in Water and its Bearing on Concrete Work," will be read by Dr. J. S. OWENS, ASSOC.M.INST.C.E., M.R.SAN.I., F.G.S.

Housing in Anglesey: £130 Cottages.—The Valley (Anglesey) Rural District Council received a report recently from their Housing Committee, who recommended that the council should forthwith build twenty workmen's cottages in different parts of the district, and that architects be invited to submit in competition a set of working plans of semi-detached cottages and of a row of four to six houses, each house to contain a fairly large living-room, a scullery and three bedrooms. During the discussion on the report it transpired that the committee stipulated that the cost of each house should not exceed £130. Eventually an amendment that ten houses instead of twenty should be erected was carried.

LOCAL GOVERNMENT BOARD INQUIRIES.

The Editor invites the co-operation of SURVEYOR *readers with a view to making the information given under this head as complete and accurate as possible.*

INQUIRIES HELD.

Blyth U.D.C. (January 8th. Mr. M. K. North).—£5,000 for the purchase of land in Bridge-street for the proposed new municipal buildings. It was stated that the estimated cost of the proposed new building, including the price of the land, was £15,000.

Chadderton U.D.C. (January 16th. Mr. T. C. Ekin). £5,500 for the reconstruction of the sewer in Bowerlane.—In the course of the inquiry, Mr. Hugh Stowell, the Mersey and Irwell inspector, stated that the Chadderton sewage works were the best in the Mersey and Irwell watershed of a similar size. During 1911-12, since the works were extended and completed, he had taken ten samples of effluent. Nine were entirely satisfactory and one unsatisfactory, but that was afterwards explained, and the difficulty had since been overcome. The effluent of the Chadderton sewage works would in every way pass the suggestions of the Royal Commission, and it was a credit to the designing and management of the works.

Darlington T.C. (January 9th. Mr. M. K. North).—£6,591 for the extension of mains, £800 for providing workmen's cottages adjoining the pumping station, and £5,358 for private street improvements.—With respect to the latter sum, it was stated that the frontagers in a number of streets, two-thirds of which were new, having failed to comply with the corporation's notices to put the roads into proper repair, the council had decided to undertake the work, and desired to borrow the money until the sum involved was repaid by the frontagers.

Hinckley U.D.C. (January 21st. Mr. M. K. North).—£3,800 for works of sewerage.—The engineer, Mr. E. H. Crump, stated that the whole of this sum was required for a new main outfall sewer. Egg-shaped concrete tubes were proposed to be used, and the same would be surrounded up to the springing with cement-concrete. The existing sewer was at the most only 21 in. in diameter, while the largest tubes would be 42 in. by 28 in. The existing sewer was quite inadequate to take the necessary flow, and had frequently burst and caused the road surface to collapse.—There was no opposition.

Strabane No. 1 (Tyrone) R.D.C. (January 17th. Mr. J. P. Hannigan).—£15,020 to enable the council to acquire the necessary plots and erect 86 cottages for labourers in their district. For Ballyneanor there were applications for 7 cottages; Baronscourt, 3; Ballymegarry, 18; Camla, 4; Churchlands, 5; Douglas Burn, 2; Dunalong, 13; Donemana, 13; Glenmorran, 5; Lislea, 3; Loughash, 1; Mountcastle, 4; Newtownstewart, 1; Urney East, 7.—Mr. Wm. Stewart, engineer, gave evidence as to the quality of the land chosen by the Sites Committee, and the possibility of obtaining a satisfactory water supply.

Sunbury U.D.C. (January 17th. Mr. F. O. Stanford). —£2,500 for the purposes of sewerage and sewage disposal.—The clerk, Mr. C. E. Goddard, stated that it was proposed to place a pair of ejectors in the Staines-road at the corner of Green-lane, and also to provide additional engine power at the sewage works. The surveyor, Mr. H. F. Coales, said the present ejectors were working well, but they had been in use for a lengthy period, and it was hardly safe to continue to rely on them entirely. They were small ejectors, and their capacity was not sufficient. With reference to the engine scheme, one of the present engines was giving trouble. If a gas engine were installed it would do the work of both the present oil engines, but it was proposed to keep the latter as auxiliaries. The suction gas engine, in his opinion, would be the most economical plant to have.

APPLICATIONS FOR LOANS.

Barnes U.D.C.—£3,550 for wood paving in Sheen-lane, and £16,200 for the Malthouse area improvement.

Colwyn Bay U.D.C.—£550 for a shelter and chapel at the cemetery.

Glastonbury T.C.—£300 for a steam fire engine.

Loftus U.D.C.—£1,000 for main sewerage.

Melton Mowbray U.D.C.—£1,063 for the Beck Mill improvement scheme.

Salford T.C.—£10,000 for the provision of a recreation ground.

Saxmundham U.D.C.—£10,000 for sewage disposal and water schemes.

Wednesbury T.C.—£1,195 for the purchase of property for a street improvement.

Widnes T.C. £2,900 for a road improvement scheme.

Winchcombe R.D.C.—£1,350 for a water supply scheme.

LOANS SANCTIONED.

Bradford T.C. £1,130 for the provision of bowling greens.

Clare R.D.C. £603 for workmen's dwellings.

Featherstone U.D.C.—£35,745 for the erection of 159 workmen's dwellings.

Hungerford R.D.C.—£1,060 for workmen's dwellings.

Lowestoft T.C.—£179 for a road improvement.

Shifnal R.D.C.—£4,350 for sewerage and sewage disposal.

Shoeburyness U.D.C. £1,270 for street improvement works.

Swindon T.C. £3,200, £1,000 and £800 for terms of fifteen, fifteen and twenty-five years respectively, for the purposes of the electricity undertaking.

Wantage R.D.C.—£1,000 for four workmen's houses.

West Riding C.C.—£31,617 for the purchase of school sites, erection of schools, and road improvements.

FORTHCOMING INQUIRIES.

	JANUARY.	£
27.	**Walton-on-Naze.** For pleasure ground, sewerage, and fire escape purposes (Mr. R. H. Bicknell)	559
28.—	**Croydon.** For the erection of a fire station (Mr. F. H. Tulloch)	8,000
28.	**Glandale.** For water supply purposes (Mr. W. O. E. Meade-King)	830
28.—	**Hendon.** For fire station and street purposes (Major J. Stewart)	27,879
28.—	**Riccall.** For works of sewerage (Mr. A. G. Drury)	780
28.—	**Ripley.** For works of sewage disposal (Mr. A. A. G. Malet)	2,781
28.—	**Swansea.** For works of water supply (Mr. R. G. Hetherington)	—
29.—	**Chesterfield.** For sewage disposal purposes (Mr. A. A. G. Malet)	2,595
29.	**Hadham.** For the purposes of a housing scheme (Mr. C. H. Eyles)	1,100
29.	**Leeds.** For the purposes of the gas undertaking (Mr. A. G. Drury)	30,000
29.—	**Watford.** For the provision of pleasure grounds (Mr. Edgar Dudley)	7,120
30.—	**Bolton.** For electricity purposes (Mr. T. C. Ekin)	130,000
30.—	**Hartlepool.** For the provision of an open space (Mr. W. O. E. Meade-King) ...	972
30.—	**Mirfield.** For sewage disposal and road improvement purposes (Mr. A. A. G. Malet)	4,467
31.—	**Baildon.** For works of sewage disposal (Mr. A. A. G. Malet)	893
31.—	**Reigate.** For road improvement purposes (Mr. Edgar Dudley)	900
31.—	**Sedgefield.** For private street works (Mr. W. O. E. Meade-King)	3,540
	FEBRUARY.	
1.—	**Chelmsford.** For the provision of stables (Mr. M. K. North)	1,850
5.—	**Howden.** For the provision of an hospital (Mr. W. W. E. Fletcher)	3,200

Calendar Competition.—The wall calendar issued this year by Messrs. John Smart & Son, 53 Victoria-street, Westminster, S.W., the well-known manufacturers of tar-macadam paving, is a reproduction of the design for which, as announced in our issue of August 2nd last, the firm awarded a prize of £10 to Mr. F. C. E. Gradisky, of Manchester. Competition, we may recall, was invited for the prize in THE SURVEYOR of June 7th, the designs received being adjudicated upon by judges appointed by this journal. A further £10 is now being offered by Messrs. Smart for the best designs submitted for their 1914 calendar, and intending competitors are advised that the necessary entry forms will be sent to them on application to the offices of the firm.

Municipal Work in Progress and Projected.

The Editor invites the co-operation of SURVEYOR *readers with a view to making information given under this head as complete and accurate as possible.*

The following are among the more important projected works of which particulars appear below: Buildings—Blyth £15,000, Hastings £20,000, Hendon, Herefordshire £11,500, Newcastle-on-Tyne, Taunton £6,000; housing and town planning—Bath; roads and materials—Bath; sewerage and sewage disposal—Beverley £9,583, Hendon £13,000, Maldens and Coombe £7,800; water, gas and electricity—Oldham, Wallasey. Particulars of other works projected will be found on our "Local Government Board Inquiries" page.

ADMINISTRATION.

Camelford (Cornwall) R.D.C.—The position of roadmen under the National Insurance Act was discussed at a recent meeting, correspondence between the county financial clerk and the Insurance Commissioners being read. In reply to questions asked, the commissioners stated that where quarrymen or stone breakers took contracts for work which they could perform at any time, or could employ others to perform, such men under the Act were not insurable. The clerk stated that he had some time since placed the position of such men before the commissioners, and the reply he received was that they were insurable, but since then they had given an opposite opinion. Mr. Wakefield mentioned that most of the men employed in the quarries and in breaking stones were occasionally employed in day work. Then undoubtedly they were insurable, and if they were not insurable in the weeks in which they happened to have no day work, it would create conditions which would be extremely confusing. It was decided to continue to insure the men until a test case had been decided.

BUILDINGS.

Blairgowrie T.C.—Plans have been prepared for new county buildings, which it is proposed to erect in Croft-square.

Blyth U.D.C.—It is proposed to build new municipal buildings at an estimated cost of £15,000.

Bolton T.C.—Shelters and conveniences are to be provided in Great Lever Park.

Chertsey U.D.C.—A site has been purchased for the erection of a storage depot.

Derby C.C.—The extension of the county buildings at Derby, which has been carried out at a cost of £30 000, has been inaugurated. Mr. G. C. Copestick, surveyor to the Derbyshire Standing Committee, was the architect.

Falkirk T.C.—A sanatorium is to be erected at an estimated cost of £4,500.

Cainsborough U.D.C.—The tender of Mr. Burrell, at £600, has been accepted for the erection of an open-air bath.

Hastings T.C.—The shore end of the pier is to be acquired for the purpose of enlargement, to provide accommodation for a band and a sheltered promenade. The completed scheme will involve the expenditure of about £20,000. It is hoped to commence the work shortly.

Hendon U.D.C.—The council are being advised by the Works Committee to erect a swimming bath at the rear of the municipal offices.

Herefordshire C.C.—The county surveyor, Mr. G. H. Jack, has prepared plans for a girls' school at Hereford, at an estimated cost of £11,500.

Herts C.C.—The Education Committee have accepted the tender of Messrs. G. Darwell & Sons, Chorley Wood, at £2,448, for the erection of a new school at Chorley Wood.

Ilkeston T.C.—It having been reported that the architect estimated the proposed alterations to the town hall to cost £900, the council have requested that a modified plan be prepared.

Keighley T.C.—Contracts to the amount of £3 225 have been placed for the erection of public baths.

Lowestoft T.C.—The design of the borough surveyor, Mr. G. H. Hamby, has been accepted for the erection of a concert pavilion at Sparrow's Nest, at a cost of £1,300.

Monmouthshire C.C.—A new school is to be built at Blackwood, at an estimated cost of £8,174.

Newcastle-on-Tyne T.C.—Public baths are to be provided at Benwell and Walker, at an estimated cost of £20,000, and at Heaton at a cost of £8,000. A mortuary is to be erected at Swing Bridge at a cost of £746.

Newcastle-on-Tyne T.C.—Mr. Beresford Pite, architect, of London, has prepared a report with respect to the best means of utilising the town hall site. After allowing for the necessary accommodation for administration departments of the municipality, the scheme provides for a small hall for public functions capable of seating about 500 persons, or "dining," say, 250 persons at one time, a small portion of the ground floor being retained for the purposes of a corn exchange.

Taunton T.C.—It is proposed that the Market Trustees and the council should jointly undertake to erect a town hall over a portion of the markets, at a cost not exceeding £6,000.

Wakefield T.C.—A special sub-committee of the council is considering a scheme for the widening and improving of Wakefield Bridge.

Weston-super-Mare U.D.C.—The surveyor, Mr. H. A. Brown, has received instructions to prepare plans for proposed abbatoirs.

HOUSING AND TOWN PLANNING.

Bath T.C.—The city surveyor, Mr. C. R. Fortune, has prepared a map of the district of South Lyncombe, showing the area which could be included in a town planning scheme. After going into the matter, the council have instructed the city surveyor to consider the advisability of including a larger area, covering the whole of the south side of the city, between Bloomfield-road and the western boundary of the city, in a town planning scheme, and to submit a map of this area to the Town Planning Committee, together with such other information upon the subject as he was able to obtain.

Bourne U.D.C.—Plans for workmen's dwellings have been approved.

Brigg R.D.C.—Inquiries are being made into the preliminaries of a housing scheme.

Chester T.C.—The city surveyor, Mr. W. M. Jones, acting in conjunction with the medical officer, has been instructed to prepare sketch plans and schemes for utilising a portion of the Richmond House site and the Sandy-lane Depot site, belonging to the corporation, for the erection of houses at low rentals for the working classes.

Exeter T.C.—The Local Government Board have intimated that they are prepared to approve of the Exeter Nursery as a site for the rehousing of 150 out of 200 persons to be accommodated under the Exeter (Paul-street, &c.) Housing of the Working Classes Order, 1911. The area of the site is 9a. 1r. 25p., and the city surveyor, Mr. T. Moulding, has submitted a plan which, with slight modifications, shows the erection on part of the land of twenty-six cottage dwellings and twelve cottage flats, which will provide accommodation for 154 persons. The part to be utilised as a recreation ground contains an area of about 3a. 2r. 3p., and is so arranged as to include and preserve the avenue of trees and the other ornamental features of the old nursery. An area of about 4a. 0r. 37p. will be available for allotments, and this will provide fifty-eight plots of about 10 poles each. The plan has been approved and forwarded to the Local Government Board.

Huddersfield T.C.—In the recent town planning competition, promoted by the corporation for the laying out of certain areas within the county borough and an adjacent suburb, the adjudicator, Mr. H. Percy Boulnois, M.INST.C.E., London, has awarded the second premium of 50 guineas to Messrs. M. A. Piercy, W. H. Beeston, C. B. Thomson, and P. H. Solon, all of the borough surveyor's department, Stoke-on-Trent.

Lyme Regis T.C.—The council have erected twelve cottages, and are erecting eight more on the same

...ate, which is just under 2 acres. The cost of the land, &c., was £750, and the building contract for the first twelve houses was £2,260. The loan granted was £3,010 at 3½ per cent. Of this £750 was to be paid in eighty years, and the remainder in fifty-six years. The eight new cottages will cost £1,596, which has to be paid in sixty years.

Market Bosworth R.D.C.—It is proposed to initiate a housing scheme for Markfield by building twelve cottages.

St. Thomas (Devon) R.D.C.—The architect's plans for six cottages at Whimple have been approved and submitted to the Local Government Board. Each dwelling contains three bedrooms.

Waterford U.D.C. Power is being sought to purchase land as a site for 200 working-class dwellings, at an estimated cost of £25,000.

Ystradgynlais U.D.C.—Sites have been selected for three batches of council houses at Colbren, twenty houses near Prices' Arms, Abercrave, twenty houses at Henneuadd and Ystradgynlais, and twenty houses near Bryn-road.

REFUSE COLLECTION AND DISPOSAL.

Kensington B.C.—The Works Committee have had under consideration a letter from the London County Council on the subject of the by-laws made relating to the removal of house refuse, which have been in force and unaltered for nearly twenty years. The committee recommend the council to reply that they are not impressed with the necessity of amending the present by-law as to the periodical removal of house refuse. They would not, however, take exception to the duty being imposed upon the sanitary authorities of making more frequent collections in those cases where the householders can reasonably satisfy such authorities that the circumstances existing warrant additional attention. They strongly object to the obligation being placed upon them of removing the refuse from all premises in the borough twice weekly or three times fortnightly, irrespective of actual necessities.

Woolwich B.C.—The council have replied to the inquiry of the London County Council with respect to the removal of house refuse that they do not consider it necessary to enforce a general collection of house refuse in the borough more frequently than once a week; that where local authorities arrange for a more frequent collection from certain streets or houses, they should have power to compel the house refuse to be brought out; and that a new by-law is desirable requiring the house refuse at each house, although not subject to daily removal, to be placed in a receptacle provided for that purpose.

ROADS AND MATERIALS.

Ballymoney R.D.C.—The statement of expenditure for road maintenance for the year 1913-14 includes, *inter alia*, a sum of £1,000 for steam rolling.

Bath T.C.—The city surveyor, Mr. C. R. Fortune, has presented a report with respect to the Broughton Hayes improvement, including the widening of the railway bridge, and he estimates the total cost at £3,150. The town council have asked the county council whether they will be willing to give up the land to enable the widening to be carried out for the whole length of the road.

Brighton T.C.—A sum of £4,000 is to be spent on double and interlacing lines on the tramway track in New England-road and Chatham-place.

Coleraine R.D.C. A road improvement scheme, estimated to cost £1,200, is under consideration.

Epsom R.D.C. — The Worcester Park Amateur Gardeners' Society have been asked to submit a list of places where they desire to plant trees and place seats, a worthy work, upon which we congratulate the society. In reporting, the surveyor to the council noted that, under the Highways Act, trees could not be planted on the highway within 15 ft. of the centre of the road, and that, in the case of private streets, trees could be planted before the roads were taken over.

Esher and the Dittons U.D.C.—As an outcome of the Road Board's recent letter as to grants or loans for works of road or bridge improvement within the Metropolitan Police area, the surveyor, Mr. H. C. Fixsd, has recommended applications as to the resurfacing with tar-macadam of Station-road, Esher, and as to several of the district roads in Long Ditton and Thames Ditton, on which approximately £600 was spent some twelve months ago to make good excessive wear caused by motor omnibuses, although the latter would seem to come within the board's condition that applications should not refer to works "that have been commenced."

Glamorgan C.C.—Reporting to the Roads and Bridges Committee, the county surveyor (Mr. Geo. A. Phillips) states that the main roads of the county suffered severely during the wet weather. A large amount of patching has been necessary, and extra casual labour required to cope with the work of clearing the mud. From November 1, 1911, to date the weather had been continuously wet or damp, the wet days recorded being 290. These did not take account of the periods in which rain fell during the night time. The surveyor added that the conditions have tended to retard the progress of all the main road widening contracts. His estimate of money required for the working of the main roads to the end of March, 1914, was £45,310, as against £43,874 for the closing year.

Greenwich B.C.—The council have sent to the members of the Government and others copies of a resolution expressing the opinion that, in view of the enormously increased cost of road maintenance due to the development of heavy motor traffic, those who conduct such traffic should be required to contribute substantially in relief of the local rates.

Lichfield T.C.—A scheme is to be promoted for the widening of Tamworth-road, at an estimated cost of £1,200, towards which it is hoped that a considerable grant may be received from the Road Board.

Maidenhead T.C.—Improvements are to be effected in High-street at an estimated cost of £1,577.

Oakham U.D.C.—Requests have been made to the county council and the Road Board for grants in aid of the cost (£550) of widening the High-street near Burgate.

Rochford R.D.C.—Consideration is being given to several important proposals for making up and sewering.

Surrey C.C.—In January, 1912, the council authorised an expenditure of £200 upon extra professional assistance to make the survey and plans in connection with the proposed new trunk road from Beverley Bridge to Esher, and also in connection with the improvement of the road from Shalford to Reigate, known as the East and West road. The Road Board have made a contribution towards the expense of this survey, and last week the council voted a further £50 for the completion of the plans and estimates. £447 has also been paid by the board as due to various district councils towards surface tarring on district roads.

Wincanton R.D.C.—The council are considering a rearrangement of the staff and the adoption of direct labour on the roads, and in reply to a question they submitted to the Local Government Board that body state that they would not consent to the relieving officers of the board of guardians devoting their services to road or sanitary business.

SEWERAGE AND SEWAGE DISPOSAL.

Beverley R.D.C.—Messrs. Fairbank, of York, have prepared a sewerage scheme for Brantingham, which is estimated to cost £9,583.

Hendon U.D.C.—A proposal has been considered for improvements at the sewage outfall works, estimated to cost £13,000.

Maldens and Coombe U.D.C. —The council have adopted a committee's report which set forth the necessity of at once constructing additional works to cope with the ever-increasing volume of sewage, and recommended the completion of tanks, the construction of additional percolating filters, and a new outlet channel, and steps for preventing the overworking of the filters and for the efficient disposal of the sludge. Another recommendation adopted was for the erection of a refuse destructor, with suitable provision for dealing with the sludge in addition to the refuse. The total cost of the scheme, including £2,500 for the destructor, is approximately £7,800.

Petersfield R.D.C. Mr. Harry W. Taylor, ASSOC.M. INST.C.E., of Messrs. Taylor & Wallin, Newcastle-upon-Tyne and Birmingham, will report upon the sewage disposal of the town, particularly from the point of view of the cost of pumping as compared with gravitation.

Shifnal R.D.C.—The Local Government Board have sanctioned the proposed scheme of sewerage and sewage disposal.

WATER, GAS, AND ELECTRICITY.

Bath T.C.—It has been decided to convert fifty-five gas lamps to electricity in various parts of the city, at a cost of £99 (coronas £63, and other charges £27).

Long Eaton U.D.C.—It has been decided to extend the electricity works by the installation of dynamos and water-tube boilers, with an engine-room, boiler-house and office, at a cost of about £8,000.

Marylebone B.C.—As a result of a report by the consulting engineer with respect to the electricity plant, the council have agreed for the purchase of two turbo-alternators, at a total cost of £8,600.

Oldham T.C.—Additional plant, estimated to cost £30,000, is to be provided at the Greenhill electricity station.

Swansea T.C.—The Water and Sewers Committee have decided to offer the Oystermouth Urban District Council a supply of water from the Cray reservoir of 25 gallons per head of the population at 5 per cent on the assessable value for the past five years, the cost of mains to be borne by the corporation, and at 6 per cent afterwards any quantity of water above 25 gallons per head to be charged at 6d. per 1,000 gallons. The present rateable value is £24,000. The proposal of the Oystermouth Council was the payment of 4 per cent for the first five years and 5 per cent afterwards.

Totnes R.D.C.—The Local Government Board have written approving of the proposed water supply for Maredon.

Wallasey T.C.—The Electricity Committee are contemplating the erection of a new power station, at a cost of about £65,000.

Wincanton R.D.C.—The Local Government Board have sanctioned the scheme for a water supply to the parish of Lovington.

MISCELLANEOUS.

Clydebank T.C.—It is the intention of the council to fix fire alarms all over the burgh, and increase the strength of the fire brigade.

Havant U.D.C.—The question of purchasing a fire engine is being considered by the General Purposes Committee.

Liverpool T.C.—The working of the tramway and electrical undertaking last year contributed £97,000 in relief of rates—a sum equal to 6½d. in the £. £67,080 of profits came from the tramways. The committee are able to devote half of the profits to the rates.

PERSONAL.

Mr. Thomas Braithwaite, surveyor and inspector of nuisances to the Selby Rural District Council, died, we regret to state, last week.

Mr. Fredk. Anstead Browne, junior, draughtsman in the general department of the Essex county architect's office, has been appointed chief draughtsman at £200 a year, rising by annual increments of £10 to a maximum of £250.

Mr. Harry Tillstone, borough surveyor of Brighton, who has been under treatment in a nursing home, is, his numerous friends will be gratified to learn, making a satisfactory recovery.

Mr. R. John Hughes, surveyor to the Penmaenmawr Urban District Council, and hon. secretary to the North Wales Centre of the Sanitary Inspectors' Association, has been presented by the members of the association with a grandfather's clock in connection with his recent marriage.

Mr. C. Brown, city surveyor of Wells, who died after a week's illness, had held office for thirty-four years, and, as was stated by the Mayor at a recent meeting of the corporation, had given the last days of his life to the services of the city. The council passed a vote of condolence with Mrs. Brown and family, and Mr. R. Brown, deputy surveyor, thanked the members on behalf of his mother for their sympathy.

Mr. William George Lane, at present borough surveyor, water engineer and sanitary engineer of Dartmouth, has been appointed to the joint offices of borough surveyor and inspector of nuisances for Ludlow, at the inclusive salary of £200. There were 163 applications for the post. Mr Lane is a member of the Institution of Municipal and County Engineers, the Royal Sanitary Institute, and the Institute of Sanitary Engineers.

Mr. John Robb, county surveyor of Mid-Lothian, died, we regret to record, on the 15th inst. at Edinburgh. Born in Alloa fifty years ago, Mr. Robb, after serving his apprenticeship in an architect's office there, took up an appointment at Edinburgh in the offices of the assessor for railways and canals. He some time after entered the service of the Mid-Lothian County Council as suburban district surveyor, which post he held till about sixteen years ago, when he succeeded the late Mr. Forbes as county road surveyor. With the increase of motor traffic, a great deal of work was required in order to bring the roads up to modern requirements, and into his work he brought many progressive ideas, and last autumn he was complimented by the Road Board representatives, who were making their annual road inspection, on the way in which the two grants of £6,000 and £5,000 had been expended. At the time of his death he was engaged in the preparation of plans for the new bridge over the Water of Leith and the Caledonian Railway line at Colinton.

MOTOR VACUUM ROAD CLEANING DEMONSTRATIONS AT MANCHESTER.

The efficacy of the patent motor vacuum road cleaner recently introduced at Southport by the well-known Sheffield firm of J. & P. Hill was further demonstrated at Manchester last week, when three days—Wednesday, Thursday and Friday—were devoted to a series of trials of the new machine, the operations being witnessed by a large number of members and officials of public bodies.

Under any circumstances, having regard to the heavy traffic in the streets of Manchester, the tests were bound to be particularly severe, but, as it happened, the roadways on the first day of the trials were well covered with mud as a consequence of the bad weather, permitting of some most convincing demonstrations being given of the thoroughness with which the machine accomplishes its work. Later on, at the corporation depot in Water-street, a roadway, paved with setts, was strewn thickly with dusty material, which was removed with the same rapidity and absence of nuisance which had characterised the previous operations.

We have already fully described the new sweeper, but we may state briefly that the mechanism consists of a cylindrical brush composed of a series of small brushes, which revolve in an air-tight sheet-iron shell in the opposite direction from the wheels of the car. The sweeping roller rotates at a circumferential speed of 4,950 ft. per minute, and in turning through two-thirds of a revolution inside the shell raises the sweepings and discharges them into boxes in the receiver at the back of the vehicle through an opening contrived for the purpose. At present the receiver is a part of the machine from which the boxes can readily be removed and emptied, but it is proposed eventually to make this part of a detachable trailer which can be released and replaced by an empty one when necessary.

From a statement issued to those present at last week's demonstrations, it appears that in the case of the Southport trials an area of 2,933 super. yds. of roadway in the principal street of the town was swept in slightly over 18 minutes, some 2 tons of refuse being collected during that time. The cost of petrol consumed was 1¾d., while the combined wages of the chauffeur and an attendant were put at 6¾d. Adding 4d. as 50 per cent of the initial cost, depreciation, upkeep and so forth of the machine, the total cost of sweeping and collecting over the area referred to was 1s., or at a rate of 4s. 4d. per 12,000 sq. yds.

We understand that Messrs. J. & P. Hill have already received orders to supply their machine to Southport and Glasgow, while Sheffield have decided to make a trial of the sweeper.

Legislation and Legal Precedents, 1892–1913.—The remainder of the matter which appeared under this heading in last week's issue is unavoidably held over.

CHADWICK TRUST LECTURES.

We understand that Mr. H. Percy Boulnois, M.INST.C.E., chairman of council of the Royal Sanitary Institute, has been selected by the committee of the Chadwick Trust to give three lectures on "The Hygiene of the Home." These lectures will be given at the Royal Sanitary Institute, 90 Buckingham Palace-road, at 8.15 p.m., on Fridays, February 7th, 14th and 21st. Admission will be free, and from our knowledge of the manner in which Mr. Boulnois treats his subjects, we feel confident that the lectures will not only be instructive, but entertaining in their character.

Further particulars, and cards of invitation, may be obtained on application to the secretary, Chadwick Trust, 25 Craven-street, W.C.

FOR OTHER ADVERTISEMENTS

See End of Paper.

DEVON COUNTY COUNCIL.

ROAD CRUST IMPROVEMENT WORKS.

The County Council of the County of Devon invite Tenders for works of Strengthening, Draining and Re-surfacing certain portions of the Main Roads in the County in accordance with Plans and Specifications prepared by the County Surveyor.

No. 2 DIVISION.

Re-surfacing with water-bound macadam:—

1. Exeter-Cullompton-Taunton Road, 43,564 super. yards.
2. Exeter-Honiton-Chard Main Road, 17,108 super. yards, including drainage work.
3. Exeter-Christleigh Main Road, 12,424 super. yards.
4. Exeter to Okehampton Main Road, 7,950 super. yards, including drainage work.
5. Exeter-Crediton-Barnstaple Main Road, 26,950 super. yards.

Surface tarring certain sections of Main Road, total area about 135,000 super. yards.

Re-surfacing with pitch-grouted macadam a section of the Exeter-Okehampton Main Road, including drainage work, 8,793 super. yards.

Plans, Specifications, and Form of Contract can be seen, and Bills of Quantities and Forms of Tender obtained at the Office of Mr. W. P. Robinson, County Surveyor, No. 22 Queen-street, Exeter, on and after Monday, the 27th instant, during Office hours.

Sealed Tenders, on the Forms prescribed, endorsed "Road Contract," must reach the undersigned by 10 a.m. on Thursday, the 6th February, 1913.

The Council will not be bound to accept the lowest or any Tender, and they will not pay any charges or expenses of or preliminary to the preparation of any Tender or incident thereto.

F. BAILEY.
Clerk of the Council.

Castle of Exeter.
January 21, 1913.

BOROUGH OF CHARD.

CHARD WATER SUPPLY.

CONTRACT No. 4.

The Corporation of Chard is prepared to receive Tenders from Contractors for laying 5-in., 4-in., 3-in. and 2½-in. diameter Water Mains, together with Valves, Hydrants and other works.

Plans, Sections and detail Drawings of the proposed works may be seen, and Quantities, Form of Tender and other particulars obtained, on application to Messrs. Dodd & Dodd, MM.INST.C.E., County Chambers, Corporation-street, Birmingham, on and after 23rd January, 1913, on payment of Five Guineas, which will only be returned upon the receipt of a *bonâ-fide* Tender and the return of all documents to the Engineers.

Sealed Tenders, endorsed "Tender for Contract No. 4," are to be delivered at my Office in Chard at or before noon on 10th February, 1913.

The lowest or any Tender will not necessarily be accepted.

By Order,
J. A. FORWARD,
Town Clerk.

BOROUGH OF CHARD.

CHARD WATER SUPPLY.

CONTRACT No. 2.

The Corporation of Chard is prepared to receive Tenders from Contractors for the Supply and Delivery of 5-in., 4-in., 3-in. and 2½-in. diameter Cast-iron Pipes, Junctions, Bends and other Special Castings.

Drawings may be seen, and Quantities, Form of Tender and other particulars obtained, on application to Messrs. Dodd & Dodd, MM.INST.C.E., County Chambers, Corporation-street, Birmingham, on and after 23rd January, 1913, on payment of Five Guineas, which will only be returned upon the receipt of a *bonâ-fide* Tender, and the return of all documents to the Engineers.

Sealed Tenders, endorsed "Tender for Contract No. 2," are to be delivered at my Office in Chard at or before noon on 10th February, 1913.

The lowest or any Tender will not necessarily be accepted.

By Order,
J. A. FORWARD,
Town Clerk.

BOROUGH OF CHARD.

CHARD WATER SUPPLY.

CONTRACT No. 3.

The Corporation of Chard is prepared to receive Tenders from Contractors for the Supply and Delivery of 4-in. and 3-in. Sluice Valves, Fire Hydrants, Air Valves, and other Special Castings.

Drawings may be seen, and Quantities, Form of Tender and other particulars obtained, on application to Messrs. Dodd & Dodd, MM.INST.C.E., County Chambers, Corporation-street, Birmingham, on and after 23rd January, 1913, on payment of Five Guineas, which will only be returned upon the receipt of a *bonâ-fide* Tender, and the return of all documents to the Engineers.

Sealed Tenders, endorsed "Tender for Contract No. 3," are to be delivered at my Office in Chard at or before noon on 10th February, 1913.

The lowest or any Tender will not necessarily be accepted.

By Order.
J. A. FORWARD,
Town Clerk.

THE FINSBURY BOROUGH COUNCIL invite Tenders as under-mentioned from 31st March next:—

1. For twelve months—
   - Granite Patent Stone, &c.
   - Horse and Cart Hire.
   - Portland Cement and Lime.
   - Sand Ballast, &c.
   - Wood Paving Blocks.
   - York Paving.
2. For alternative periods of one and three years—
   - Blacksmiths' Work.
   - Carbolic Acid.
   - Castings.
   - Chandlery, Oils, &c.
   - Stoneware Goods.
   - Timber.

Particulars and Forms of Tender may be obtained on Saturdays, 10 to 12, on other week-days 10 to 4, from the Borough Surveyor at the Town Hall. Requests for forms should be accompanied by a stamped addressed foolscap envelope.

Tenders must be delivered before noon on Monday, 11th February prox. Only Tenders upon the official form, properly filled up and signed, and confined to the articles specified therein, will be entertained.

GEORGE WHITEHEAD PRESTON,
Town Clerk.

Finsbury Town Hall,
Rosebery-avenue, E.C.
January 22, 1913.

"REINFORCED CONCRETE." Special Correspondence Course by Experts. Moderate fees. Write for full particulars, Leonard Leeper, B. Eng., A.M.I.C.E., 25 Nelson-road North, Great Yarmouth.

BATTERSEA BOROUGH COUNCIL.
TO CONTRACTORS AND OTHERS.

The Council invite Tenders for the following from the 1st April next, as per Form of Tender:—

1. Veterinary attendance.
2. Horse hire.
3. Supply of materials for cart and van covers.
4. Removal of old tins from Culvert-road depot.
5. Supply of harness material and fittings.
6. Supply of paints, &c.
7. Supply of painters' sundries.
8. Supply of varnish, &c.
9. Supply of tools, &c.
10. Supply of ironmongery, &c.
11. Supply of granite macadam.
12. Supply of tarred slag macadam, gravel tar paving, &c.
13. Supply of York paving.
14. Supply of Thames ballast and sand.
15. Supply of stoneware pipes.
16. Supply of timber, &c., for carpenters' and joiners' work.
17. Supply of timber, &c., for wheelwrights' work.
18. Supply of bricks, cement, lime, slates, &c.
19. Supply of iron castings.
20. Supply of iron bars, &c., for blacksmiths' work.
21. Supply of disinfectants.
22. Coal and coke.
23. Soaps, oils, &c.

Forms of Tender, containing full particulars, may be obtained at the Town Hall between 10 and 4 (Saturdays 10 and 1), or by sending me stamped addressed envelope, under cover, endorsed "Tender Form," and no Tender will be considered unless made on such forms.

Tenderers must pay the trade union rate of wages in all departments. Tenders, in separate envelopes sealed and marked on the outside "Tender for——," must be delivered to me by 3 p.m. on Wednesday, 12th February, together, in the cases of Nos. 11, 13, 14 and 15, with samples, carriage paid.

W. MARCUS WILKINS,
Town Clerk.

Town Hall, Battersea.
January 22, 1913.

URBAN DISTRICT COUNCIL OF WOKING.
TENDERS FOR GRANITE.

The Council are prepared to receive Tenders for the Supply of 4,000 tons (more or less) of broken granite, to be delivered during the year ending December 31st, 1913.

Specification and Forms of Tender can be obtained of the undersigned, to whom sealed Tenders, endorsed "Tender for Road Granite," together with sample of the material to be supplied, must be sent not later than noon on Friday, February 14th, 1913.

The Council reserve the right to apportion the order as they may see fit.

The lowest or any Tender will not necessarily be accepted.

G. J. WOOLDRIDGE.

Council Offices.
Woking.
January 22, 1913.

BRITON FERRY URBAN DISTRICT COUNCIL.
HOUSING OF THE WORKING CLASSES.
TO BUILDERS AND CONTRACTORS.

The Urban District Council of Briton Ferry invite Tenders for the erection of Sixty-two Houses in Rows of 9, 10, 11, 12 and 20 Houses respectively.

Plans and Specifications may be seen at the offices of the undersigned after Saturday, 25th January. Persons desirous of Tendering are requested to notify the Architect, and to deposit with him the sum of One Guinea, which will be returned upon receipt of a *bonâ-fide* Tender.

Sealed Tenders, marked "Tender for Workmen's Dwellings," must be sent to James Revell, Esq., Clerk and Solicitor to the Council, not later than 22nd February, 1913.

The Council do not bind themselves to accept the lowest or any Tender.

H. ALEX. CLARKE,
Architect and Surveyor.

Council Offices,
Briton Ferry.
January 20, 1913.

METROPOLITAN BOROUGH OF SHOREDITCH.
ANNUAL CONTRACTS.

The Council of the Metropolitan Borough of Shoreditch are prepared to receive Proposals and to Contract with any person or persons for the following Articles and Works for one year from the 1st day of April next to the 31st day of March, 1914 (inclusive) viz.:—

1. Highways Department.—For Paving, Repairing, and Relaying the Footway and Carriageway Pavements within the said Borough, and the Supply of Materials. (A £10 Bank of England Note to be deposited with the Borough Accountant at the Town Hall at the time the Tender is lodged, otherwise the Council will not be responsible for same.)
2. For Supplying and Laying Patent or Manufactured Stone or other Paving Material.
3. Asphalting.
4. Broken Granite.
5. Plumbers' Work.
6. Smiths' Work.
7. Drain Pipes, Junctions, Bends, &c.
8. Drain Rods, Pails, Ropes, &c.
9. Timber.
10. Sewer Ironwork and Street Posts.
11. Lime, Cement, &c.
12. General Cartage. (A £10 Bank of England Note to be deposited with the Borough Accountant at the Town Hall at the time the Tender is lodged, otherwise the Council will not be responsible for same.)
13. Street Name Plates, Notice Boards, Writers' Work.
14. Ballast, Hoggin, Shingle, and Sand.
    Samples of the above Articles can be seen at the Depot, Flemming-street, Kingsland-road, N.
15. Scavenging and other Departments.—Iron, Ironmongery, Coach Ironmongery, Coal and Coke, Basket Work, and Miscellaneous Indiarubber Work, Brooms, Brushes, Harness, Sundries, Loin Cloths, and Sail Cloth Covers.
16. Uniforms and Costumes.
17. Paints, Oil, Cotton Waste, &c.
18. Gas Mantles and Chimneys.

Samples of the Articles required for these Departments may be seen, and Forms of Tender obtained, at the Town Hall, Old-street, E.C.

Tenders must be sent, properly endorsed, to the Town Clerk at his Offices as under, before 3 o'clock on Tuesday, the 18th February, 1913, after which time no Tenders can be received.

Contractors must agree to pay the trade union rate of wages observed at the date of the Contract, and to observe the usual hours of labour recognised by the trade, and not to sub-let the Contract.

The Council does not pledge itself to accept the lowest or any Tender, and none but Tenders on the official printed forms will be received, which, with any further information, may be obtained from the various Departments of the Council, or from

J. A. D. MILNE,
Town Clerk.

Shoreditch Town Hall,
Old-street, E.C.
January 22, 1913.

THE URBAN DISTRICT COUNCIL OF BARNES.
MOTOR FIRE ENGINES.

The above Council are prepared to receive Tenders for Two Motor Fire Engines.

Particulars and Form of Tender may be obtained at the Engineer and Surveyor's Office, the Council House, High-street, Mortlake.

Sealed Tenders, endorsed "Tender for Motor Fire Engines," made out on Forms to be obtained as above, to be sent in to the undersigned not later than 12 o'clock noon on Monday, February 10, 1913.

The Council do not bind themselves to accept the lowest or any Tender.

(By order)

G. BRUCE TOMES, ASSOC.M.INST.C.E.,
Engineer and Surveyor,

The Council House,
High-street, Mortlake, S.W.
January 21, 1913.

Mechanical Haulage.*

By JOHN ROBINSON, Surveyor to the Darlington Rural District Council.

When asked at your last meeting to read a paper on "Light Mechanical Haulage," it was with considerable diffidence I consented to do so. After giving the subject due consideration, I venture to think that it may be a matter of interest to most of you present here to-day to have my experience on mechanical haulage generally.

Before going further, I should explain that my district is somewhat exceptional, and mechanical haulage of some description is almost imperative in order to carry out the work in a satisfactory manner. Almost the whole of the material used in the district is obtained from two sources:—

(*a*) My council's own slagworks at Middleton-St.-George, at the extreme south-east of the district; and

(*b*) Messrs. Ord & Maddison's whinstone quarry at Bolam, at the extreme north-west of the district.

The district is badly supplied with railway stations or depots, so that if material were obtained by rail there is often a cartage of 3 to 4 miles in order to get it to its destination. From the two sources named I estimate that the average lead is 5 miles. You will easily see that, to lead by horses and carts alone, a great number would be required, and the cost would be very heavy.

HEAVY HAULAGE ENGINE AND WAGONS

Upon turning up my old reports, I find I first advocated mechanical haulage (traction engine and two wagons) in April, 1902, when I recommended my council hiring, at the rate of £2 11s. per day, inclusive of driver, two men, fuel, stores, &c. My report upon the working of the engine was as follows:—

"The work done with the traction engine, from April to the end of July, was 784 tons led from Bolam to Boroughbridge and Durham road, at a cost of 8s. 3d. per ton, against 10s. 10d delivered at Aycliffe Station, showing a saving of 2s. 7d. per ton, or £101 5s. 4d. Ninety-six tons were led to Stockton and Barnard Castle road (Piercebridge length), at a cost of 8s. 1d. per ton, against 9s. 10d. per ton delivered at Piercebridge Station, showing a saving of 1s. 9d. per ton, or £8 8s.; 240 tons were led to Stockton and Barnard Castle road (Sadberge length), at a cost of 8s. 5d. per ton, against 10s. 5d. delivered at Fighting Cocks Station, showing a saving of 2s. per ton, or £24; 64 tons were led to district roads from slagworks, at a cost of 3s. 5d. per ton, against 4s. 11d. if sent by rail, showing a saving of 1s. 6d. per ton, or £4 16s. The total quantity of stone hauled is 1,184 tons, at a saving of £138 17s. 1d., or an average of over 2s. 4d. per ton."

In March, 1903, my council decided to purchase a convertible haulage engine and two 8-ton wagons from Messrs. J. & H. McLaren, of Leeds, at a cost of £896 5s. This plant was delivered, and commenced work on May 21st that year. In November I reported the result of work done with the plant to September 30th. The cost of working had been £103 14s. 10d., and the amount earned upon private work was £123 8s. 2d., together with 941 tons hauled on to the council's own roads, which would have cost, to lead by carts, £111 4s. 8d., so that, allowing 15 per cent on capital expenditure for depreciation, the saving from May 21st to September 30th, as against horses and carts, was about £63 8s. My experience, ever since my council purchased their plant, has been that a very considerable saving has been made upon each ton of material hauled by the traction engine. In July, 1904, it was thought desirable to purchase a further two wagons, so that two wagons could be loading and two wagons on the road, thus enabling us to get an extra journey daily. It would be invidious on my part to contend that this class of haulage did not damage the roads, but I submit that any damage done has been more than compensated for by the saving as against carting, and also the fact that we were enabled to keep our roller supplied with a regular and sufficient quantity of material. A great advantage in working your own haulage plant is that you can employ men to drive who will be careful to do the least possible damage to the roads by continually crossing their tracks as they are coming and going. Again, the engine is only used for hauling during the dry months of the year, say from the end of March to the end of October. During the winter the engine is converted and used as a roller.

I give you a few extracts from reports showing the cost of haulage from time to time:—

Half-year ended September 30, 1904—2,208 tons hauled for £137 7s. 2d., or 1s. 3d. per ton.
Half-year ended September 30, 1905—1,927 tons hauled for £131 5s. 7d., or 1s. 5d. per ton.
Half-year ended September 30, 1906—1,985 tons hauled for £112 2s. 1d., or 1s. 2d. per ton.
Half-year ended September 30, 1907—1,272 tons hauled for £93 13s. 11d., or 1s. 6d. per ton.
Half-year ended September 30, 1908—882 tons hauled for £60 0s. 2d., or 1s. 4d. per ton.
Half-year ended September 30, 1909—1,236 tons hauled for £103 6s. 8d., or 1s. 8d. per ton.
Half-year ended September 30, 1911—1,122 tons hauled for £79 12s., or 1s. 5d. per ton.

Had the above quantities been led by horses and carts, the average cost would have been 3s. 3d. per ton.

During the past two or three years my council have kept two sets of hired traction engines and wagons at work practically the whole of the summer months.

COUNTY COUNCILS ASSOCIATION'S PROPOSALS

It may be of interest to you to know that the County Councils Association have formulated a series of proposals which they are endeavouring to carry through Parliament—viz.:—

Size and Weight.—Further powers should be obtained so as to enable regulations to be made by local authorities, subject to the approval of the Local Government Board, restricting the size and weight of locomotives and of trailers, and of the weights to be carried by the latter.

The weight of a traction engine should be the gross load upon the road, including full supply of water, fuel, &c., and such gross load should be ascertained and certified by the county council, who should issue a plate indicating such weight for affixing to the engine.

The county surveyor should be notified forty-eight hours prior to the traversing of any roads in his county by an engine or engines hauling an indivisible article exceeding 16 tons in weight, and should be empowered to select the route to be taken, or prohibit the journey in unfavourable weather.

As regards wagons and trailers, weights upon any axle should be regulated according to the diameter of wheel and width of tyre, and should in no case exceed that which it is recommended should be adopted for the Heavy Motor Car Order.

Frost. County councils should have power by by-law to regulate or prohibit the use of locomotives on highways when under repair, or upon the break-up of a frost.

Construction of Wheels.—County councils should have power by by-law to prohibit projecting diagonal cross bars on driving wheels, and narrow bands round front wheels of heavy motors.

Licence Fees.—The annual licence fees should be identical throughout the kingdom, and should be increased to an amount more nearly approximating the benefits received by traction engine owners in the use of the highways by this exceptional class of traffic.

Daily Permits.—The daily permit fee should be 20s., and locomotive owners, before taking out a daily permit, should supply information as to whether the locomotive is already licensed—if so, when and where; they should pay the fee at least two days before the locomotive is used, unless by special permission under regulations made by the local authority, and produce the permit whenever the locomotive is driven on a highway. When the locomotive in respect of which a daily permit is required exceeds 14 tons in weight the owner of the locomotive should be required to apply under Section 28 of the Act of 1878 for authority to use such locomotive in the

* A paper read at a Northern District meeting of the Institution of Municipal Engineers, held at Newcastle-on-Tyne on the 11th inst.

county in which it is unlicensed before bringing such locomotive into such county.

Drivers' Licences.—Drivers should be licensed under conditions identical with those imposed upon drivers of heavy motors.

Chain Couplings.—County councils should be empowered to make by-laws requiring a safety chain coupling in addition to the ordinary draw bar.

Communication.—It should be made obligatory for a man to be placed at the rear of the rear wagon, who should be provided with means for communicating with the driver of the locomotive.

STEAM MOTOR CART.

In June, 1904, I recommended the council to consider the advisability of purchasing a steam motor cart, but, before deciding anything definite, suggested they should try and get one on hire for three months with the option of purchase. Terms were eventually made to hire a new steam cart, inclusive of driver, for £2 per day, but should the council decide to purchase at the end of three months no hire to be charged, the council to pay the driver's wages only. The result of the three months' working upon the terms given above showed a saving of 6d. per ton on every ton hauled, as against cartage by horses and carts. I, however, decided to recommend my council not to purchase the wagon, as we experienced great difficulty in getting out of Bolam quarry, which is a soft, clayey bottom; and I also found that when it came to long leads (7 to 8 miles) the traction engine and four wagons (two wagons loaded ready upon her return to the quarry) could do two journeys per day, taking 16 tons each journey, and the motor cart could only do the same number of journeys carrying 5 tons per journey.

RUBBER-TYRED PETROL WAGON.

I have advocated my council purchasing one of the above wagons for service for the shorter leads, at present dealt with solely by horses and carts. The following is a copy of my report to my council:—

August 21, 1912.

"In accordance with instructions received at your last council meeting I have gone very carefully into the question of light mechanical haulage, and have now pleasure in submitting a report for your consideration. I have had considerable correspondence with Mr. Maybury, the county surveyor of Kent, and other users of steam wagons, steam tractors, rubber-tyred petrol wagons and rubber-tyred steam wagons. Mr. Maybury is a very strong advocate of the 3-tons rubber-tyred petrol wagon as against the steam tractor. I will therefore first deal with the advantages or otherwise to be derived from the use of the former wagon. The average cost of the rubber-tyred petrol wagon is £750, and you should allow 20 per cent for depreciation, or £150 per annum. Assuming the wagon worked 280 days, this would amount to about 10s. 9d. per working day. The cost of running, including all repairs, is 20s. per day, making a total of £1 10s. 9d. per day for a distance, as given by Mr. Maybury, of 64 miles. For the purpose of comparing this class of haulage with horses and carts, I assume the wagon travels 50 miles per day instead of 64 miles. The average run from your slag works and back is, say, 10 miles; this means conveying 5 loads of 3 tons each, or 15 tons per day, for £1 10s. 9d., or 2s. per ton. This quantity led the same distance by horses and carts, in accordance with your mileage basis, would cost 3s. 3d. per ton, or £2 8s. 9d., so that, after allowing the wide margin of 20 per cent for depreciation, and covering repairs in working costs, the petrol wagon shows a saving of 1s. 3d. per ton, or 18s. per day. I must warn you, however, that if you propose adopting petrol motors you would require not less than three, and probably four, in order to carry out your work satisfactorily.

"I will next deal with the steam tractor and trailer, the cost of which I put at £600. The wear and tear not being so heavy, I will allow 10 per cent for depreciation as against 20 per cent on the petrol wagon, or £60 per annum; taking 230 working days, that is about 6s. per day. The working cost of the tractor, including repairs, is 24s. per day, making a total cost of 30s. per day for a distance of 32 miles. The tractor would do three journeys, taking 6 tons each time, or 18 tons for 1s. 8d. per ton. This is 1s. 7d. per ton cheaper than horses and carts, and 4d. per ton cheaper than the petrol wagon. You must, however, consider the extra weight taken by the tractor, and also that it is iron shod; consequently more damage is done to the roads, and, whereas the rubber-tyred wagon can travel almost any time, the tractor would be unable to do so in frost and snow. My opinion is that your large traction engine, taking one wagon at a time instead of two, would do less damage if the roads were soft and wet than the steam tractor. I give a comparison of widths of wheels and weights carried.

	Heavy traction engine and one wagon.	Tractor and trailer.
Weight of engine ...	11 tons.	6 tons.
Width of wheels ...	18 in.	12 in.
Weight of wagon ...	3 tons 5 cwts.	2 tons 6 cwts.
Width of wheels ...	9½ in.	5½ in.
Weight carried ...	8 tons.	6 tons.

"Your traction has considerably more power than the tractor; consequently the drag on the roads is very much less when drawing only one wagon. The cost, however, of running the traction with only one wagon would be greater, but not more than 3d. per ton. Your district is so situated that it is impossible to work it economically without the use of the heavy traction. Your supplies of material are derived mostly from your own slag works and Bolam quarry. During last year 16,000 tons of various kinds of material were sent out from your own slag works, fully 8,000 tons of this being led by traction engines. The amount paid by you for haulage and cartage last year was, roughly, £1,500. The distance to send material is often great, as the railway facilities are remote, and, again, you have no siding at your slag works, so that it is often economy to lead direct to the road rather than truck. You are in a position to choose the time to do your own haulage, and as most of the work is done between the end of March and end of October, except in a very wet season such as the present, the damage done is infinitesimal. Mr. Maybury, in his paper read before the Rural District Councils Association's annual conference last year, says: 'It is sometimes expedient for a surveyor to recommend the employment of traction engines, and in many cases it is almost a *necessity* to do so. In many counties it is impossible to obtain sufficient team labour, particularly at the time of the year when the roads are in the best condition to support the traffic without *appreciable injury*.' The question of payment for plant is one that could be arranged quite easily over, say, a period of five years, and the 20 per cent allowed for depreciation on the petrol wagons covers the purchase during that period. In conclusion, I recommend that in the interests of economy you would be well-advised to purchase one rubber-tyred petrol wagon. The working cost, together with daily work done, would be carefully kept and reported upon at the end of three months. Should the report then received be as satisfactory as I anticipate, you can consider the advisability of further increasing your plant."

The outcome of the above report was that my committee authorised me to arrange for a demonstration with a rubber tyred petrol tip wagon, and on the 14th of October last I was able to report to them as follows:—

"Since your last meeting I arranged for a demonstration with a rubber-tyred petrol tip wagon. The wagon was loaded with 3 tons 10 cwts. of 2-in. broken slag, and took the same quite easily up Stapleton Bank. During the time the wagon was being tried it worked, in all, three-quarters of a day. The working cost per day I estimated in my previous report was £1 10s. 9d. To have hauled the same quantity of material by either traction or carts which the motor wagon hauled during the three-quarters of a day it worked would have cost £2 12s. 10d., so that you will see there is a very considerable saving. The makers of the wagon are Clayton & Co., Huddersfield."

The result is they have decided to purchase a 4-ton rubber-tyred petrol wagon, but it is not definitely settled yet what make of wagon will be considered most satisfactory.

Personally, I am greatly in favour of mechanical haulage, and trust that the figures I have submitted in this paper will be of some assistance and guidance to you should your council at any time contemplate adopting mechanical haulage.

Aberdare Tramways Scheme.—The first sod in connection with the new tramways scheme at Aberdare was cut on Monday. The scheme, which is being carried out for the Aberdare Urban District Council by Messrs. Wm. Griffiths & Co., London, at a cost of £50,000, is unique by reason of the fact that the outlying districts will be served by the Cedes Stoll system of trackless cars.

THE "TARMAC" WORKS.

COMPLETION OF EXTENSIONS.

Tarmac, Limited, Ettingshall, Wolverhampton, write: "We believe you are aware that early in last year we commenced important extensions to our works at Wolverhampton and Denby. It was anticipated at the time of commencement that these extensions would be complete by June or July, and this anticipation would have been realised had normal trading conditions existed. However, immediately after we had commenced the unfortunate coal strike intervened, which not only stopped the entire output from both our works, but brought to an absolute standstill the work upon the extensions. Not only this, but as a result of the strike it has been impossible to obtain deliveries of the necessary steelwork and machinery; promises of delivery have been made to us, only to be broken and broken again, although we have repeatedly offered premiums for quick delivery. Our extensions are only just complete.

"Acting on the assumption that we should have our extensions complete by July at the very latest, heavy engagements were entered into for delivery during the later months in the year. Owing to circumstances beyond our control the extensions were, however, not complete, and this in itself was sufficient to throw our arrangements into a great deal of confusion; add to this the loss of about nine weeks' work owing to the coal strike, and some idea of our unfortunate position as regards delivery can be imagined. We should feel much obliged to you if you would publish this letter in your valuable journal, thus enabling us to reiterate apologies communicated direct to our customers, and give publicity to the fact that the extensions are complete."

A NEW FOLDING SCAFFOLD.

The invention of Mr. Heathman, of Parson's Green, Fulham, the accompanying sketches illustrate an exceedingly useful scaffold for use in premises where every inch of storage space is a consideration. The "Shorrolds" pattern telescopic folding trestle can be stored in a very small space, and easily carried about premises to the position where it is desired to set it up for use.

The trolley base is upon castors, so that it may be of service to move goods upon, and a box or basket made to size can easily be fixed on it for daily warehouse service, while the trestles can be employed for decorating purposes out of the usual business hours.

The trestles are rapidly set up and fixed to the carriage by set screws, and the sliding section easily adjusted to the height requisite to reach the work to be done. Two sets can be used conjointly with scaffold boards and protection rails, or one scaffold can be used separately as varying circumstances necessitate. The whole can be carried upon a barrow or cart, and is made in three or four sections (as well as the two section illustrated), so that they may be used for very low as well as high rooms; further, the ladders can be used quite independently of the trolley base to lean against walls as three separate ladders to each set or as self-standing trestles.

Mr. Heathman's ingenuity deserves to be made known because of the great utility and convenience of these trestles, which save a lot of time and expense in rigging up, taking down, transport and storage. The appliances are also made with larger wheels for road and street service.

"The Civic Engineer's Who's Who."—The first issue of "The Civic Engineer's Who's Who" (London: St. Bride's Press, Limited, 24 Bride-lane, E.C., 2s. 6d. nett) gives wonderfully complete lists of the engineering officials of England and Wales. For a first issue it is very creditable.—*Glasgow Herald.*

INSTITUTION OF MUNICIPAL AND COUNTY ENGINEERS.

President—Mr. R. J. THOMAS, M.INST.C.E., County Surveyor, Buckinghamshire.

EASTERN DISTRICT.

A meeting of the Eastern District will be held in Westminster at the New Middlesex County Council Buildings and Lyon's Victoria Mansions Restaurant, on Friday, February 7th.

EAST MIDLAND DISTRICT.

The East Midland District meeting at Newark, fixed for Saturday, February 8th, has been altered to Saturday, February 15th.

SOUTHERN DISTRICT MEETING.

A meeting of the Southern District will be held at Southampton on Saturday, February 22nd next.

NORTH-EASTERN DISTRICT.

A meeting of the institution will be held in the North-Eastern District at Newcastle-on-Tyne on May 2nd and 3rd next.

ANNUAL MEETING AND TOWN-PLANNING CONFERENCE.

The Fortieth Annual General Meeting and Conference with delegates from local authorities on Housing and Town Planning will be held at Great Yarmouth on July 23rd, 24th, 25th and 26th next. Those desirous of reading papers at either of these meetings are requested at once to communicate with me.

APRIL, 1913, EXAMINATIONS.

The next examination will be held in London at the Examination Hall, Queen-square, W.C., on April 10, 11 and 12, 1913.

Candidates who have received permission from the council to sit for examination, and who are desirous of entering their names for the April examination, should do so at the earliest possible date as accommodation is limited. The latest date for the receipt of entries is February 1st.

Examinations will also be held in India and Africa probably on the same date.

Notice is hereby given that, under the provisions of by-law 14, nominations for the council of 1913-14 must be received by me not later than February 1, 1913.

Each member or Associate member of the institution is entitled to nominate one member or associate member for the council. Nominations must be accompanied by the consent of the nominee.

By order of the Council,
THOMAS COLE,
11 Victoria-street, S.W. *Secretary.*

INSTITUTION OF MUNICIPAL ENGINEERS.

President—Mr. FRANK LATHAM, M.INST.C.E.I., F.S.E., Borough Engineer and Surveyor, Penzance.

COUNCIL MEETINGS.

The next council meeting will be held at 39 Victoria-street on Wednesday, January 29th, at 6 o'clock. The following council meetings have been arranged: February 22nd, Newcastle-on-Tyne; March 26th, London; April 30th, London; May 31st, Manchester; June 28th, London; July 30th, London.

SOUTHERN DISTRICT.

A visit will be paid, by kind permission of the authorities, to the Royal Arsenal, Woolwich, on Thursday, January 30th. Members will meet at the main gates of the Arsenal, Beresford-square, at 2 o'clock sharp.

WESTERN DISTRICT.

A meeting (of which full programme will be issued later) will be held at Birmingham on Saturday, February 8th or 15th.

GENERAL MEETING.

A visit will be paid to the Building Exhibition at Olympia on April 12th, by kind permission of the promoters. Full particulars will be issued later.

B. WYAND,
39 Victoria-street, S.W. *Secretary.*

INSTITUTE OF SANITARY ENGINEERS.

President—Mr. H. PERCY BOULNOIS, M.INST.C.E., F.R.SAN.I.

SESSIONAL MEETINGS.

Sessional meetings of the Institute of Sanitary Engineers, to be held at Caxton Hall, Westminster have been arranged as follows:—

February 3rd.

Annual dinner at the Holborn Restaurant. Reception at 6.30. The president will take the chair at 7 p.m.

February 5th.

"Reminiscences of a Municipal Engineer," by Mr Cuthbert Brown, ASSOC.M.INST.C.E., Engineer and surveyor, Edmonton Urban District Council.

February 17th.

"A Plea for Scientific Research in the Field of Sewage Purification," by Mr. A. J. Martin, M.INST.C.E., F.G.S.

March 17th.

"The Dwelling House," by Dr. S. C. Lawrence, medical officer of health, Edmonton Urban District Council.

April 2nd.

"Heating and Ventilation," by Mr. Arthur H. Barker, Lecturer on Heating and Ventilation to University College, London, and the London County Council. Mr. A. H. McFerran, chief engineer, H.M Office of Works, in the chair.

April 21st.

"House Drainage on the Continent," by Mr. Frank R. Durham, ASSOC.M.INST.C.E.

May 19th.

"Micro-Organisms and Public Health," by Dr. H. R. Kenwood, Chadwick Professor of Hygiene and Public Health in the University of London, medical officer of health for the County of Bedford and for the Metropolitan Borough of Stoke Newington.

ROYAL SANITARY INSTITUTE.

A sessional meeting of the institute will be held at 90 Buckingham Palace-road on Tuesday, February 11th, at 7.30 p.m., when a discussion will take place on "The Eighth Report of the Royal Commission on Sewage Disposal, on Standards and Tests for Sewage, and Sewage Effluents Discharging into Rivers and Streams," to be opened by Samuel Rideal, D.SC., F.I.C., J.P.

The following hope to be present and take part in the discussion: A. P. I. Cotterell, M.INST.C.E., Bristol; Gilbert J. Fowler, D.SC., F.I.C., Manchester; George A. Hart, Leeds; Prof. A. Bostock Hill, M.D., M.SC., Birmingham; Lieut-Colonel A. S. Jones, V.C., M.INST.C.E., Fincham; stead; W. Kaye-Parry, F.R.I.B.A., M.INST.C.E., Dublin; Baldwin Latham, M.INST.C.E., London; E. G. Mawbey, M.INST.C.E., Leicester; George Reid, M.D., D.P.H., Stafford; J. D. Watson, M.INST.C.E., Birmingham; H. MacLean Wilson, M.D., B.SC., Wakefield.

General discussion is invited.

The chair will be taken at 7.30 p.m. by Colonel T. Walter Harding, D.L., J.P., LL.D.

E. WHITE WALLIS,
Secretary.

SOCIETY OF ENGINEERS.

At a meeting to be held on Monday, February 3rd, at the Institution of Electrical Engineers, Victoria Embankment, W.C. (south end of Savoy-street, near Waterloo Bridge), a paper on "The 'Bus *v.* Tram Controversy, and other Aspects of the London Traffic Problem," will be read by Mr. Wm. Yorath Lewis, A.M.I.MECH.E., A.M.I.E.E., M.AM.SOC.MECH.E., the following being a synopsis: The traffic trust—Why the Press contributes so little to the solution—Experiments in nationalisation—Speyer's designs—London County Council ineffectiveness in transport matters—Politics and transport—Reform of London government—"London Transport Association"—Bus *v.* tram controversy—Mr. Pott's paper—Analysis of 'bus returns and operation—Stage ratings—Average fare—Profits—High cost per ridden mile—Average ride length—Seats occupied—Petrol tax—'Bus prospects—Analysis of tramway operation—Relief of congestion—Further tramway expenditure justifiable—Comparison by points between merits of 'bus and tram—Inadequacy of both—Immediate requirements.

The chair will be taken at 7.30 p.m. precisely.

The presidential address will be delivered on March 3rd.

A. S. E. ACKERMANN,
Secretary.

17 Victoria-street, S.W.

APPOINTMENTS VACANT.

Official and similar advertisements received up to 4.30 p.m. on Thursdays will be inserted in the following day's issue, but those responsible for their despatch are recommended to arrange that they shall reach THE SURVEYOR office by noon on Wednesdays to ensure their inclusion in the weekly list of summaries. Such advertisements may, in cases of emergency only, be telephoned (No. 1369 Holborn), subject to later confirmation by letter.

ENGINEERING ASSISTANT.—January 25th.—Corporation of Swansea. £160 per annum. Borough Engineer.

WORKING SUB-FOREMEN OR GANGERS.—January 27th.—Hampshire County Council. 30s. 40s. per week.—Mr. W. J. Taylor, county surveyor, The Castle, Winchester.

SURVEYOR'S JUNIOR CLERK.—January 27th.—Woking Urban District Council. 25s. per week.—Mr. Robert Mossop, clerk.

ASSISTANT WATER ENGINEER.—January 27th.—Corporation of Richmond (Surrey). £250 per annum.—Mr. Henry Sagar, town clerk.

CLERK OF WORKS.—January 27th.—West Suffolk County Council.—Mr. W. Lionel Jenkins, county surveyor.

SANITARY INSPECTOR.—January 27th. Corporation of the City of London. £150—£250.—Town Clerk, Guildhall.

ENGINEERING ASSISTANT.—January 27th.—Corporation of Birmingham. £150 per annum.—Mr. Henry E. Stilgoe, city engineer and surveyor.

SURVEYOR.—January 27th.—Burley-in-Wharfedale Urban District Council. £130 per annum. Mr. G. Wilkinson, clerk.

ROAD FOREMAN.—January 27th.—Hampshire County Council. 30s.—40s. per week.—Mr. W. J. Taylor, county surveyor, The Castle, Winchester.

SURVEYOR.—January 30th.—Wells (Somerset) Town Council. £150 per annum. Mr. E. P. Foster, town clerk.

SURVEYOR'S ASSISTANT.—January 30th.—Uxbridge Rural District Council. £65 per annum.—Mr. C. Woodbridge, clerk.

ASSISTANT.—January 30th.—Neath Rural District Council. £2 per week.—Messrs. Cuthbertson & Powell, clerks.

ASSISTANT INSPECTOR OF NUISANCES.—February 1st.—Corporation of Reading. £80—£100. Mr. W. S. Clutterbuck, town clerk.

ENGINEERING ASSISTANT.—February 1st.—Watford Urban District Council. £80 £100. Mr. W. Hudson, clerk and solicitor.

ENGINEERING ASSISTANT.—February 1st.—Municipal Engineer's staff in Northern town. £180 per annum.—Box 1,217, office of THE SURVEYOR, 24 Bride-lane, Fleet-street, E.C.

SANITARY INSPECTOR.—February 1st.—Edmonton Urban District Council. £100—£120.—Mr. W. F. Payne, clerk.

CLERK OF WORKS.—February 3rd.—Alsager Urban District Council. £2 per week.—Mr. H. V. Lynam, surveyor.

INSPECTOR OF NUISANCES AND BUILDING SURVEYOR.—February 4th.—Christchurch Rural District Council. £90.—Mr. A. Druitt, clerk.

QUANTITY SURVEYOR.—February 10th.—Beckenham Education Committee.—Mr. F. Stevens, clerk, Council Offices, Beckenham.

BOROUGH ARCHITECT.—February 11th.—Corporation of Swansea. £500 per annum.—Mr. H. Lang Coath, town clerk.

ASSISTANT ENGINEERS.—May 1st.—Indian Public Works and State Railway Departments.—Secretary, Public Works Department, India Office, London, S.W.

JUNIOR ENGINEERING ASSISTANT (Temporary).—No date. The Road Board. £250 and travelling expenses.—Mr. W. Rees Jeffreys, secretary, Queen Anne's Chambers, Westminster.

MUNICIPAL COMPETITIONS OPEN.

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SWAFFHAM.—January 25th.—Plans, specifications and estimates for workmen's dwellings, for the rural district council. A premium of £10 is offered to the selected plan.—Mr. Sydney Matthews, clerk.

JAMAICA.—January 31st.—Plans for municipal buildings to cost £9,000. A premium of £100 is offered. Messrs. Young, Limited, 60 Fenchurch-street, London, E.C.

HEMEL HEMPSTEAD.—January 31st.—Design for a housing scheme, comprising twenty-five houses, for the town council.—Mr. A. E. Usher, town clerk.

HARROGATE.—February 3rd.—Designs for a council school, for 675 children.—Mr. C. E. Rivers, ASSOC.M. INST.C.E., borough engineer.

DUBLIN.—February 6th.—Designs for municipal buildings for the corporation. The proposed expenditure is £50,000, and the author of the design placed first will be appointed to carry out the scheme on a 5 per cent basis. Premiums of £150 and £100 are offered. The assessor is Mr. Albert E. Murray, F.R.I.B.A. —The Town Clerk.

RANGOON.—March 1st.—Designs for municipal buildings. Premiums are offered of £300, £200, and £100.—The Clerk to the Rangoon Municipality.

WINNIPEG.—March 1st.—Designs for city hall. Limited to British architects in Canada. Premiums are offered of 5,000 dols., 3,000 dols., and 2,000 dols.—The Clerk.

BARNET.—April 29th.—Designs for schemes for the erection of new municipal offices, at a cost not exceeding £4,000, for the Barnet Urban District Council. Premiums of £25, £15, and £10 are offered. —Mr. H. W. Poole, clerk, 40 High-street, Barnet.

HORBURY.—No date.—Drawings for a public hall, for the Horbury Urban District Council.—Mr. W. Sugars, engineer and surveyor.

MUNICIPAL CONTRACTS OPEN.

Official and similar advertisements received up to 4.30 p.m. on Thursdays will be inserted in the following day's issue, but these responsible for their despatch are recommended to arrange that they shall reach THE SURVEYOR office by noon on Wednesdays to ensure their inclusion in the weekly list of summaries. Such advertisements may, in cases of emergency only, be telephoned (No. 1359 Holborn), subject to later confirmation by letter.

Buildings.

HARROW-ON-THE-HILL.—January 25th.—For the erection of public offices, for the urban district council.—Mr. J. P. Bennetts, surveyor.

IPSWICH.—January 27th.—For building concrete intake chamber and other works, for the corporation. —Mr. F. Ayton, Constantine-road.

DUNOON.—January 27th.—For repair of sea wall and promenade, for the town council.—Mr. William Rodger, burgh engineer.

SAFFRON WALDEN.—January 27th.—For the erection of a brick water tower, for the corporation. —Mr. A. H. Forbes, borough surveyor.

SUSSEX.—January 28th.—For the erection of a county high school for girls, for the county council.— Mr. L. Thompson, secretary, Education Committee, High-street, Worthing.

ESSEX.—January 28th.—For the widening of Springfield Bridge at Chelmsford, for the county council.—Mr. Percy J. Sheldon, county surveyor, Chelmsford.

WEST HAM.—January 28th.—For the erection of workshops, office, and watch-room, for the town council.—Mr. Fred. E. Hilleary, town clerk.

SHOEBURYNESS.—January 28th.—For the erection of a shed at the gasworks, for the urban district council.—Mr. Frederic Gregson, clerk.

NORWICH.—January 28th.—For the erection of a fish market, for the corporation.—Mr. A. E. Collins, city engineer.

HEREFORD.—January 30th.—For alterations at a public school, for the corporation.—Mr. Arthur Holt, town clerk.

HULL.—January 30th.—For alterations and additions to a school, for the corporation.—Mr. Joseph H. Hirst, city architect.

ST. HELENS.—January 31st.—For the erection of a public library, for the corporation.—Mr. W. H. Andrew, town clerk.

EGYPT.—February 1st.—For the erection of pumping station buildings at Kafr el Gamus, for the Public Works Ministry.—Controller-General, Main Drainage Department, Public Works Ministry, Cairo.

BRADFORD.—February 1st.—For the erection of a new hall at public baths, for the corporation.—Mr. F. Stevens, town clerk.

MEXBOROUGH.—February 3rd.—For extensions to the electric power station, for the urban district council.—Mr. J. W. Hattersley, clerk.

COLCHESTER.—February 3rd—21st.—For the erection of a school, for the Education Committee.—Mr. D. W. Clark, architect, 3 High-street, Colchester.

HULL.—February 3rd.—For alterations and additions to library, for the corporation.—Mr. Joseph Hirst, city architect.

WATFORD.—February 4th.—For the erection of a new sub-station and extensions to existing sub-station, for the urban district council.—Mr. W. Hudson, clerk.

STAFFS.—February 6th.—For the erection of a school, for the Education Committee.—Mr. G. Balfour, director of education, County Education Offices, Stafford.

MIDFORD.—February 8th.—For building fifty-two labourers' cottages, for the rural district council.— Mr. S. Watters, clerk.

RADCLIFFE.—February 8th.—For the construction of a footbridge, for the urban district council.— Mr. S. Mills, clerk.

EDINBURGH.—February 12th.—For the erection of wash-houses, for the corporation.—Mr. T. Hunter, town clerk.

CARNARVON.—February 17th.—For the erection of twenty-five artisans' dwellings, for the corporation.— Mr. E. Hall, borough surveyor.

Iron and Steel.

SALTBURN-BY-THE-SEA.—January 30th.—For repairing boiler, pumps, feed tank, and steam piping at the brine baths, for the urban district council.— Mr. Cecil E. Preston, clerk.

ELLESMERE.—January 31st.—For providing and laying 9,000 yds. of 4-in. and 3-in. cast-iron mains, sluice valves, fire hydrants and air valves, for the rural district council.—Mr. H. R. Giles, clerk.

SWINTON.—February 4th.—For the erection of engine and pump house, for the urban district council.—Mr. H. Birks, engineer and surveyor.

WITHNELL.—February 5th.—For the supply of gas engine and pump, for the urban district council. —Mr. Thomas Moss, surveyor.

ANTWERP.—February 7th.—For the supply of pipes for water under pressure and stopcocks, for the city council.—The Secretary, Hotel de Ville.

PENRITH.—February 10th.—For laying and jointing cast-iron piping, with valve and hydrants, for the rural district council.—Mr. J. W. Smith, clerk.

BOMBAY.—March 25th.—For supplying and laying about 19 miles of 50-in. diameter steel main, for the municipality.—Mr. H. J. Trivess Smith, hydraulic engineer, Municipal Offices, Bombay.

Roads.

NORTHAMPTONSHIRE.—January 25th.—For the supply of broken granite, for the county council.— Mr. C. S. Morris, county surveyor.

ESSEX.—January 25th.—For the supply of Norway granite kerb and setts, for the county council.—Mr. P. J. Sheldon, county surveyor, Chelmsford.

WANDSWORTH.—January 25th.—For the purchase from the council of a Leyland patent steam motor wagon fitted with interchangeable tipping body and 1,000-gallon tank.—Mr. P. Dodd, borough engineer.

SHEFFIELD.—January 27th.—For the supply of 2,000 tons of Portland cement, and from 8,000 to 10,000 super. yds. of natural flags, for the corporation.— Mr. R. M. Prescott, town clerk.

SLEAFORD.—January 27th.—For the supply of granite and slag, for the rural district council.—Mr. E. Clements, clerk.

PRESTWICH.—January 27th.—For the supply of granite setts, for the urban district council.—Mr. Lewis A. Orford, clerk.

BURGESS HILL.—January 27th.—For the supply of tar for roads, for the urban district council.—Mr. A. F. Hardwick, clerk.

FARNBOROUGH.—January 27th.—For the supply of road materials and hire of steam roller, for the urban district council.—Mr. J. E. Hargreaves, surveyor.

WHITLEY AND MONKSEATON.—January 27th.—For street improvement works, for the urban district council.—Mr. Augustus Whitehorn, 60 Saville-street, North Shields, clerk.

WANGFORD.—January 27th.—For the supply of granite, red broken gravel, fine gravel, shingle, and best marl, for the rural district council.—The Clerk.

SHOEBURYNESS.—January 28th.—For making up certain roads, for the urban district council. Mr. Frederic Gregson, clerk.

LARNE.—January 28th. For making a new road, for the rural district council.—Mr. S. M. Wallace, clerk.

LYMM.—January 28th.—For the supply of road materials, for the urban district council.—Mr. W. Mullard, clerk.

DONCASTER.—January 28th.—For paving work with granite setts, for the corporation.—Mr. F. O. Kirby, borough surveyor.

SCUNTHORPE.—January 29th.—For making up a certain street, for the urban district council.—Mr. W. M. Hett, clerk.

NESTON AND PARKGATE.—January 29th.—For the supply of broken stone chippings, tarred macadam, kerbs and granite setts, for the urban district council.—Mr. J. P. Gamon, clerk.

WORSLEY.—January 29th.—For the supply of concrete flags, for the urban district council.—Mr. J. P. Monks, clerk.

BRACKLEY.—January 30th.—For the supply of granite, for the corporation.—Mr. C. E. Barnes, town clerk.

SOUTHEND-ON-SEA.—January 30th.—For the construction of the Western Esplanade extension (section No. 3), for the corporation.—Mr. H. J. Worwood, town clerk.

LARNE.—January 30th.—For the supply of whinstone and hire of steam roller, for the urban district council.—Mr. W. G. Younge, clerk.

DOWNHAM.—January 31st.—For the supply of road materials, for the rural district council.—Mr. H. R. B. Wayman, clerk.

WORCESTERSHIRE.—January 31st.—For the supply of 50,000 tons of granite and 10,000 tons of tar macadam, for the county council.—Mr. C. E. Gettings, county road surveyor.

BEXHILL.—January 31st.—For the supply of distilled tar, or Tarvia, for the corporation.—Mr. T. E. Rodgers, town clerk.

SOMERSET.—February 1st.—For steam rolling and scarifying main roads, for the county council.—Mr. H. T. Chapman, county surveyor.

SOMERSET.—February 1st.—For surface tarring on main roads, for the county council.—Mr. H. T. Chapman, county surveyor.

SOMERSET.—February 1st.—For the supply of broken granite or basalt, for the county council.—Mr. H. T. Chapman, county surveyor.

SOUTH STONEHAM.—February 1st.—For the supply of 2,000 tons of granite, for the rural district council.—Mr. E. T. Westlake, clerk, 20 Portland-street, Southampton.

HEADINGTON.—February 1st.—For the supply of Hartshill or other approved stones, and carting, for the rural district council.—Mr. Thomas W. Mallam, clerk.

RENFREW.—February 1st.—For the supply of road metal, for the first or upper district.—Mr. J. A. McCallum, district clerk, 15 West George-street, Glasgow.

LANCASHIRE.—February 3rd.—For the supply of 11,000 tons of 4-in. by 5-in. granite setts, and 2,000 tons of 4-in. by 4-in. granite cubes, for the county council.—Mr. Harcourt E. Clare, clerk.

WATH-UPON-DEARNE.—February 3rd.—For the making up of certain roads, for the urban district council.—Messrs. Nicholson & Co., clerks.

LEPTON.—February 3rd.—For steam rolling and scarifying, for the urban district council.—Mr. Geo. W. Smith, clerk.

HOLLAND (Lincs).—February 3rd.—For the supply of broken granite, granite chips, slag rejections, slag, builders' sand, and tar for the county council.—Mr. W. H. Gane, clerk, Sessions House, Boston.

SUTTON-IN-ASHFIELD.—February 3rd.—For the supply of tar-macadam and broken slag, for the urban district council.—Mr. J. D. Fidler, clerk.

ESCRICK.—February 4th.—For the supply of best whinstone, tar-macadam, slag and granite, for the rural district council.—Mr. Fred. C. Camidge, clerk, 3 Stonegate, York.

MIDDLESBROUGH.—February 4th.—For the supply of whinstone, limestone, tarred slag and whinstone, for the rural district council.—Mr. W. Richardson, clerk.

WATFORD.—February 4th.—For the supply of distilled tar, for the urban district council.—Mr. D. Waterhouse, engineer.

DESBOROUGH.—February 4th.—For the supply of broken granite and slag, for the urban district council.—Mr. Geo. E. Marlow, surveyor.

MERIDEN.—February 4th.—For the supply of granite, for the rural district council.—Mr. A. W. Liggins, clerk, 11 Priory-street, Coventry.

HORNSEY.—February 4th.—For making up certain roads, for the corporation.—Mr. J. E. Lovegrove, borough engineer and surveyor, Municipal Offices, Highgate.

SHOREHAM.—February 4th.—For making up certain roads, for the urban district council.—Mr. H. Brown, clerk.

MARGATE.—February 4th.—For the supply of large brick burrs and pit flints, for the corporation.—Mr. E. Brooke, town clerk.

CHINGFORD.—February 4th.—For the supply of road materials and hire of steam roller, for the urban district council.—Mr. L. C. Bowen, clerk.

MIDDLESEX.—February 5th.—For the supply of 12,000 tons of hand-broken basalt, for the county council.—Mr. H. T. Wakelam, county engineer, 63 Victoria-street, Westminster, S.W.

HERTFORDSHIRE.—February 5th.—For the supply of broken granite and slag, for the county council.—Mr. Urban A. Smith, county engineer.

MIDDLESEX.—February 5th.—For the supply of basalt and chippings, and the cartage of road materials, for the county council.—The Clerk, 65 Victoria-street, Westminster, S.W.

NORTHAMPTON—February 5th.—For the supply of granite, slag and gravel, for the rural district council.—Mr. W. Fawkes, clerk.

STOKESLEY.—February 6th.—For the supply of whinstone, limestone, and tarred slag and whinstone, for the rural district council.—Mr. W. Richardson, clerk.

ISLE OF ELY.—February 6th.—For the supply of broken materials for the repair of main roads, for the county council.—Mr. R. S. W. Perkins, county surveyor, Ely.

CLAYTON (Suffolk).—February 6th.—For the supply of granite, pit, and picked stones, for the rural district council.—Mr. R. M. Cook, clerk, 6 Providence-place, Ipswich.

SELBY.—February 7th.—For the supply of whinstone, for the urban district council.—Mr. Bruce McG. Gray, engineer and surveyor.

HORNCASTLE.—February 8th.—For the supply of granite and slag, for the rural district council.—Mr. J. E. Chatterton, clerk.

REIGATE.—February 10th.—For the supply of road materials and team labour, for the rural district council.—Mr. E. C. Morrison, clerk.

EASINGWOLD.—February 12th.—For the supply of whinstone and slag, for the rural district council.—Mr. F. J. H. Robinson, clerk.

CORK.—February 13th.—For supplying and laying bituminous or other similar street-surfacing materials, for the county council.—Mr. F. W. McCarthy, town clerk.

CORK.—February 13th.—For laying certain streets with Trinidad Lake asphalt-macadam, similar to that laid for the London County Council on the Victoria Embankment, for the corporation. — Mr. F. W. McCarthy, town clerk.

SURBITON.—February 17th.—For the supply of road materials, brooms, and horse-sweeping brooms, for the urban district council.—The Clerk.

LITTLE HULTON.—February 24th.—For the supply of broken granite, grit setts, granite setts, granite and limestone chippings, and grit kerbs, for the urban district council.—Mr. J. H. Heyes, clerk.

TANGIER.—April 10th.—For the construction of a sewer and a road, for the Special Committee of Public Works.—Commercial Intelligence Branch of the Board of Trade, 73 Basinghall-street, E.C.

Sanitary.

HOVE.—January 24th.—For the removal of house refuse, for the corporation.—Mr. H. Endacott, town clerk.

CANNOCK.—January 24th.—For the supply and laying of 8,000 yds. of 12-in., 9-in. and 6-in. stoneware pipe sewers, and construction of manholes and flushing chambers, for the rural district council.—Mr. A. W. Carver, clerk.

STOCKTON.—January 25th. For the execution of a scheme of sewerage, for the rural district council.—Mr. T. H. Faber.

DOWNPATRICK.—January 25th.—For the construction of a sewer, for the rural district council.—Mr. R. L. Morrow, clerk.

ROMFORD.—January 27th.—For the construction of sewerage works, for the rural district council.—Mr. W. J. Grant, surveyor.

ABERGELE.—January 27th.—For work in connection with sanitary conveniences, shelter, jetty, pumping installation, sewerage works, and cast-iron surface-water drain, for the urban district council.—Mr. E. A. Crabbe, clerk.

HARPENDEN. January 27th. For the construction of sewerage works, for the urban district council.—Mr. C. S. Tuckey, clerk.

KEIGHLEY.—January 27th.—For the supply of pot pipe drain, for the rural district council.—Mr. J. N. Clarkson, clerk.

SHOEBURYNESS. January 28th.—For the erection of public conveniences, for the urban district council. Mr. Frederic Gregson, clerk.

SOUTHAMPTON.—January 28th.—For the extension of a public convenience, for the corporation. Mr. R. R. Linthorne, town clerk.

MIDDLETON.—January 30th.—For the execution of deep drainage at the cemetery, for the corporation. Mr. F. Entwistle, town clerk.

KINGSTON-UPON-THAMES.—January 31st.—For the supply of 300 tons of bauxite for the sewage works, for the corporation.—Mr. Harold A. Winser, town clerk.

SILSDEN.—January 31st.—For the erection of a percolating filter and other works, for the urban district council.—Mr. John Driver, clerk.

DURHAM.—January 31st.—For the supply of fluid disinfectant, for the Education Department.—The Clerk, Shire Hall.

ILKESTON.—February 1st.—For laying and jointing cast-iron pipe sewers, concrete tube sewers, stoneware pipe sewers, construction of manholes and flushing chambers, and construction of engine-house, for the corporation.—Mr. S. F. James, town clerk.

LUTON.—February 1st.—For the supply of concrete and stoneware main and socketed pipes, for the corporation.—Mr. W. Smith, town clerk.

SOUTHEND-ON-SEA.—February 1st.—For the construction of six refuse destructor cells, for the corporation.—Mr. H. J. Worwood, town clerk.

HOLYHEAD.—February 1st.—For the construction of sewers, for the urban district council.—Mr. T. R. Evans, clerk.

DRIFFIELD.—February 1st.—For house scavenging and supervision of sewerage and sewage disposal system, for the rural district council.—Mr. Herbert Botterill, clerk.

MANCHESTER.—February 3rd. For the construction of main drainage works (new sewers in Withington), for the corporation.—Mr. Thomas Hudson, town clerk.

SAWBRIDGEWORTH.—February 3rd. For the removal of house refuse, for the urban district council. Mr. William Morris, clerk.

ROWLEY REGIS.—February 4th.—For work of scavenging, for the urban district council.—Mr. D. Wright, clerk.

BROMLEY. February 4th. For the erection of a convenien..., for the corporation.—Mr. F. H. Norman, town clerk.

DRIFFIELD.—February 4th.—For the construction of a 9-in. pipe drain, for the rural district council. Mr. T. Casson Beaumont, surveyor.

ALSAGER.—February 5th.—For the erection and completion of sewage disposal works, to include the building of all tanks, beds, and the work in connection therewith, and the supplying and laying of about 400 yds. of 9-in. stoneware pipe sewer, for the urban district council.—Mr. H. V. Lynam, surveyor.

LEWISHAM.—February 5th.—For the removal of house refuse, for the borough council.—The Surveyor.

THAMES DITTON.—February 5th.—For the extension of sewage disposal works, for the urban district council.—Mr. J. T. Metcalfe, clerk.

HORSFORTH.—February 10th.—For laying sewers and constructing manholes, for the urban district council.—Mr. J. Davidson, clerk.

GRIMSBY.—February 10th.—For the construction of a 15-in. glazed stoneware pipe sewer, half to be laid in concrete on piles varying from 8 ft. to 65 ft. in length, for the corporation.—Mr. H. Gilbert Whyatt, borough engineer and surveyor.

RUSHDEN.—February 12th.—For the construction of sewage disposal works, comprising alteration of existing works, new screening and detritus tanks, sedimentation tanks, storm-water tanks, humus tanks, percolating filters, culverts, drains, ejector house and plant, sludge-drying beds, laying out land, road making and incidental works, for the urban district council.—Mr. W. B. Madin, engineer and surveyor.

AMBLESIDE.—February 11th.—For the construction of sewage disposal works, for the urban district council.—Mr. G. Gatey, clerk.

WINDERMERE.—February 15th.—For laying and jointing stoneware pipe sewers and cast-iron pipe sewers, and constructing manholes, lampholes, sedimentation tanks, bacteria beds, effluent tanks, sludge lagoons, engine-houses, pump wells and roads, for the urban district council.—Mr. J. T. Bownass, clerk.

PORT SAID.—March 1st.—For the construction of drainage works, for the municipality.—Mr. A. L. Webb, C.M.G., Queen Anne's Chambers, Broadway, Westminster.

Stores.

CROYDON.—January 27th.—For the supply of articles for the roads, sanitary and waterworks departments, for the corporation.—Mr. F. C. Lloyd, town clerk.

CHELTENHAM.—January 30th.—For the supply of Portland cement, forage, stoneware pipes, broken stone, kerbs, setts, disinfectants, oils, colours, ironmongery, timber, indiarubber goods, lead, brass fittings, tools for highways, wrought iron, steel files, electric light fittings, lias lime, bricks and waterproofs, for the corporation.—Mr. J. S. Pickering, borough engineer.

GRIMSBY.—January 31st. For the supply of whinstone or columnar basalt macadam, drainage pipes, artificial flags, Yorkshire flags, Yorkshire kerbs, granite setts, kerbs, channel, pitch, tar, Portland cement, lias lime, slag, carbolic acid, carbolised oil, disinfectant fluid and powder, formalin, brushes and oils, for the corporation.—Mr. H. Gilbert Whyatt, borough engineer and surveyor.

HUDDERSFIELD.—February 5th.—For the supply of granite setts, gritstone and Lonkey setts and macadam, furnace slag, broken or unbroken, granite, slag, limestone tar-macadam, flags, landings, kerbs, pitch and creosote oil, cast-iron materials, Portland cement, bricks, lime, river sand, hay, straw, scavenging machine brushes and brooms, earthenware pipes, junctions, bends, coal, team labour, shoeing horses, and oils, for the corporation.—Mr. J. Henry Field, town clerk.

OSSETT.—February 8th.—For the supply of materials, stores and workmen's tools required in the highways, gas, lighting, water, sanitary and educational departments, for the corporation.—Mr. T. W. Wilson, town clerk.

BLACKBURN. February 8th.—For the supply of miscellaneous materials and labour, for the corporation.—Mr. William Stubbs, borough and water engineer.

YORK.—February 8th.—For the supply of Portland cement, stoneware pipes, sludge press cloths, building and sewage lime, pitch and creosote oil, Yorkshire stone flags, kerbing, edging, whinstone, slag, and limestone chippings, for the corporation.—Mr. F. W. Sparr, city engineer.

WOOLWICH. February 12th.—For the supply of ballast, sand, brooms, brushes, cement, chandlery, drain pipes, forage, granite kerb, harness, ironmongery,

road material, sewer ironwork and timber, for the borough council.—Mr. Arthur B. Bryceson, town clerk.

BRADFORD.—February 12th.—For the supply of road metal, gullies, earthenware pipes, timber for sewerage, cartage, and team labour, for the corporation.—Mr. Frederick Stevens, town clerk.

GOOLE.—February 19th.—For the supply of road metal (Guernsey granite and chippings), granite setts, slag, hardcore, concrete flags, York flags, kerb, channel, stoneware pipes, Portland cement, tar-macadam, brough gravel, coal and bricks, for the urban district council.—Mr. C. G. Bradley, engineer and surveyor.

LEICESTERSHIRE.—No date. For the supply of tar, pitch, and creosote oil, for the county council. Mr. W. J. Freer, clerk, 10 New-street, Leicester.

TENDERS FOR MUNICIPAL WORKS OR SUPPLIES.

The Editor invites the co-operation of SURVEYOR *readers with a view to making the information given under this head as complete and accurate as possible.*

* Accepted. † Recommended for acceptance.

BEXHILL.—For making up four roads, for the corporation:

James M. Vine, Tunbridge Wells	£3,361
Peerless, Dennis & Co., Limited, Eastbourne	3,277
Stephen Carey, Bexhill-on-Sea	2,690

BRANDON AND BYSHOTTLES.—For laying a 9-in. sewer, for the urban district council. Mr. Geo. G. Donkin, surveyor:

Walton Brothers, Crook	£67
J. Carrick, Durham	64
Wood Brothers, Brandon*	62

BUCKLOW.—For making up Oldfield lane, for the rural district council:—

Bethell & Sons, Sale, £320

CHESTER-LE-STREET.—For making up three private streets, for the rural district council:—

J. Carrick, Durham, £616.

CLEETHORPES-WITH-THRUNSCOE.—For the construction of an underground conveniences.—Mr C. H Waithman, engineer and surveyor:—

G. F. Mashford & Sons, Limited, Cleethorpes	£604
G. W. Brown, Cleethorpes	512
Swaby & Walsham, Grimsby	511
Hewins & Goodhand, Grimsby	507
Wilkinson & Houghton, Cleethorpes*	194

Quantities by Surveyor.
Surveyor's estimate, £500.

ESSEX.—The following tenders have been accepted by the county council:—

W. and C. French, of Buckhurst Hill, at £494, for re-building Burnt Mill Bridge.

Garratt and Son, Balham hill, London, at £857, for the re-building of High Ongar Bridge.

HINCKLEY.—For the erection of brick chimney shaft, for the urban district council.—Mr. E. H. Crump, engineer and surveyor.

W. Flavell, Hinckley	£167
G. Greaves, Hinckley	140
Goodman Brothers, Hinckley	126

LONDON.—For the supply of about 3½ miles of grooved trolley wire required for the overhead system for the county council.

	Price a mile.
Thomas Bolton & Sons, Limited, Bishopsgate, E.C.*	£109 4s.
The British Insulated and Helsby Cables, Limited, Prescot	£112 11s. 6d., less 2½ per cent discount.
Thompson & Co., Lincoln's-inn-fields, W.C.	£116.

LONDON.—For the supply of 3,000 pairs of tramway rail fishplates, for the county council:—

	Price a ton.	Total approximate value.
Cammell, Laird & Co., Limited, Sheffield	£9 15s.	£780 0s.
Walter Scott, Limited, Leeds	£12 10s.	£968 15s.
Alfred Clare & Co., Victoria-street, S.W.	£24 10s. a bar or 17s. 6d. a joint.	£2,621 10s.

(For special joints of the firm's own manufacture.)

MATLOCK.—For the erection of a bowls and tennis pavilion in the Hall Leys Pleasure Grounds, for the urban district council.—Mr. Joseph Turner, surveyor:—

F. Hopkinson	£287
E. W. Taylor	285
J. H. Lewis	259
Wm. Boden	259
J. W. Wildgoose*	248

SWANSEA.—For carrying out private street work, for the corporation:—

Hawthorne-avenue.

Griffith Davies, Swansea	£491
Bennett Brothers, Swansea	348
J. & F. Weaver, Swansea	331
S. R. Hill, Sketty	327
J. H. Stephens & Co., Swansea*	310

Back-road, Eaton Crescent.

C. T. Hutt, Swansea	£413
S. R. Hill, Sketty	408
Griffith Davies, Swansea	390
Bennett Brothers, Swansea*	357
William Jones, Gorseinon	353

WOKING.—For the construction of sewers and manholes, for the urban district council.—Mr. G. J. Wooldridge, engineer:—

G. A. Franks, Guildford	£6,315
G. Trentham, Birmingham	5,772
E. Iles, Croydon	5,757
E. Ireland, Bath	5,735
Simon, Johnson & Co., London	5,676
J. Stone & Co., Balham	4,946
A. N. Coles, Plymouth	4,891
A. Streeter & Co., Shalford, Guildford	4,705
W. Wright, Chesham	4,589
Grounds & Newton, Bournemouth	4,199
Ripley, Strong & Co., Farnborough	3,804
F. Osmond & Co., Southampton	3,799
Hardy & Co., Woking*	3,556

Engineer's estimate, £4,307.

WORKSOP.—For the supply of slag for the urban district council:—

	s. d.
W. F. Oates, Swinton	7 6
J. Carr & Co., Dronfield	7 5
W. Prestwich & Sons, Dronfield*	7 0
Tarmac Limited, Ettingshall	7 0
C. L. Stiff & Co., Birmingham	6 0
T. W. Ward, Limited, Sheffield	6 0
Contract & Works Supply Company, Kirton Lindsey	5 6
Staveley Iron Company, Chesterfield	5 6
Stanton Iron Company, Nottingham	5 2
E. V. Davis, Ilkeston	5 1
J. Parker & Sons, Sheffield	4 9
Hudson & Son, Nottingham	4 1

MEETINGS.

Secretaries and others will oblige by sending early notice of dates of forthcoming meetings.

JANUARY.

29. Institution of Municipal Engineers: Council Meeting, 39 Victoria-street, S.W. 6 p.m.
30.—Concrete Institute: Dr. J. S. Owens on "The Settlement of Solids in Water and its Bearing on Concrete Work." 7.30 p.m.
30.—Institution of Municipal Engineers: Visit to Woolwich Arsenal.

FEBRUARY.

3. Society of Engineers: Mr. Wm. Yorath Lewis on "The 'Buss' Tram Controversy and other aspects of the London Traffic Problem," Institution of Electrical Engineers, Victoria-embankment. 7.30 p.m.
3. Royal Institute of British Architects: President's address to students; presentation of prizes.
3.—Institute of Sanitary Engineers: Annual Dinner, Holborn Restaurant. 7 p.m.
5.—Institute of Sanitary Engineers: Paper by Mr. Cuthbert Brown, ASSOC.M.INST.C.E., engineer and surveyor, Edmonton U.D.C., "Reminiscences of a Municipal Engineer."
7.—Institution of Municipal and County Engineers: Dinner and Presentation to President, Lyons' Victoria Mansions Restaurant. 6.30 p.m.
7.—Institution of Municipal and County Engineers: Eastern District Meeting, New Middlesex County Council Buildings and Lyons' Victoria Mansions Restaurant.
8.—Royal Institute of British Architects: President's Address to Students; Presentation of Prizes.
11.—Royal Sanitary Institute: Discussion on Eighth Report of the Royal Commission on Sewage Disposal, on Standards and Tests for sewage, and Sewage Effluents Discharging into Rivers and Streams, 90 Buckingham Palace-road. 7.30 p.m.
15.—Institution of Municipal and County Engineers: East Midland District Meeting at Newark.
17.—Institute of Sanitary Engineers: Paper by Mr. A. J. Martin, M.INST.C.E., F.G.S., "A Plea for Scientific Research in the Field of Sewage Purification."
17.—Royal Institute of British Architects: Messrs. A. Saxon Snell and Wm. Milburn, on "Modern Hospitals." 8 p.m.
22.—Institution of Municipal and County Engineers: Meeting at Southampton.
24.—Surveyors' Institution. Annual Dinner, Whitehall Rooms. 7 p.m.

MARCH.

3.—Society of Engineers: Presidential Address.

APPOINTMENTS OPEN.

Official and similar advertisements received up to 4.30 p.m. on Thursdays will be inserted in the following day's issue, *but those responsible for their despatch are recommended to arrange that they shall reach* THE SURVEYOR *office by noon on* **Wednesdays** *to ensure their inclusion in the weekly list of summaries. Such advertisements may, in cases of emergency only, be telephoned (No.* 1359 *Holborn), subject to later confirmation by letter.*

WATFORD URBAN DISTRICT COUNCIL.

ENGINEERING ASSISTANT.

The Watford Urban District Council invite applications for the appointment of an Assistant in the Engineer's Department.

The applicant should be a good draughtsman, and have a practical knowledge of municipal engineering generally.

Salary, £80 per annum, rising by annual increments of £10 to £100.

Applications, stating age, qualifications and experience, accompanied by copies (originals, if sent, will not be returned) of not more than three recent testimonials, to be sent to Mr. D. Waterhouse, Engineer to the Council, not later than Saturday, February 1st, 1913.

Canvassing, directly or indirectly, will be a disqualification.

W. HUDSON,
Clerk and Solicitor.

Council Offices,
High-street,
Watford.

WEST SUFFOLK COUNTY COUNCIL.

COUNTY SURVEYOR'S DEPARTMENT.

APPOINTMENT OF CLERK OF WORKS.

Applications are invited for the post of "Clerk of Works" for a period of about 18 months during the reconstruction of certain main roads in the county.

Applicants should possess a thorough knowledge of modern methods of road construction, and be able to set out the work, and be prepared to keep the same hours as the workmen.

Applications, endorsed "Clerk of Works," to be made in candidates' own handwriting upon forms to be obtained from the undersigned (together with particulars of the duties), stating wages required and the date upon which the duties could be taken up, accompanied by copies of three testimonials, to be sent to the undersigned not later than the 27th January, 1913.

W. LIONEL JENKINS, ASSOC.M.I.C.E., P.A.S.I.,
County Surveyor.

Shire Hall,
Bury St. Edmunds.
January 8, 1913.

CHRISTCHURCH RURAL DISTRICT COUNCIL.

The Christchurch Rural District Council invite applications for the post of—(a) Inspector of Nuisances and designated Officer under the Housing (Inspection of District) Regulations, 1910. Salary £80. (b) Building Surveyor. Salary £10.

Applicants must hold the Certificate of the Royal Sanitary Institute for Inspectors of Nuisances.

The person appointed will be required to live in the town of Christchurch, and to give his whole time to the service of the Council, and the appointment will be subject to approval by the Local Government Board.

Applications from persons not more than 30 and not less than 24 years of age, and accompanied by three testimonials of recent date, with particulars of qualifications, to be sent to A. Druitt, Christchurch, Clerk to the Council, on or before the 4th February.

COUNTY BOROUGH OF SWANSEA.

APPOINTMENT OF BOROUGH ARCHITECT.

The Corporation of Swansea invite applications for the appointment of Architect to the Corporation of Swansea, at a salary of £500 per annum.

The gentleman appointed must devote the whole of his time to the duties of the office; staff and accommodation will be provided by the Corporation.

Applicants must be Fellows or Associates of the Royal Institute of British Architects.

Conditions and particulars of the appointment can be had on application to the undersigned.

Canvassing is prohibited, and will disqualify any candidate.

Applications, accompanied by not more than three recent testimonials, endorsed "Borough Architect," to be sent to the undersigned by 11th February next.

H. LANG COATH,
Town Clerk.

Guildhall, Swansea.
January 21, 1913.

THE ROAD BOARD are prepared to consider applications for the position of a Junior Engineering Assistant for temporary employment. Applicants must have had practical experience under a Municipal or County Engineer of preparing plans, specifications and estimates for road work, both in water-bound and bituminous materials, and be competent to design, organise, and supervise the carrying out of such work. The success-ful applicant will at first be stationed in Ireland, and employment for at least twelve months will be guaranteed. Salary £250 per annum and travelling expenses on the Civil Service scale. Applicants must state age, previous experience, present employment, and may accompany their applications (which must be in writing only, and addressed to the Secretary of the Road Board, Queen Anne's Chambers, London, S.W.) with copies of recent testimonials.

PUPIL.—The Borough and Waterworks Engineer of Leamington (A.M.I.C.E.) has a vacancy in his office for a Pupil.—Address, Town Hall.

ENGINEERING ASSISTANT (experienced) required temporarily on Municipal Engineer's Staff in important Town in the North.

Only those with good Municipal experience and with special knowledge of Sewerage, Steel and Masonry Bridge work need apply. Preference given to candidates who are Associate Members of the Institution of Civil Engineers, or who hold the Testamur of the Institution of Municipal and County Engineers.

Salary £180 per annum.

Testimonials need not be sent, but applicants should state age, previous experience, and the names of two Engineers to whom reference may be made as to character and capabilities.

Replies, not later than 1st February, to Box 1,217, office of THE SURVEYOR, 24 Bride-lane, Fleet-street, E.C.

COMPETITIONS OPEN.

BARNET URBAN DISTRICT COUNCIL.

MUNICIPAL OFFICES.

The above-named Council invite Designs from competent Architects for schemes for the Erection, at a cost not exceeding £4,000, of New Municipal Offices within the Urban District.

The following premiums are offered: First premium £25, second premium £15, third premium £10.

Copies of the Conditions and Instructions to Architects, together with any other particulars, may be obtained on application to the Surveyor to the Council, Mr. W. F. Wilkins, C.E., M.S.E., at his Office, No. 40 High-street, Barnet, Herts.

The designs, endorsed "Municipal Offices," must be addressed to H. W. Poole, Esq., Clerk to the Council, and delivered at the Council Offices, No. 40 High-street, Barnet, not later than the 29th day of April, 1913.

H. W. POOLE,
Clerk to the Council.

January 21, 1913.

TENDERS WANTED.

CITY OF YORK.

The Corporation of the City of York invite Tenders for the supply of the following material during the year ending March 31st, 1914, in such quantities and at such times as may be ordered—viz.:—

Portland Cement.	Building and Sewage Lime.
Stoneware Pipes.	Pitch and Creosote Oil.
Sludge Press Cloth.	Yorkshire Stone Flags, Kerbing and Edging.

Whinstone (Broken and Rough), Slag (Broken and Rough), and Limestone Chippings.

Forms of Tender will be supplied upon application to the undersigned.

Tenders, sealed and endorsed, to be delivered to me on or before the 8th February, 1913.

The Corporation do not bind themselves to accept the lowest or any Tender, and reserve the right to accept one or more Tenders for any portion of the material required.

F. W. SPURR,
City Engineer.

Guildhall, York.
January 20, 1913.

BOROUGH OF KINGSTON-UPON-THAMES.

TO ROAD CONTRACTORS.

The Corporation invite Tenders for Levelling, Paving, Metalling, Flagging, Channelling, Sewering, and Lighting Woodbines-avenue, in accordance with the Plan and Specification prepared by the Borough Surveyor, Mr. R. Hampton Clucas, which can be seen at his Office, Municipal Offices, where Forms of Tender can be obtained.

Sealed Tenders, endorsed "Tender for Road Making," to be sent to me not later than Wednesday, the 12th February, 1913.

The person whose Tender is accepted will be required to enter into a Contract and a Bond, with two sureties, for the due performance of the work.

The lowest or any Tender will not necessarily be accepted.

HAROLD A. WINSER,
Town Clerk.

Municipal Offices,
Kingston-upon-Thames.
January 22, 1913.

The Surveyor

And Municipal and County Engineer.

Vol. XLIII. JANUARY 31, 1913. No. 1,098.

Municipal Engineering in 1912.

The rapidity of modern development in the various branches of municipal engineering practice renders it increasingly necessary for members of the profession, both senior and junior, to keep themselves thoroughly abreast of the times. We venture to suggest that an excellent way of doing this is to peruse the pages of THE SURVEYOR week by week. Even for the regular reader, however, it is a very useful practice to pause once a year in order to consider recent events in the light of any possible permanent influence which they may exercise upon the future course of civic engineering work. We therefore submit to our readers our eighteenth Special Annual Issue, in the confident expectation that it will meet with a reception not less kindly and appreciative than that which has been accorded to its predecessors. All the usual features have been retained, including special articles recording the progress which has been made in regard to electricity supply, tramways, water supply, municipal and public buildings, sewerage and sewage disposal, refuse disposal, roads and streets, highway bridges, and street lighting. The function of the present introductory article is briefly to review these Reviews, which are all contributed by experts in their respective spheres. The great coal strike, which took place in the early part of the year, had effects which were very far-reaching in many directions. The electricity works of the country managed to come through this period of strain and anxiety with very little disorganisation, and with great credit to those responsible for their management. It is interesting to note, too, that the permanent results of the strike have been positively beneficial. Not only have many manufacturers become regular consumers of electric power, but managers of electricity works have at the same time given greater attention to the economy of their boiler house plant, thus effecting a considerable revenue saving. Apart from the abnormal situation created by the strike, the main general features of electricity supply have been the continued prosperity of the metallic filament lamp, an enormous increase in the total power load, and a general reduction in the price of electrical energy. The reports in regard to tramway undertakings which have been published during the year are almost without exception of a very favourable character. Indeed, in most cases an absolute record in revenue receipts has been established. Although this very satisfactory state of affairs may be largely attributed to certain specific causes, it is to be hoped that the present prosperity may not prove to be merely temporary in character. In this connection it may be pointed out that it will be necessary in the future to watch very closely the keen and increasing competition of the motor omnibus and the railless trolley car. The relative position of local authorities and private companies as owners of tramway undertakings is shown by the recently issued annual return of the Board of Trade. This document shows that there are at present 2,637 miles of tramway in the country, of which 1,777 are owned by local authorities. The net receipts of the latter undertakings for the year 1911-12 were 4¼ millions, and during the same period nearly half a million was paid in relief of the rates. The provision of public buildings and the initiation of housing and town-planning schemes are matters which have occupied the attention of many local authorities during the year. All other enterprise in regard to the erection of municipal buildings is overshadowed by the erection of the new County Hall for London, which continues to make progress, although it is impossible as yet to forecast the date of completion. Of the housing schemes which have been completed, that which has been carried out on the Liverpool Berrington-street area is the most noteworthy; while as regards town planning, in addition to the general progress which has been achieved in Great Britain under the Act of 1909, the feature of the year has undoubtedly been the competition—the first of any magnitude—promoted by the Government of the Commonwealth of Australia in connection with the laying out of the new Federal capital. Turning now to a matter which is of supreme importance to municipal and sanitary engineers—sewerage and sewage disposal—we find two events of great interest—namely, the issue of the Eighth Report of the Royal Commission, and the Report of the Local Government Board on the intercepting trap. The conclusions set out in the latter document have aroused great interest, being in direct opposition to the popularly received opinion as to the necessity of the trap as a safeguard against the dangers supposed to be lurking in sewer air. The report has been the subject of discussion at many meetings, and there can be no doubt that it will exercise great influence in regard to the sanitary practice of the future. The Eighth Report of the Royal Commission deals with standards and tests for sewage and sewage effluents discharging into rivers and streams, and affords very interesting reading. It foreshadows the issue of a ninth and final report which will bring to a conclusion the labours of a Commission which has discharged its functions with singular efficiency. In regard to roads and streets, our review points out that the proceedings of the Road Board have continued to be the most important central activities in highway administration. The Institution of Civil Engineers have taken a step of great importance in the appointment of a Standards Committee on road materials. The chief matters of general interest to record are the continued increase in the use of motor traction, the advent of the railless trolley car, and the additional experience which has been gained in the use of tar macadam and in surface tarring. The use of reinforced concrete as a material for the construction of highway

bridges has become more general. Reference must be made, too, to the enormous damage done to bridges in the neighbourhood of Norwich by the exceptional floods of last August. No fewer than fifty-two bridges and culverts were damaged or destroyed, the damage being estimated at a sum approaching £16,000. Finally, as regards street lighting, it is interesting to observe that the year 1912 was the centenary of the first public supply of gas in this country. The industry is still far from moribund, recent competition from other illuminants having been met by a spurt of improvement in methods and fittings for the supply of gas. The development of centrally suspended high-power gas lamps (especially in the City of London), and the invention of the several systems of control have contributed to the maintenance of gas as a street illuminant. The above matters are all fully dealt with in the special articles which follow. Municipal enterprise continues to develop in every direction, and while the year under review has not been characterised by the inauguration of many works of great magnitude, municipal engineers may look back upon it as a period of steady progress in almost every branch of work with which they are specially concerned.

ELECTRICITY SUPPLY.

Substantial progress has been made in this department of municipal activity during the past year, not only in the older branches of lighting and power supply, but also in those branches which have more recently claimed the attention of the central station manager, such as heating and cooking. We may still be a long way from the ideal sketched out by Dr. Ferranti, when electricity will be used for everything, but steady development is taking place in that direction, and the cheapening of the supply, which he postulated as a condition precedent to the fulfilment of his bold prophecy, is proceeding slowly but surely. There are now places where electricity can be had even for lighting at a flat rate of 2½d. per unit, while power supply is in many areas available at ½d. per unit (or less) in the case of large consumers, and in a few towns cooking is charged for at the same low price. Fears had been expressed lest the supply of electricity at low rates for cooking should develop a load overlapping the lighting load, thus raising the "peak," and necessitating the extension of plant and the strengthening of mains; but so far there is no evidence whatever, even in those places where the cooking load has been most sedulously fostered, that any such untoward result is likely to be met with.

As regards electric heating, although it is admitted that this is more costly than heating by coal or gas, there appears to be no great difficulty in inducing the well-to-do members of the public to indulge in this luxury, when the convenience and comfort of the system have been brought home to their understanding. At any rate, it is certain that the manufacture and sale of electric heating and cooking appliances in this country is developing to an extent hardly dreamt of by those who are not in close touch with the trade, and an extraordinary variety of domestic electrical apparatus is continually coming on the market.

THE COAL STRIKE.

One of the most noteworthy events of the past year was the great strike in the coal-mining industry, an event which had been anticipated with dread by almost all parties, under the impression that it would entail disastrous consequences to our trade as well as to the well-being of the community in other respects. Contrary to all expectation, however, the outcome was by no means so unfortunate; the great bubble was pricked, and it was demonstrated that we could survive a six weeks' coal strike without suffering extreme disorganisation of trade and industry, or undergoing any great hardships. The electricity works of the country laid in large stocks of coal in advance, and with few exceptions were able to carry on their supply without interruption throughout the period of stress. In some cases it was found necessary to diminish the consumption for a time by extinguishing the public lamps at midnight, or by cutting off the supply to large factories; but, fortunately, these were quite exceptional instances, and in most cases the full supply was maintained during the whole period. Not only so, but in very many cases manufacturers who ran short of coal sought aid from the electricity supply, and installed electric motors, with the natural result that many of them became permanent consumers, and the development of the power load thus received a great impulse.

Another beneficial effect of the strike was that managers were compelled to give serious attention to the economy of their boiler-house plant, and to provide for the increase of their facilities for storing fuel in large quantities; the generation of steam with oil-fuel was also investigated, and in many stations temporary devices were installed for this purpose, with satisfactory results. The cost of oil prohibits its use except in time of emergency, but it has been fully demonstrated that at such times it can be very effectively employed as a temporary expedient; and those stations which employed Diesel oil-engines of course were practically unaffected by the strike, except in so far as the price of the fuel and the means of transport were concerned. There can be no doubt that, on the whole, the strike indirectly engendered confidence in the reliability of electricity supply, and thus benefited the industry.

LAMPS AND LIGHTING.

In the lighting department there is little novelty to record. The metallic-filament lamp and its big brother, the flame arc lamp, continue to make rapid progress in the public favour: neither has been the subject of any noteworthy invention during the year, but the quality of the lamps themselves has steadily improved, and the tungsten lamp now appears to be, for all practical purposes, as robust as its carbon predecessor, while its useful life is at least twice as long. Litigation has taken place regarding the patent rights, with the result that the situation has been cleared, and an association of tungsten lampmakers has been formed, which will ensure the full utilisation of all new inventions and maintain the standard of quality, while incidentally, no doubt, it will take care that the selling price is not allowed to touch bedrock.

Remarkable developments have taken place in connection with the methods of lighting interiors, largely due to the high efficiency of the tungsten lamp, for the advantages of the "new methods" have been well known for many years; the avoidance of "glare" due to the exposure of the source of light, and the comfort of indirect lighting from a white ceiling or reflector, have been enlarged upon *ad nauseam* by the vendors of special fittings and shades devised for the attainment of these ends, and the popularity of the improved methods bears witness to the appreciation with which consumers have received them. Comparatively little progress has been made by the mercury-vapour lamp, which is not well adapted for use except in workrooms, but an improved form of Geissler tube filled with neon, one of the rarer gaseous constituents of the atmosphere, has been developed, giving a beautiful rose-tinted light at an efficiency about 50 per cent better than that of the tungsten lamp, and has been used in a number of installations in France.

POWER APPLICATIONS.

As we have mentioned above, the power load increased rapidly during the year, and the improvement was due not merely to the strike, but to normal conditions also. For example, in the course of 1911-12 the Glasgow Corporation sold over 40

million units, of which more than half was for power, and had motors of nearly 37,000-horse power connected to the mains. The growing demand has necessitated extensions of generating plant at a large number of stations, and some which supply direct current have been obliged to adopt high-pressure three-phase generators, with converter sub-stations, in order to cope with the load. What the power load may mean to an electricity supply undertaking is well exemplified by the case of Coventry, a town to which we have often drawn attention, where, with a population one-tenth that of Glasgow, the total output is over 10 million units a year, and of this no less than 90 per cent is used for motive power.

The employment of electric power is gradually extending in textile mills, of which there is a very large number, and some municipal undertakings already count these amongst their most important consumers; collieries and steel works also are making continually wider use of the electric motor. Several local authorities have adopted electric power for pumping water during the year at a saving, as compared with steam power, of 40 or 50 per cent, and this is an application which lends itself to co-operation with the electricity works exceptionally well, as the pumps can be stopped whilst the demand for other purposes is heavy.

ELECTRIC COOKING AND HEATING.

We have already touched upon the progress which is being made in these departments, which offer an enormous field for cultivation. Like the power load, these applications of electricity have a direct effect upon the emission of smoke into the atmosphere, for which the domestic fire is very largely to blame, and municipal authorities are evincing a keen interest in their development for this reason, quite apart from the commercial benefit derived by their supply undertakings. The adoption last year of electric cooking in several large establishments, not as a fad but as a business proposition, cannot fail to produce its effect in the near future, and an electrical restaurant has recently been opened in London by one of the companies manufacturing the apparatus. In Southampton, one of the few places where electricity is supplied for cooking at the low price of ½d. per unit, the system has been very widely adopted, with very satisfactory results to the supply authority; but it would be quite a mistake to suppose that the price named is necessary to the development of the business, as excellent results are obtained where the price is 1d. The great obstacle to its extension is undoubtedly the high cost of the apparatus. The one way in which this difficulty can be solved is by the adoption of the hiring-out system, and this is gradually coming into vogue on the lines already followed with such wonderful success by the gas supply authorities. Hitherto the suppliers have been somewhat chary of investing capital in apparatus the durability of which was questionable, and which might be superseded by later inventions at a very early date, but the manufacture has become more stable, and the life of the apparatus is now better known. At Marylebone, where the manager, Mr. Seabrook, has always pursued a forward policy, the hiring-out system has been practised for some time with very satisfactory results.

It appears to be very desirable that the supply authority should keep in touch with the user, and take steps to inspect the appliances from time to time; and the adoption of a suitable tariff is said to be of great importance, for if a separate meter and wiring are necessary in order to secure a low price for energy, the consumer raises objections. This statement applies more particularly to radiators than to cooking apparatus, as the former should be available all over the house, whereas in the case of the latter some extra wiring is a necessity.

No great advance has been made in the design of cooking or heating appliances, but the construction of the heating elements, which are the key of the position, is improving, and apparatus is available for practically every possible requirement of the household.

GENERATING PLANT.

The large extensions which have been going on all over the country have in almost all cases involved the installation of steam turbo-generators, and these are being made in continually larger sizes. One of 25,000 kilowatts is being built in this country for an American company. The construction of these machines has been somewhat simplified by a compromise between the features of the impulse and reaction types, and new radial-flow turbines have been devised which may exercise some influence on future developments.

The large gas-engine still fails to fulfil the predictions which were so freely made regarding the supersession of the steam-engine at the beginning of the century, but Accrington proposes to install a large gas-driven plant as an extension to its steam station. Chester is adopting a water-power scheme, deriving power from the river Dee to the extent of about 800-h.p. The economies effected by the use of oil-engines in small stations have been further exemplified during the year, and storage batteries are being installed by some large undertakings. Unfortunately several important electricity works experienced shut-downs, including Liverpool (for three-quarters of an hour) and Islington (for a night); at Salford damage was done by fire to the extent of £10,000. These occurrences, which have happily been rare in recent years, are often due to the retention of obsolete switchgear, and while the latter, it is true, is definitely abolished by the fire, it is a pity that it should be disposed of in such a costly manner, for the damage is not limited to the moment, nor even to the town where the interruption takes place. Reliability of supply is one of the first essentials to securing the public confidence and support, and such mishaps work untold injury to the industry.

THE DISTRIBUTING SYSTEM.

The enormous cost of the distributing system which usually is in the neighbourhood of half the total outlay on an undertaking, renders it of the first importance to utilise any possible means of economy in this item. Unfortunately there appears to be little likelihood of any material reduction in the cost of underground mains, which have become thoroughly standardised; but wherever it is feasible to adopt overhead conductors, a very considerable saving is effected. In the past the Board of Trade has set its face steadfastly against their use, and still prohibits the system in towns of any size; but a tendency to relax this attitude in the case of small towns and villages has been manifest in recent years, and the local authorities also, who at first were strongly opposed to overhead wires, appear to have modified their views on the subject, for there has been during the year a remarkable number of cases in which the overhead system has been sanctioned for both public lighting and private distribution. Indeed, in many instances the local authority itself has adopted overhead wires, at least on the outskirts of a town, or for transmission to an adjoining suburb—even such towns as Bury, Wakefield, and Worksop being included.

When properly carried out there is little objection to the system, and it enables a supply of electricity to be given to places which must otherwise go without. Villages in particular cannot hope to share in the comforts of electric lighting and heating unless overhead mains are permitted, but fortunately this fact has been appreciated, and village lighting has consequently made great progress of late, thanks also to the economy of the tungsten lamp, which enables the lighting supply to be given at a cost but little above that of paraffin lamps. The facilities afforded by the Electric Lighting Act of 1909 to enable authorities to supply electricity to places beyond their municipal

boundaries have also been largely availed of, with great benefit to the parties concerned.

THE TARIFF QUESTION.

The efforts of station managers to devise tariffs which shall improve their load factors, treat all classes of consumer equitably, be comprehensible to the consumer, be equally applicable to "peak" and "off-peak" loads, and return an adequate profit, have resulted in a state of chaos, suggesting that a time will come when each consumer will be provided with a separate tariff of his own. There appears to be little tendency, even now, for the innumerable systems to be boiled down to a reasonable number—in this matter every authority is a law unto itself. The difficulty of understanding the maximum demand system has led recently to its being denominated by a Scottish councillor the "maximum bedamned" system, and there are many who will cordially sympathise with him.

The need for a tariff which shall enable a consumer to add heating and cooking to his lighting installation without necessitating the use of an additional meter and separate wiring is fairly met by the "telephone" system, and this, or a similar tariff, is coming into use in many places. The idea of charging the consumer on the basis of his rating assessment seems to be growing in importance, and has been adopted even in such places as Liverpool and Sunderland as an alternative. Mr. Lackie, electrical engineer to the Corporation of Glasgow, read an important paper on the subject in February before the Institution of Electrical Engineers, describing the system he had adopted for the domestic consumer in that city, and it led to useful discussions at various centres.

There is only one good thing that can be said on the tariff question, and that is that the price of electrical energy is almost universally being reduced. At Govan, for instance, it is only $2\frac{1}{2}$d. per unit, and many other municipalities charge but little more. Unfortunately the companies supplying electricity, especially in London, appear to be unable, or at any rate unwilling, to follow this example very far.

ADMINISTRATION AND FINANCE.

The feeling that the profits derived from a municipal supply of electricity should not be devoted to the relief of the rates is gaining in strength, and while it is argued not unreasonably that an amount equal to the difference between the interest paid by the municipality on the borrowed capital and the interest that a company would have had to pay may fairly be claimed by the ratepayers, the tendency to cripple the undertaking in this way is diminishing. At Leeds a Local Government Board inspector commented very severely on the policy which had been followed there of allocating large surpluses to the rates, whilst borrowing large sums for further capital expenditure on such short-lived apparatus as meters. The Board considers that meters, services, and radiators should be paid for out of revenue, and urges managing committees to follow this course.

The sale of fittings by municipalities has, as usual, been the subject of much discussion, an injunction having been granted to stop the Sheffield Corporation from carrying on their sales department, and from doing wiring, &c., on consumers' premises. The Corporation promoted a Bill conferring power upon them to undertake such work, but this has not yet passed through Parliament, the Lords refusing consent, while the Commons insist upon granting it. The Municipal Electrical Association is also renewing its attempt to secure wiring and trading powers for all municipal authorities. The contest between the electricity committee of Marylebone and the opponents of municipal contracting still goes on. An agreement was almost arrived at with the Electrical Contractors' Association, but the latter at the last assumed an irreconcilable attitude, demanding the complete closing of the sales department, and the Committee decided to continue their practice of taking contracts and placing them in the hands of a contractor, with the difference that in future the area will be divided between a number of contractors instead of employing one only. In view of the necessity of hiring-out cooking and heating apparatus to consumers, which cannot be done as a rule by contractors, it is most desirable that general powers for this purpose should be at once conferred upon municipalities, and there are strong arguments in favour of adding powers to do wiring and repairs as well; if the local authorities are empowered to carry on the supply of electricity, it seems only fair that they should be allowed to do the business properly and not by halves. The new Industrial Committee of the Institution of Electrical Engineers, which last year revised its Articles of Association in order to be able to play a more important *rôle* in the interests of the industry, has made it the first of its labours to reconcile the station engineers and the contractors, and it is hoped that the result will be a speedy end to this injurious conflict.

HIGHWAY BRIDGES.

Steady progress has been made during the past year with the work of improving and rebuilding bridges in the counties, and a considerable number of old bridges have been replaced by new ones. The satisfaction with which those concerned in such work contemplate the substitution of a serviceable new structure for a dangerous or inconvenient old one need not be grudged them, but young engineers must not too readily assume that there was something wrong with the design of the old bridge in any particular case. In some cases the old bridge would have lasted another century if it had been properly cared for in the past, while in other cases the necessity for the new work has arisen from an increase in the amount of traffic. Some bridges have had to be replaced because the heavy axle loads of to-day would involve an increase in dead load beyond that for which the spans were designed, and others because the whole weight of a heavy vehicle, or of two at once, is more than the spans could safely carry. Some old bridge abutments have been needlessly exposed to scour, and it is probable that in some cases the reclamation of broads and swampy lands, or other agricultural work, has led to an increase in the flood discharges of the river, making it seem as though the old bridge had been designed with insufficient waterway. In any case a condemned bridge is usually worth study, and a comparison of the loads actually carried with the strengths of the various parts calculated as they stand is often worth making.

TWO BRIDGES ON SEDGEMOOR.

The retention, in a modern form, of an important structural feature may be noted in the case of two new bridges, replacing old ones, on Sedgemoor. These new works, designed by Mr. E. J. Stead, ASSOC.M.INST.C.E., were described, with illustrations, in a paper read by Mr. R. M. Stone at the Glastonbury meeting of the Somerset surveyors. (See p. 864 of June 14th.) Like the bridges which they replace, the new ones are founded on piles, the old elm piles and the 9-in. slabs which rested on them being represented by piles of ferro-concrete 13 in. square in section and 30 ft. long driven into the lias clay which underlies the peat bog, the heads being connected monolithically by beams and slabs. On this foundation the abutment proper was built of mass concrete. The load on each pile is about 28 tons, which is less than the load which could be supported by 5 cwt. of frictional resistance per square foot of the surface of the pile, without counting the bottom support. The arch of Pons Perilis bridge is of ferro-concrete,

the span 25 ft. and the rise 6 ft., the thickness at the crown being 10 in. and at the springings 13 in. The three arches of the Hartlake bridge are of smaller span and less thickness. The old foundations, being designed only to support the bridge on the bog itself, had proved incapable of holding the spans up to their work under the loads and vibration due to the passage of the heavy and speedy vehicles of to-day; but these old works were well designed for their purpose. The old bridge at Hartlake was founded about 1 ft. below the bed of the stream on 3-in. elm slab rafts, supported by round timber piles about 5 ft. long and 6 in. in diameter. In the foundation of Pons Perilis, which was a modern bridge in comparison, being only eighty-five years old, the 9-in. elm slab raft was about 2 ft. below the bed of the river, and below it were transverse elm baulks, 12 in. square. This foundation is well worth study, and it is significant that the abutments in both cases gave way in the middle over the joints in the slabs, which were laid lengthwise. If the slabs had been laid so as to break joint the bridge might perhaps have stood much longer. It is also suggested by the description of the way in which failure took place that if the foundations had been laid a little deeper, and therefore less open to attack by scour, the failure might not have taken place, nor, perhaps, would scour have been so serious a matter if the foundations had been taken a little further upstream and downstream.

FERRO-CONCRETE BRIDGES.

A brief reference was made in last year's Annual Issue to a bridge over the river Sow, at Stafford, designed by Mr. W. Plant, ASSOC.M.INST.C.E. In spite of the statement made, by inadvertence, on p. 210 of our issue of February 2nd, it must be pointed out that the span of 56 ft. with a rise of 6 ft. is an arch, not a beam. If the two ferro-concrete ribs were free to slide on the abutments, or on one abutment, they would be beams; but assuming that the ends of these ribs are connected with the abutments in any ordinary way, and that the latter are reasonably rigid and heavy, the ribs are in actual fact arches, and their cross-sections are wholly in compression. The ribs are $6\frac{1}{2}$ ft. apart and the deck is 3 in. thick. This is a very elegant span, and seems to suit the situation very well from an artistic standpoint.

A ferro-concrete bridge of another type is described on p. 21 of the Supplement in our issue of December 29, 1911. This bridge, designed by Mr. W. J. Taylor, M.INST.C.E., county surveyor of Hampshire, carries the Portsmouth road over mill-race culverts at Cams Mill, and is combined with sluiceways. The unusual features of the site are such as make it undesirable to attempt a brief description of these beam bridges, plans and sections of which will be found on the page referred to above.

Two ferro-concrete bridges at Exmouth, built by Mr. S. Hutton, surveyor to the urban district council, take the form of large slab culverts, but, by the use of ferro-concrete, spans of 18 ft. were possible. That the design was also economical is shown by the fact that the waterway-roadway square foot costs of these bridges were, respectively, 3s. 6d. and 3s. 8d. It is interesting to note the connection between the unusual form of these bridges and the circumstances under which they were built. Slab spans of 18 ft. are unusual, and, at first sight, uneconomical. When, however, we learn that the gravel for making the concrete was obtained free on the beach, and that, in the case of one of the bridges, the carting of the gravel cost less than £10, we realise that a beam and slab bridge, involving more costly timbering and more work in placing the reinforcement, might easily have cost more. Generally, it may be pointed out, the span for which a single slab is economical is extended by a low cost of aggregate and high cost of timbering and work on reinforcement, as well as by a demand for the maximum possible waterway or headway combined with the least possible rise of roadway, especially if a smooth waterway be required for a rapid stream, which may rise to the floor of the bridge. The conditions generally in South Devon are very different from those in the Fenlands, where sluggish streams ooze easily past bridges which would be very obstructive to rushing torrents.

A FERRO-CONCRETE GIRDER FOOTBRIDGE.

In last year's Annual Issue we referred to an example of the use of the twin-rib ferro-concrete type as a graceful bridge to carry light loads. The same county—Surrey—provides this year a very interesting example of the possibilities of the ferro-concrete girder in the same direction, the span being 84 ft. The need for making a single long span arose in this case from the difficulty or expense of placing columns between the railway tracks over which the bridge carries a footway at Richmond. The work, which was carried out under the direction of Mr. J. H. Brierley, ASSOC.M. INST.C.E., borough engineer, includes, besides the main horizontal span of 84 ft., a girder stairway at each end, and at one end an approach span. The two ferro-concrete bow girders are spaced 6 ft. apart, and are connected by a 4-in. ferro-concrete floor. The compression flanges of the girders are 8 in. wide, and the web is 3 in. thick, stiffened by verticals spaced from 3 ft. to 4 ft. apart. Two 8-in. by 8-in. transverse wind braces are provided at the middle of the span, and a ferro-concrete smoke hood is placed over each track. The span seems a very long one for a girder without diagonals, but possibly the need for making a complete web to protect the foot-passengers from smoke from the locomotives led to the economical provision of such a web as was found to make diagonals unnecessary. (See the issue of June 7th.) Two ferro-concrete bridges of the bowstring or bow type have recently been built in France. These are railway bridges over the river Arize, with clear spans of $98\frac{1}{2}$ ft. and $65\frac{1}{2}$ ft. The depth of the girders of the larger span is nearly 15 ft., and the panels are about 9 ft. long, verticals and diagonals being provided as in steel girders of the same general type. These bridges cost about the same as steel bridges would have cost, but it is naturally expected that the cost of maintenance will be less. Among the earliest designs of the type of which we have heard were sketch designs prepared by Mr. R. Ryves, for aqueducts. These were through girders, and were therefore designed with webs as well as diagonals and verticals. The cost was found to prohibit their adoption, apart from any difficulty in making the concrete waterproof.

A BEAM BRIDGE FOR HEAVY LOADS.

An important bridge in which deep ferro-concrete beams are a notable feature has recently been built at King's Cross Station, under the supervision of Mr. W. Willox, M.INST.C.E., engineer of the Metropolitan Railway Company. There are two spans, one 52 ft. and the other 32 ft. The width between parapets is 60 ft., providing two 12-ft. sidewalks and a roadway with two lines of electric tramways, these being in the middle and separating the free traffic in the two directions. In the 52-ft. span the five beams supporting the roadway are 5 ft. 8 in. deep, the three which take the weight of the tramcars being 24 in. wide, and those under the roadway curbs 22 in. wide. The main tension reinforcement of the five beams consists in every case of four groups of seven bars each, the three middle beams having $1\frac{1}{8}$-in. bars, and the central beam having in addition four $1\frac{1}{16}$-in. bars below the groups. The other two beams have $1\frac{1}{16}$-in. bars. The two outermost beams, supporting the outside edges of the footways, are about 5 ft. 3 in. deep, with tension reinforcement consisting of $\frac{7}{8}$-in. bars in three groups of seven. Compression and sheer reinforcements are proportionately calculated. The reinforcement of the 32-ft. span is similar, but of course considerably lighter.

SKINNER'S-ROAD BRIDGE, COLOMBO.

A massive masonry bridge with a ferro-concrete span, carrying Skinner's-road across a canal at Colombo, was described in our issue of June 21st. This is a good example of a definite type, a bridge spanning a canal in cutting, provided with massive abutments and low wing walls; these slightly convex to the waterway, protecting the abutments from scour, holding the toes of the earth slopes, and guiding the current smoothly through the bridge. Bridges built in situations of this kind often exhibit poverty of design as regards provision for meeting the effects of the scour of water down the banks and close to the abutments, and the attention of engineers in India may be directed to this Colombo bridge.

GENERAL NOTES.

The damage done by the floods resulting from the enormous downpour of rain in the district around Norwich was very great, and the city engineer, Mr. T. H. B. Heslop, reported that fifty-two bridges and culverts on the main roads had been damaged or destroyed. His rough estimates of the cost of repair and rebuilding were—for bridges £15,800 and for roads £12,000. As regards the provision of increased waterway there are three ruling considerations in such a case. First, it is so very unlikely that such a fall will occur again that it need not be considered as practically affecting the calculations for waterway, even where there is ample water slope. Secondly, in a country like that round Norwich, the rate of flow away from the whole flat area is so small that flooding would in any case occur even with a much smaller rainfall. Thirdly, the capacity of the area liable to flood being taken into account, the waterway of bridges on the streams leading from it is a matter of importance, since it is desirable to keep flood levels in this area as low as possible in the earlier part of a long rainstorm or wet spell, even if flooding cannot actually be prevented. In this connection the student may refer to Mr. Ryves' series of articles on Preliminary Studies in Bridge Design in the February and March issues, which articles are now available in book form.

A new edition of the British Standard Specifications for Structural Steel for Bridges and General Building Construction was issued last year, and the more important modifications introduced are given on p. 331 of September 6th. The diagrams showing types of culverts (U.S.A. Office of Public Roads), which will be found on p. 386, September 20th, are worth the attention of draughtsmen and assistants. It should be remembered that all standardisation of this kind has limitations which are not always obvious at the first inspection of a site. Young engineers may be recommended to use such designs rather as checks upon the general correctness of their quantities and costs than as guides to the actual form to be given to the work. It is usually worth while to make the design even for a small culvert.

The possibilities of ligno-concrete should be kept in view, especially as regards culverts. See Mr. G. O. Case's studies of this material (p. 540 of April 5th).

The Widening of Blackfriars Bridge and the Repairs to the Menai Suspension Bridge provide subjects for two papers in Vol. cxc. of the "Proceedings" of the Institution of Civil Engineers.

FOREIGN COUNTRIES.

As the result of the burst of activity in road-making which is being experienced in the United States, many highway bridges have recently been built. At Rochester a masonry arch bridge of nine spans has been built across the river Genesee. The longest span is 76 ft., with a rise of $10\frac{1}{2}$ ft., the smallest 50 ft. with a $9\frac{1}{2}$ ft. rise. Each span consists of a number of ferro-concrete spandrel arch ribs, 16 in. wide, with riveted reinforcement, spaced 5 ft. apart, centres, and braced by transverse floor-beams, the ribs themselves being carried up as lengthwise spandrels to the floor level.

In Maryland a fine reinforced concrete bridge is under construction—or by now completed—at Baltimore, the central arch having a clear span of 126 ft. In this small State 37 bridges and 567 culverts have been built on the State highways in the four years 1908-1911.

An important work carried out by the French Public Works Department in Algeria is the great masonry viaduct at Constantine. It includes thirteen arches of about 29 ft. clear span, eight of 31 ft., four of $52\frac{1}{2}$ ft., one of $98\frac{1}{2}$ ft., and a great arch of 227 ft. over a deep gorge. This arch has a rise of 82 ft., and presents, in one of its simplest and most striking forms, an example of the important type which consists essentially of a pair of arch ribs on which stand columns or piers supporting the roadway. In the present example the roadway and parapets are not visually separate from the arch in the middle part of the span, and of the eight "jockey" spans, four in each half of the span, the two end ones are each wholly over the abutment, which is continued in the solid for a distance about equal to a jockey span and its pier. This exhibits, appropriately, the fact that great weight is not needed in the abutments, and would, indeed, be wasteful in the upper part of the abutment, since the thrust of the main arch is wholly taken by the lower part of the abutment and the rocky side of the gorge, and no further load is needed to hold the arch by friction. The whole viaduct, except the floor slab, is built of cut limestone. It is described in the *Annales des Ponts et Chaussées*, May June issue.

Remarkable work has been done by the engineers of the French Public Works Department of late years, notably with cut stone, a striking example being the Pont Sejournet in the Pyrenees, a masonry viaduct being carried across a valley and over a gorge without change of type as regards the viaduct itself. The deep gorge is spanned by a pointed arch, one pier of the viaduct proper standing on the middle of this arch, and another over each of the abutments.

At Shanghai the Bund bridge has been replaced by a three-hinged concrete arch bridge, 45 ft. span and 100 ft. wide, founded on ferro-concrete piles.

MUNICIPAL AND PUBLIC BUILDINGS.

The past year has been noted more particularly for the initiation of building schemes on a large scale rather than the completion of buildings of any magnitude. The slump in the building trade of the past few years has been chiefly brought about by diminished speculative building and local authorities postponing any schemes which might have been proceed until a more suitable opportunity presented itself without adding additional burdens on the already overburdened tax and rate payer. There is an ever-increasing tendency towards the beautifying of our towns, and an eagerness shown by a large number of authorities to put the Housing and Town Planning Act into operation, so that the incongruities of past planning will be avoided in the future.

One of the most ambitious schemes which has been suggested for London is the improvement on the southern side of the Thames, between Waterloo and Westminster Bridges, so that visitors to London would immediately upon their arrival at Waterloo Station be impressed by a magnificent and effective view of artistically designed public buildings and gardens instead of the slum property which at present exists.

PUBLIC BUILDINGS.

Early in the year his Majesty the King performed the ceremony of laying the foundation-stone

of the New County Hall, which is being erected at a cost of £1,400,000 on a site of 6½ acres at the southern end of Westminster Bridge. The building will be 750 ft. in length, with an average width of 310 ft., and will contain nine storeys. The style of architecture is a free treatment of the English Renaissance, and when it is completed (the exact date is difficult to estimate) it will be one of the finest public buildings in London. The Glamorgan County Council have moved into their new County Hall in Cathays Park, Cardiff. The whole of the exterior facing and sculpture of the new hall is faced with Portland stone, and the stylobate and steps to the front are of granite. The entire cost of the hall and equipment is about £60,000. The new municipal buildings at Stoke-on-Trent were opened in November, the total cost of these being £46,000. Birmingham Council House extension and Art Gallery is proceeding rapidly towards completion, and a tender, amounting to £57,058, has been accepted for erecting the Art Gallery by the extension of a further suite of the "Feenery Galleries," which will have an imposing entrance from Great Charles-street. On September 18th the foundation-stone of the new county buildings at Dumfries was laid by the Marquess of Tullibardine. The Hertford Corporation, who were obliged by a referendum of the electors to reject the offer of the historic Hertford Castle made to them by the Marquess of Salisbury, have now decided that they can take over the castle under an Act of 1882. The castle will be used for municipal offices instead of a museum, as at first proposed. Wallasey Corporation propose to erect municipal buildings at a cost of £80,000. The Corporation of the City of London have decided to proceed with the rebuilding of the structure on the east side of Guildhall-yard, including the Art Gallery, at an estimated cost of £68,000.

A new town hall has been opened at Pudsey. The building was formerly known as the Mechanics' Institute, but it has been converted and redecorated at a cost of £16,000. The Cornwall County Council are now in occupation of their new offices at Truro.

With respect to competitions, Glasgow have, after a long discussion, decided to invite competitive designs for the extension of their municipal buildings, at an estimated expenditure of about £150,000. Dublin Corporation also are inviting competitive designs for municipal buildings, which are estimated to cost £50,000. Marylebone Borough Council have now approved the amended design of Mr. E. Cooper, F.R.I.B.A., for their municipal buildings, the outlay on which is expected to be £61,913. The new design has a stately clock-tower over the main entrance, and Corinthian columns instead of columns of the Ionic order.

HOUSING.

At present great activity is being shown by municipal authorities in the erection of houses for the working classes; but it is questionable whether even this activity will be sufficient to make up the shortage of this class of house which undoubtedly exists throughout the country. The deficiency has been mainly brought about by two causes—first, the nervousness of investors to advance money to speculative builders; and secondly, the activity shown by municipal authorities to close or demolish slum property without showing an equal activity to replace those houses pulled down or closed.

The total number of houses closed and demolished throughout England and Wales under the Housing Acts during the four years ending March 31st, 1912, is 23,590, the number in urban and rural areas being 12,052.

The number of houses proposed to be erected by urban and rural authorities under the 1890 Act since the passing of the Housing and Town Planning Act is 2,666, which accounts for the deficiency of 9,386 houses when compared with the number of houses closed or demolished in the same areas. It will be realised what a serious question the housing of the working classes will become if the same procedure is continued, and unless a great revival in the speculative building trade takes place.

In 1900 the loans sanctioned for the erection of houses for the working classes under Part III. of the Housing of the Working Classes Act, 1890, totalled £354,923, a greater amount than has been sanctioned previous to this year. The second largest sum was £230,889 in 1901, while in 1909 the figure was as low as £49,254. The amount sanctioned during the first ten months of 1912 was £438,846.

Of the housing schemes which have been completed during the year, the Liverpool Berrington-street area housing scheme is one of the largest. It consists of 226 tenements, each of two, three, and four rooms, and includes fifty-two self-contained cottages. The total cost of the scheme is £100,000. A housing scheme at Bury, which includes 124 houses built in pairs at rents varying between 4s. 2d. and 6s. 3d., has also been completed. Other housing schemes completed or contemplated are Coventry, £68,730; Hornsey, £29,267; Liverpool, £200,000; Doncaster, £29,000; Seaham Harbour, £14,909; Chelmsford, £26,000; Acton, £70,000, and several smaller schemes.

A Royal Commission has been appointed to inquire into the housing of the industrial population of Scotland, rural and urban, with special reference in the rural districts to the housing of miners and agricultural labourers, and to report what legislative or administrative action is in their opinion desirable to remedy existing defects.

The schemes referred to are somewhat put into the shade by the Bill which has recently been passed by the French Government authorising the loan of £8,000,000 voted by the Municipal Council of Paris for the construction of cheap dwellings. Out of the proceeds of the loan the City of Paris will lend £2,000,000 to societies for the construction of cheap dwellings. The residue will be applied by the Municipal Council to the construction and acquisition or the sanitary improvement of buildings containing lodgings. Two-thirds of these lodgings, calculated according to the rental value, are to be reserved for families with more than three children under sixteen years of age.

TOWN PLANNING.

Considerable progress is now being made by a large number of local authorities with schemes of town planning under the Housing and Town Planning Act, 1909. The Local Government Board have approved schemes submitted by Birmingham (two) and Rochdale. In twenty cases the Board have given authority for the preparation of schemes, and the Middleton Corporation have been given authority to adopt a scheme prepared by owners. Several applications for authority to prepare schemes are at present before the Board; in fourteen cases preliminary notices have been served, and in eighty-four cases proposals are under consideration. In all about 124 local authorities are proceeding, or contemplate proceeding, under the Act.

A unique competition, inasmuch as it is the first of any magnitude, was that promoted by the Government of the Commonwealth of Australia in connection with the design of the new Federal capital city. The city is intended to be the permanent seat of government of the Commonwealth, and it is here that the Governor-General will have his residence. It will, therefore, be the social centre of Australia in the same way as Washington is the social centre of the United States of America.

The premiums offered were £1,750, £700, and £500. Unfortunately, the Association of British Architects did not agree with the conditions of the competition, as no security was given that the selected competitor would be engaged to carry out the work, and they advised their members to refrain from taking part in the competition. No doubt this is the chief reason why no English competitor was among the first three selected. The design

placed first was that of Mr. Walter Burley Griffin, of Chicago, which provides for the radial system of planning, with ample open spaces and ornamental waters. Altogether 137 designs were submitted from engineers and architects in all parts of the world. Another large competition recently announced is that for the town planning of Dusseldorf, with premiums of £1,000 and £375. In this country competitions have been invited by the corporations of Hull and Huddersfield, whilst several others are contemplated, notably that of Hendon, covering an area of 6,000 acres.

SCHOOLS.

Owing to the varying views and ideas of the Board of Education and educational authorities school planning is continually changing. The rapid transition from the central hall system of planning to the single-floor verandah school, and latterly the open-air school, is some justification for the Departmental Committee of the Board of Education reporting that the cost of schools should be cheapened. In most cases schools which have been built for more than ten years are now quite obsolete and do not lend themselves to the new and up-to-date educational methods of instructing young children. Again, the varying size of classes required by the Board of Education regulations is a continual source of worry and expense to local educational authorities, and very often means a large expense in the building of new schools.

The Report of the Departmental Committee of the Board of Education recommended that school buildings should be cheapened by the use of concrete blocks and reinforced concrete, and that the elevation of the buildings should be brightened and made more attractive by the use of half-timbered and stucco work. This latter suggestion is of primary importance, for when it is remembered that children have to spend many years in these buildings it seems only right that the impression made upon their minds should be as bright and pleasing as possible.

A school recently erected near Doncaster under the West Riding Education Committee embodies most of the up-to-date ideas. The building gives accommodation for 1,000 children, and has been built round four sides of a square, with a large centre plot of lawn, which will be used for open-air classes. All the class-rooms open on to the quadrangle, and flat roofs, which will be used for open-air instruction, are a feature of the structure. The cost works out at £10 2s. per head.

The open-air school which has been opened at Uffculme, Birmingham, is of considerable importance as representing one of the latest attempts of the educationist to benefit those children who by their environment have been rendered unfit physically for a proper assimilation of that knowledge which educational authorities in the past have been able to give them. The class-rooms have north walls only, the roofs being carried on brick piers at the corners. Collapsible glass shutters, however, are provided for use in very rough weather. Charlottenburg is the birthplace of this class of school, and the movement has spread rapidly through Germany, France, and America, London opening her first school in 1907.

The new Batley Car Council Schools at Dewsbury, which have cost about £10,000, were opened in August last with accommodation for 500 children. Lord Derby laid the foundation-stone of a new secondary school at Clitheroe in October last, which is to be built for the Lancashire County Council at a cost of £20,000. The building is designed as a dual school; the sexes will be in separate wings for teaching purposes, but will have the common use of assembly hall, science, and other departments. The building will also be used for technical purposes. A new secondary school is being built for the Hereford County Council at a cost of £10,000. New elementary schools have been built at Chiswick (accommodation 120), Hampstead (990), Cambridge (820), Harrogate (675), Acton (850), in addition to several schools for county councils.

The cost of the later types of schools compares very favourably with that of older types, the average cost per head of all schools built in this country during the last few years having been between £12 and £13. Thus schools which are built on higher hygienic principles do not necessarily involve increased expenditure, while the improvement in the health of the children and teachers is, of course, very great.

HOSPITALS.

The most noteworthy event during the past year affecting the erection of isolation hospitals is the issue of the report made by Dr. H. Franklin Parsons, late chief medical officer to the Local Government Board. Repeated complaints have been made to the board of the excessive cost of buildings of this description, and an inquiry was carried out by Dr. Parsons with the view of vetoing in future schemes of too expensive a character. The main points dealt with in the report were :—

1. The advantage of combining districts for the purpose of hospital provision as compared with the establishment of a separate hospital for each district.

2. The design of isolation hospitals, in which it is pointed out that the cheapest hospitals have been those which have most nearly followed the board's plans.

3. The advantages and disadvantages of the compartment and cubicle blocks.

4. Details of construction. Under this heading Dr. Parsons reports that the Local Government Board have in one instance (at Acton) sanctioned a loan for the construction of a ward-block built of blocks of clinker concrete. The accommodation is for thirty-six beds, and the total cost, including roads, sewers, &c., £4,000, or £111 per bed. In this instance the local authority had to make a special by-law exempting the hospital from the by-laws in force within the district.

5. Competition for plans are as a rule waste of time and money.

Several other matters are dealt with in the report, which is of great importance to those about to embark upon a hospital scheme, and should be carefully studied by all officials who are called upon to advise in the matter. The report was dealt with at length in THE SURVEYOR of September 13th, 1912.

The Acton Pavilion referred to above has been completed, and up to the present the new method of construction has proved highly satisfactory. A new infectious diseases hospital is being erected at Eastleigh upon an area of 12½ acres. The buildings comprise isolation block, pavilion, administrative block, laundry, and mortuary.

PUBLIC BATHS.

The majority of local authorities during the past twelve months have been marking time where public swimming-baths are concerned. One noteworthy work, however, is the new building at East Ham, the work of erection in this case being carried out by direct labour at a cost of £9,000. The bath was designed by Mr. A. H. Campbell, M.INST.C.E., now city engineer of Edinburgh, and the scheme was carried out by the present borough engineer, Mr. J. E. W. Birch. The swimming-bath is 120 ft. long and 40 ft. wide. The apparatus for heating has been installed by Messrs. Royles, Ltd., of Manchester, and is on the aeration and filtration principle. The West Hartlepool Council have accepted the gift of a public swimming-bath from an anonymous donor, and have agreed to provide a site for the building.

LIBRARIES AND MUSEUMS.

His Majesty the King laid the foundation-stone of the National Museum of Wales in the Cathays Park, Cardiff, in June last. The estimated cost of the building is £260,000. Gradually the scheme for erecting the most important buildings of the

city and those of Welsh national importance in this beautiful park is being completed, and already the Town-hall and municipal offices, law courts, Glamorgan County Hall, and Welsh University buildings have been erected. When the whole of the buildings which it is proposed to erect, and the public gardens surrounding same, are completed, the scheme will be one of the finest in the kingdom, and it will be indeed difficult to find such a magnificent group of buildings in such picturesque surroundings.

The Mitchell Library, Glasgow, has been completed. The central hall of this building has an area of 113 ft. by 52 ft., and accommodates 322 readers. It is divided longitudinally into three principal bays by massive piers panelled and ornamented in plaster, each of these piers being further divided by two Ionic columns, which carry the entablature round the four sides of the room at a height of 26 ft. The cost of the building was £100,000. Central reading rooms have been erected at Dundee with special accommodation for juveniles.

The foundation-stone of the second of the three branch libraries being provided at Hackney through the munificence of Mr. Andrew Carnegie was laid in October. The estimated cost of the library is £5,250. The first of the branch libraries was opened in the same month, while the plans of the third have been approved.

OTHER PUBLIC BUILDINGS.

The London County Council have decided that the existing Court House at Newington is to be demolished and a new Court House built on its site. The estimated cost is £100,000. Hampshire County Council have approved a scheme for the erection of a new asylum, for the joint use of the county and county boroughs of Southampton and Bournemouth, at Park Prewett, near Basingstoke. The estimated cost is £355,000.

The competition for the Port of London Authority's new offices, which are to be erected in Trinity-square, resulted in the design of Mr. Edwin Cooper, F.R.I.B.A., being selected. The style of architecture is free English Renaissance, and the buildings are planned in the form of a rectangle, with large central hall and dome over. Sir Aston Webb's award was received with universal approval, as undoubtedly the plans were the best submitted both from the point of view of convenience in planning and architectural effect. The estimated cost of the building is £300,000.

REFUSE DESTRUCTION.

Neither our columns nor those of our contemporaries for the year 1912 have contained accounts of striking installations of refuse destructors, nor any papers or important contributions to the science or practice of refuse destruction. Nevertheless it is well known that some of the biggest installations ever undertaken are now in hand on the Continent of Europe, and mostly by British contractors, concerning which we shall no doubt hear more anon. Indeed it is doubtful whether the Continental countries are not at present more active in the destruction of refuse, and much more alive to the dangers of exposed putrefying organic matter than we are at home.

Although great strides have been made here during the past twenty years, the ever present outcry of "cost" is heard, and in almost every case where a borough engineer has to report on the advisability of resorting to incineration he is called upon to discuss the alternatives to this, and to battle against any other way out, or at least to make semi-apologies for any expenditure at all. One or two examples may well be cited.

MIDDLESBROUGH.

Mr. S. E. Burgess, the borough engineer of Middlesbrough, in the early part of the year presented a report dealing with this subject. The corporation, he stated, sent away about 45,000 tons of refuse per annum. "The cost of disposal by destructor is 1s. 8d. or 1s. 9d. per ton, and there is a residue of one-third clinker. The cost of barging to sea on the existing arrangement is 1s. 4d., or from a properly constructed dock 1s. 6d. The cost of sending it away to farmers by railway truck, including all charges, is 7½d. There is not another town in the country, he adds, that could dispose of its refuse at 7½d. per ton, and the more they got rid of by that means the better it was for the corporation."

MANCHESTER.

At the annual conference of cleansing superintendents held in July last Mr. A. Jennison, a member of the Corporation Cleansing Committee, said that over 200,000 tons of refuse were dealt with in Manchester each year, and the value of this work from the point of view of public health was indicated by a drop in the death-rate of the city from 26 per 1,000 in 1891 to 17·12 in 1911.

The manufacture of fertilisers, of which 2,500 tons per year were sold at £3 per ton, was explained, as was the work of improving the estates of Carrington and Chat Moss, where sixty-four tenants now occupied the land and paid £7,170 a year in rent.

In the annual report of Mr. R. Williamson, superintendent of the Cleansing Department, it appears that there were collected and disposed of during the year 139,702 tons of ashes, 31,373 tons of night soil and pail contents, 16,544 tons of warehouse and trades refuse, 6,368 tons of slaughter-house refuse, 5,504 tons of stable manure, and 2,491 tons of fish refuse.

NEWCASTLE-ON-TYNE.

The city engineer, Mr. W. J. Steele, reported in July last that during the year 136,964 tons of refuse were disposed of in Newcastle; 44,499 tons were deposited on tips within the city; 40,284 tons were sent to sea; 34,512 tons were burnt at the destructor; and 17,669 were sent by rail to various farms.

The house refuse amounted to 88,272 tons, equivalent to 6·56 cwt. per head of population or 35·10 cwt. per house, the cost of removal and disposal being 9s. 5d. per house. The cost of collection and disposal thus works out at 5s. per ton, but includes of course the various modes of disposal.

BLACKPOOL.

Mr. James Bee, superintendent of the Blackpool Cleansing Department, in his annual report states that the quantity of refuse dealt with at the destructor last year amounted to 18,372 loads, the weight of which was just over 18,943 tons. This quantity, though considerably below the previous year with regard to the number of loads removed, is only a slight decrease as regards tonnage, the figures for 1910-11 being 18,734 loads and 19,000 tons. The difference is accounted for by the carts taking larger and heavier loads.

There has again been a slight reduction in the cost of dealing with the town's refuse, which during the year averaged 1s. 0¾d. per ton, whereas the average cost per ton for the previous year was 1s. 1d. It is worthy of note that the cost has gradually decreased from 1s. 6½d. per ton in 1906-7.

There is, it appears, a steady increase shown in the profit-earning by-products.

"I have much pleasure in being able to report," says Mr. Bee, "that the tremendous increase that has taken place within the last half-dozen years in the revenue from the sale of products at the destructor has been maintained. During the year the unprecedented sum of £1,660 was derived from this source, an increase of £55 on the income obtained from last year's sales. To show the wonderful possibilities which lie in what is apparently the waste material of the town, it is only necessary

for me to point out that during the year 1904-5 we were deriving what was then considered the respectable sum of £248. We have thus increased our revenue in eight years by £1,412."

A table of statistics shows how the money is obtained. Compared with 1910-11, there are considerable decreases in the sale of ashes and clinkers and mortar, but the yield from fish manure has risen from £558 to £815, which brings about the total increase. During the year 2,327 loads of ashes and clinkers were disposed of, a decrease of 782 loads, which represents a loss of revenue of £102. The quantity of mortar manufactured was 1,490 tons, or 570 tons less than last year, which created a record by bringing a revenue of £470. This year the amount was £330.

The above reports are typical of many we have perused, and show the futility of any one attempting to make comparisons between the economical destruction of refuse in different towns, because, naturally enough, for the purposes of each particular town, the offices concerned reduce everything to a dead level of cost per ton.

Now, as a general advantage to the whole of the municipalities, would it be too much to ask for a uniform subdivision of these costs? The costs of collection will vary in each town according to the *loci* of the destructors, and will be much more per ton in some places than in others. Cost of collection might well, therefore, be an item apart, as also the cost per ton of disposal for each different method of disposal, whether barging to sea, freighting to farmers, tipping on vacant ground, or incinerating. And again, where incineration is resorted to the actual cost of this should surely be subdivided into—(*a*) actual cost of burning (labour); (*b*) sinking fund, interest, and maintenance; (*c*) deduction for residuals.

COLOMBO.

Our issue of April 12th contained an illustration and detailed description by Mr. Clive H. Kilmister, chief assistant engineer, Works Department, Colombo Municipality, of the new refuse destructor at Colombo. It is one of Messrs. Horsfall's, having six cells, each 30 sq. ft. area, of the back-feed type, with special cremator cells for diseased carcases. The feed is hot air after its passage through regenerators; air boxes are built in cell walls, and the cold air is taken in over the hoppers, so as to include any gaseous emanations.

In view of the heavy tropical rains to which at times Ceylon is subjected, and the extraordinarily wet character of some of the refuse, it was considered advisable to provide special oil jets to be used in case of necessity. The complete description of this oil apparatus, and indeed the contribution from start to finish, is well worthy of perusal by all interested in refuse destruction.

NUNEATON.

Mr. F. C. Cook, borough engineer and surveyor of Nuneaton, in the paper he read before the Institution of Municipal and County Engineers in May last, referred to the destructor in that town, installed by Mr. J. S. Pickering, his predecessor, in 1901. At that time it was coupled up to a 27-ft. by 7-ft. Lancashire boiler, working at 80-lb. pressure, and consisted of a Meldrum front-feed three-grate furnace, having a total grate area of 70 sq. ft. and capable of dealing with 30 tons per 24 hours. A test made in the previous March yielded figures as follows:—Duration of test, 37½ hours; time for clinkering, 6½ hours; refuse consumed, 63,868 lb.; refuse per sq. ft. of grate area per hour, 24·33 lb.; steam pressure maintained, 60 lb.; water per lb. of refuse, 1·409 lb. These results were certainly not advanced as showing any extraordinary performance; indeed it was pointed out that the installation had been in use for 32 consecutive days prior to the test being carried out. The cost of labour worked out at 1s. 8d. per ton, and the total nett cost (excluding capital charges), taking into consideration the saving in coal, 1s. 9d. per ton.

A duplicate destructor of similar type has recently been installed by Messrs. Heenan & Froude, this having a grate area of 75 sq. ft., and said to be capable of dealing with 45 tons per 24 hours. Two new Lancashire boilers, 28 ft. by 7 ft. 6in., have also been installed, and the flue to the chimney is so arranged as to be utilised as a drying floor for tarmacadam.

HOT-AIR REGENERATORS *v.* STEAM JETS.

Reference was made in our "Coming-of-Age" issue to changes which have been much discussed during the past year relative to the nett advantage gained by hot draught and the use of regenerative appliances.

At the time when hot forced draught was first introduced into destructor practice the "fume cremator" was still among us, and the very name of this was suggestive of noxious smells and bad practice generally. It cannot be denied that both dust and objectionable gases escaped from the chimneys; owing to bad and clumsy firing, incandescence was not permanently maintained on the grates, these being for the most part single and independent cells, and evil-smelling gases, which were merely the result of refuse dry distillation, were delivered at times into the atmosphere.

The remedy for this was said to be a high temperature, and the straight way to a high temperature to be hot blast. Whether the aim and object of those who first used hot blast for boiler purposes was "high temperature" or quick steam raising, which are not exactly identical, is doubtful; assuming that hot blast did actually produce higher temperatures, makers contended that, inasmuch as it dispensed with fume cremators and abolished the discharge of gases not of an elementary character, its use was justifiable even if the regenerative plant were expensive both to instal and maintain. But the introduction of side-by-side grates caused the single cell makers to look to their laurels, and to bring about improvements conducive to permanent incandescence on the grates, and it gradually became evident that incandescence in sufficient portions of an installation could be maintained with steam jets and comparatively cold-air feed, or air from other sources than regenerators.

The actual economy of preheating of course then demanded investigation, as compared with steam jets. This does not by any means imply that we suggest regenerative heating appliances to be uneconomical. We recently saw a combustible (producer) gas being raised to a temperature of 1,000 deg. Fahr. before its combustion in a furnace, without which preheating the gas would certainly never have produced the desired temperature at all; moreover, the preheating of air in the blast furnace stoves for purposes of hot blast is recognised the world over as being most certainly economical, and dehydration is also practised largely.

But these are instances of high range preheating for the specific purposes of the process, and not as matters of economy only, whereas since it has now been demonstrated that incandescence can be maintained in a refuse destructor, apart from fans and air regenerators, the question to be considered is whether it is good practice to run machines which utilise 12 per cent of the total heat of a destructor (otherwise wasted) and absorb as much, if not more, than this amount for their propulsion. On the face of it, destructor owners get nothing out of this but the pleasure of paying for machinery first cost, repairs and labour; the position, indeed, is slightly worse, for a certain amount of air feed preheating can be brought about by air conduits built in the destructor. Of course there are makers who claim to run blowers and all mechanism on less than 12 per cent of energy available.

The plant erected at Sowerby Bridge exemplifies some noteworthy changes. It was built by Messrs. Dawson & Manfield, and consists of two cells with a grate area of 25 sq. ft. each. The cells are the side-by-side type, but with a back feed opposite the

clinkering doors, the feeding floor being a matter of a foot or more higher than the clinkering floor, thus permitting a fall in the grates.

The capacity of the installation is said to be 20 tons per diem of 24 hours, but as this is more than the collection of the district, it is at present dealing with 12 tons collected and 5 tons from an old tip per 12 hours, equivalent to about 60 lb. per square foot of grate area per hour. This is accomplished with a very moderate forced draught which yields only a small amount of flue ash, and a considerable quantity of hot gas is by-passed from the combustion chamber to the chimney stack as altogether superfluous for boiler purposes. The power generated in the boiler can only be used for sludge pumping purposes. A steam jet blast is provided, but the air feed is passed through passages in the brickwork, not through regenerators.

The installation, though small, is very promising, and allows much economy in cost of construction. It is admittedly a small one, and no safe deductions can be made in comparison with a big installation using fans and hot blast, or steam jets and regenerators. What is required, and what we hope to be able to give particulars of at an early date, is an independent and reliable test showing a detailed balance sheet of the economies effected by a destructor using hot blast, jets, and fans alternately, and a similar sheet for the same destructor working under like conditions with cold blast and possibly with steam jets and air feed heated by its passage through jackets or air boxes, or both.

MAKERS' REPORTS.

Reports from makers or contracting firms show that the year has been a fairly busy one.

The Horsfall Destructor Company, Ltd., report that the works at Southport, Doncaster, and Ilford are all three awarded to them subject to the approval of the Local Government Board.

Messrs. Hughes & Stirling report that during the present year they have completed the installations at Worthing—two-cell grate back-feed type—and at New Stevenston, N.B., a second installation for the Lanark County Council—two-grate front-feed type, complete with buildings and chimney. They report themselves also to be engaged at present in erecting the following:—Manly, N.S.W., Australia, two-grate front-fed destructor, complete with buildings and chimney; Napier, New Zealand, two-grate back-fed plant at sewerage works; City of Turin, Italy, 240-ton top-fed plant; Abertillery, South Wales, two two-grate front-fed destructors, complete with buildings and chimney; Boston, U.S.A., two-grate top-fed plant; Halifax, Nova Scotia, three-grate top-fed plant, complete with buildings and chimney; Pittsburg, U.S.A., four-grate, top-fed plant complete; the City of Bath, six-grate back-fed type complete.

Messrs. Goddard, Massey & Warner report that they have just carried out a repeat order for the rebuilding of the old destructor at Bournemouth, this order having been placed with them after the recent destructor erected by the firm had been submitted to tests which resulted satisfactorily. They report further:—"We are at the present time erecting two large destructors at a brick-works, where the proprietors are utilising the heat for driving brick machinery and for drying the bricks on heated floors. In connection with one set there are six cells of the up-to-date type, having sliding balance doors, extra large feeding openings, and powerful forced draught. The heat produced is taken through two large Lancashire boilers set at right angles to the furnaces. The alterations in bringing the destructors up to date have consisted during the year mainly in details, such as strengthening of flues, strengthening of the iron-work, and rearrangement of the flues so that the heat can pass off the cells without being throttled, and we have also devised and patented a special dust catcher, which is formed in an extended portion of the flue near the chimney shaft, having a series of blades for deflecting the dust into a pit underneath, and so arranged as not to impair the current passing along."

Manlove, Alliott & Co., Ltd., of Nottingham, report that during the year they have been entrusted with a considerable amount of work in connection with refuse disposal, and that at the present they are engaged on a number of important contracts. At Margate they have in hand an eight-cell destructor plant. This will be arranged in two units of four cells each, on the continuous grate principle, each unit having its own combustion chamber and water-tube boiler. The destructor will be arranged for back feed, and each cell will be provided with a drying hearth. The boilers, of which there will be two, will be of the Babcock Wilcox type, and will have approximately 2,900 sq. ft. of heating surface. Two large direct-driven fans of a special design will provide the forced draught, and, as an auxiliary supply, steam jet blowers will also be installed. Another eight-cell plant, which is somewhat similar to the one for Margate, is being erected by this firm at Bristol. The boilers in this case, however, are a little larger, having approximately 3,240 sq. ft. of heating surface. The forced draught will be provided by two large electrically-driven fans. Steam generated by the destructor will be employed for driving a clinker crushing and screening plant, together with a mortar mill, both of which will be supplied by the same firm. The Corporation of Stroud has also intrusted Messrs. Manlove, Alliott & Co., Ltd., with a contract for the erection of a two-cell destructor plant. The cells will be arranged side by side on the continuous grate principle, both cells being provided with a short drying hearth and arranged for back-hand feed. A combustion chamber is also included, together with a water-tube boiler, having approximately 735 sq. ft. of heating surface. The forced draught will be provided by means of a special arrangement of steam jet blowers beneath the grate-bars of each cell; also by means of a direct steam-driven fan.

Messrs. Heenan & Froude have again had a busy year, reporting that the installations completed by them during the past year were:—Droylesden (extension), 1 grate, total capacity 50 tons per 24 hours; Nuneaton, 3 grates, 50 tons per 24 hours; Dinnington Main, 2 grates, 25 tons per 24 hours; Swinton and Pendlebury, 3 grates, 50 tons per 24 hours; Barnes, 3 grates, 60 tons per 24 hours; Largs, 2 grates, 30 tons per 24 hours; Rotterdam, 40 grates, 500 tons per 24 hours; St. Petersburg, 9 grates, 150 tons per 24 hours; Rouen, 9 grates, 150 tons per 24 hours; Moosejaw, 3 grates, 60 tons per 24 hours; Calgary (first installation), 4 grates, 75 tons per 24 hours; Ottawa, 3 grates, 70 tons per 24 hours. They have installations in course of erection at Paris (St. Ouen), 24 grates, 480 tons per day; Paris (Issy), 3 grates, 70 tons per day; Nancy, 12 grates, 200 tons per day; Calgary (No. 2), 3 grates, 60 tons per day; Strathcona, 3 grates, 60 tons per day; London, Ontario, 3 grates, 60 tons per day; San Paulo, 3 grates, 60 tons per day; Craiova, 6 grates, 120 tons per day; Turn Severin, 2 grates, 40 tons per day; Lichfield, 2 grates, 30 tons per day; Bury, 4 grates, 70 tons per day; Rotherham, 4 grates, 50 tons per day (extension unit to existing plant); Rhondda, 12 grates, 150 tons per day; Pontypool, 2 grates, 30 tons per day; Saskatoon, 4 grates, 75 tons per day; Horsham, 2 grates, 30 tons per day; Hanwell, 2 grates, 25 tons per day; Atlanta, 250 tons per day; Patterson (New Jersey), 100 tons per day.

The firm are at present introducing a new feature in destructor practice, in the form of a trough grate. Two types have been introduced—one with a single drawbar in the centre of the bottom of the trough, the other with two bars in the bottom of the trough and a division ridge intervening. The grate is entirely stationary, the clinker being withdrawn on the drawbars into a special clinker wagon. Suitable recesses or channels are provided in the

bottom of the grate, also in the bottom of the special clinker wagon to accommodate the drawbars. The grate itself is built up in sections, the latter being so constructed that any one of them can, when desired, be removed and replaced without interfering with the other portions of the grate. The castings forming these sections are carefully machined and fitted in such a manner that no bolts are required for coupling up. The whole grate, however, is left free to expand and contract both longitudinally and laterally. To obviate the possibility of the burning out of the grate, air-cooling surface is provided by means of a large number of gills, which are cast to the sections forming the trough side and bottom plates. The side and bottom plates, as well as the division or ridge castings in the case of the type provided with double drawbars, are fitted with orifices for the air supply, so disposed that this is concentrated on the whole body of refuse lying in the trough. The air supply comes in at the level of the top of the trough, just under the charging deadplate, and is compelled to pass immediately on the underside of the gills on the side plates to the bottom of the trough. The fine ash that may drop through the orifices referred to is deposited on a light steel plate ashpan which is fixed in a position close up to the gills. Means are provided for automatically discharging the fine ash from the ashpan to the bottom of the ashpit by means of a catch connected to the rod which controls the air-supply valve. The act of closing this valve brings the catch into operation, and the act of opening it brings the ashpan close up to the gills. The position of this ashpan relative to the grate is such that the air is forced to take an upward course and to pass over and between the ribs and gills, thus bringing into use the whole of the cooling surface of the trough plates. The object of the central ridge, which in some cases is provided in the bottom of the grate, is to increase the zone of combustion, and as a consequence to augment the rate of burning on the grate. This is particularly desirable where the refuse is of a light nature and where bulky and thick charges are required. The grate is supported on rolled steel joists or channels resting in suitable well boxes let into the end or division walls between the grates. In the clinkering doors small auxiliary doors are provided, which permit the firemen to spread the refuse as desired. The clinkering operation is effected by backing the special clinker wagon referred to against the clinkering mouthpiece of the grate. A winch is either attached to the wagon, as in the case of the single drawbar type, or a suitable standard with the winch attached is run along and suspended from the wall immediately opposite the clinkering doors. This arrangement can be adopted with either the single or double drawbar type of grate. The clinker wagons are run on a light railway into a clinker yard, or clinker cooling and storage shed, as may be desired. Spare drawbars are supplied, and immediately the clinker is withdrawn into the wagons the spare bars are run into the channels provided in the bottom of the grate. The bars withdrawn into the wagons are cooled off while the next charge is burning on the grate, and are ready for use when the next grate is clinkered.

The advantages claimed for the new "trough" grate are stated by the makers to be as follows:—"More efficient combustion, owing first of all to the form of grate itself and the disposition of the air supply orifices, which is such as to concentrate the forced draught upon the body of fuel lying in the trough. Blowholes as they occur with the ordinary flat grate are impossible with this system of construction; consequently it is possible with this type to obtain a much higher percentage of CO_2 in the gases. Owing to the form of the trough the latter may be charged with less skill and attention, and yet better results are obtained than with the old type of flat grate. This is due to the fact that, whereas the air used to be blown up through the refuse in the old design of destructor, in the trough grate it is blown sideways into the refuse, which, as remarked, prevents the formation of blowholes and forms a hot central zone. The third point is the quality of the clinker residual. An examination of the clinker produced with this type of grate shows at once that it is much harder, its cohesive properties are greater, and it is a much more marketable commodity than the clinker obtained with the ordinary destructor furnace. This is a point of considerable importance where the clinker is crushed and graded for concrete-making and roads or pressed for making slabs or other such purposes. The most important advantage to be derived from its use is to be found in the fact that the clinker is removed by relatively small effort on the part of the men without inconveniencing or exposing them to intense heat. As is well known, the operation of clinkering is far and away the most arduous and the most onerous in the whole cycle of destructor working. By means of the drawbar placed in the bottom of the grate the clinker can be removed by a single operation in a mere fraction of the time usually occupied, the grate itself being stationary at all times. By these means, therefore, it will be obvious that a very great saving in time is effected. This brings up the destroying capacity of the furnace at once by not less than 25 per cent, and this apart from the increased efficiency of combustion which the form of grate itself accomplishes. Further, this advantage is such that it means a substantial saving in labour, so much that two men will readily deal with the quantity that three men have some difficulty in dealing with ordinarily, so far as the charging and clinkering of the furnace are concerned. Moreover, the facility of clinkering gives such men as may be employed more time to attend to their various duties connected with the working of the entire plant. A further advantage is that much less dust is contained in the clinker owing to it being fused in one mass. This is due to the intensity of the fire obtained in the trough-grate. Also less dust is blown off, seeing that the air current instead of being directly vertical is in a horizontal direction, and as the clinker has not to be broken up before withdrawal, no dust is liberated during clinkering, as happens with the ordinary flat grate. Another advantage accruing from the simplicity of the clinkering operation is that, instead of three or four journeys having to be made with clinker barrows, the entire clinker cake is removed in one operation. Owing to the absence of the fire-brick division walls, which are required in the flat-grate system, there is considerable reduction in repairs to brickwork and jambs. A direct advantage accruing from the adoption of the trough grate is that the ashpits can be practically dispensed with; the operation of cleaning is no longer required."

ROADS AND STREETS.

While there have been no striking development in highway work during the past year, there are indications that a steady advance is taking place. Many surveyors now write their reports in such a way that these present the facts relating to the roads in question with sufficient reference to the local conditions to make them useful to other surveyors, either by force of contrast or by virtue of similarity; and when the points dealt with have been those previously suggested by ourselves as worthy of special attention it has been with much satisfaction that we have noted these local responses to a central stimulus. In many cases surveyors have contributed valuable information which has been put before their fellows in our reports of the proceedings at meetings, in the form of special articles, or in suggestive letters to the Editor. While fully recognising the right of users of the roads to make their views known, we have steadily opposed all unjustifiable

interference with the progress of road development, as it must be worked out by the Road Board and the surveyors; and we have especially resisted attempts to influence the choice of methods and materials, which is a matter for the local surveyors and for the technical advisers of the Road Board to deal with from their several points of view. At the same time we have duly noted competent criticism, direct or indirect, when this has been made by qualified engineers, even when their qualifications do not include any special experience of road-making and maintenance. Further, as regards reconstruction, we have recognised the fact that highway engineers in other parts of the world have had recent experience in road construction which must be taken into account when reconstruction work is undertaken in this country, where so little actual road-making has been done for many years past. When reconstruction is contemplated—and we have strongly insisted upon its being fully considered as in many cases necessary before crust improvement is carried out—the surveyor is brought face to face with problems of earth-works, hydraulic engineering, and applied mechanics, with which he has previously dealt only in the form of existing conditions and not as problems involving the use of theory and of the scientific imagination in order that the effects brought about by these works may be anticipated before they are carried out. We have, therefore, kept before our readers the importance of such matters as the theory of the hydraulic gradient in soils, the influence of mass and bulk upon the road crust, and the mechanical weakness of an unsupported edge; and we have alluded to many other matters which are of increasing importance, and must be dealt with from time to time as occasion serves. The necessity of taking climate and geology into consideration is now more generally realised owing to the spread of information from one county to another, and by brief sketches of the conditions in different counties, as well as in other parts of the world where important developments in road work are taking place, we have endeavoured to forestall the erroneous impressions which might otherwise be formed, especially by students and assistants, as to the applicability of the practice of one locality to places where the conditions differ as regards any or all of the factors: climate, geology, the occupations of the people, and the density and incidence of the population of the area itself and neighbouring places.

The proceedings of the Road Board have continued to be the most important central activities in highway administration. To the Board as an administrative machine in highway matters we have given our unqualified support, while criticising frankly its policy and methods and its contributions to technical knowledge. In view of probable developments, we have endeavoured to keep constantly before the Board the value and importance of the work done locally by surveyors, and the danger of adopting anything in the nature of an "up-hill-and-down-dale" policy of improvement, which does not fully take into consideration local conditions which are familiar to individual surveyors; and at the same time we have urged upon the surveyors themselves the consideration that a satisfactory organisation of the administrative machine cannot be obtained unless local officers generally give their loyal support to the Board and to each other. The fear that the Board would be the instrument of some dreadful policy involving alterations, administrative and technical, which would leave the surveyor stranded, has, as we ventured to foretell, proved unfounded, and the courteous attention which is paid by Sir George Gibb and his colleagues to all statements of fact and expressions of opinion as regards relations between the central department and the surveyors has taken an outward and visible form in the circulars issued by the Board and in the annual report. By the appointment of a whole-time engineer a beginning has been made in the establishment of the necessary professional links between the central authority and the local surveyors; and the development of a satisfactory organisation is now, to a large extent, in the hands of the profession generally.

It is to be hoped that the present year will see some general agreement brought about amongst all who are directly concerned with highway administration—such an agreement on matters of principle as will make it possible to put forward definite proposals leading to the passing of Acts of Parliament which will admit of the changes necessary to develop the county and district system with a view to efficiency in highway administration; and it may be suggested that this is a matter which should receive special attention at the Road Congress which is to be held in London next June.

ADMINISTRATION AND ORGANISATION.

Few developments of any importance in organisation and administration actually took place during the past twelve months, but the subject has received special attention in our columns, an article to which attention may be particularly directed being that on page 551 of the issue of April 12. One development of first importance must be noted, however—namely, the acceptance by the Road Board of the important principle that the central organisation has need of permanent engineering officers, Mr. Killick's appointment being, it is to be hoped and expected, the first step in the creation of a technical staff, though the services of the Advisory Committee will, no doubt, be in request for some years to come. Some reference to the Road Board's annual report will be found on page 285 of August 30, and an important circular relating to road improvements is discussed in a "minute" in the issue of January 5, the circular itself being reproduced on page 9. This circular marks a development of Road Board policy, and recognises the importance of matters of principle which had previously been urged upon the attention of surveyors generally and of the Road Board in particular in the pages of THE SURVEYOR. Road Board Specification No. 7, reproduced January 12, page 36, is criticised on page 33, and Specifications 1, 2, and 3 are discussed on page 199 of February 2. Each member of the Board and of the Advisory Committee is the subject of a short biographical note, and these will be found in the issue of February 23, all the March issues, and those of April 5 and 12. Unofficial associations continue to move actively, sometimes too actively, in highway affairs. The annual report of the Roads Improvement Association is quoted on page 594 of April 19, and there are some comments on this report on page 583 of the same issue. It may be suggested that this association might exert its influence in order to prevent the placing of sentry boxes within the limits of highways, pointing out to other associations concerned in this matter that the proper course in all cases is to obtain a private "pitch" for this purpose in a yard or garden adjoining the road. This matter was referred to in the issue of December 22, 1911 (not 1912). Another administrative matter which demands attention is the placing of posts carrying road signs (see January 5). In contrast with the irresponsible criticisms which we are accustomed to hear and read throughout every twelve months, an important article, written in a fair and reasonable spirit, but condemnatory of certain aspects of road administration, was contributed to the *Commercial Motor* by Mr. E. Shrapnel Smith; and in so far as it seemed necessary to defend surveyors and local councillors, his article was, it is hoped, fully met by our own comments (see page 661 and 685 of October 15).

Two important papers on road administration were presented at the annual general meeting of the Institution of Municipal and County Engineers: one on Irish Roads, by Mr. R. H. Dorman, and the other on Scottish Roads, by Mr. Allan Stevenson (see page 289 of August 30). In the West Country important developments are taking place, and proposals for dealing with the main roads of Cornwall are under consideration, the idea at present being that it will be best to create a system of main roads without any secondary system of county-aided roads. The most conspicuous scheme for the creation or development of a system of urban main roads—apart from the planning of Delhi and of the federal capital of Australia—is that contemplated in Calcutta as a part of the work of the Improvement Trust. On the other side of the Atlantic there is great activity in highway development in both Canada and the United States. A brief reference to the highways of Bulgaria, on page 66 of January 19, may be noted, and various other references may be found from the index. On the technical side of highway administration the appointment by the Institution of Civil Engineers of a Standards Committee on Road Materials is an event of importance. This committee was formed as the result of action taken by The Surveyor, as explained on page 936 of the issue of June 28, and on page 954 of the same issue is a report of a preliminary Conference on the subject. It is to be hoped that the committee will recognise the limitations of standardisation in the direction of specifications for processes and for combinations of materials, and will at the same time duly recognise the advantages of the creation of definite standard sizes, or scales of sizes, for road metal, and the establishment of definite relations between the names and the properties of materials. On the economic side of road administration the relation between capital expenditure and annual cost of maintenance is of first importance. Some consideration is given to the subject in our issue of December 6 (suggested by a letter from Mr. T. Jones in the issue of November 22). The main point of this article is that as far as the surveyor is concerned the economic expenditure of capital is definitely limited by the relation which the annual cost of providing the capital bears to the cost of maintenance.

TRAFFIC AND ROAD VEHICLES.

The most important of the traffic developments of the past twelve months is the increase in the numbers of motor vehicles of several classes, and, looking at the country as a whole, without taking into consideration developments which affect small areas or a few larger areas, it is the increase in the numbers of ordinary motor-cars and of rubber-tyred wagons of the twelve miles an hour class which chiefly affects road maintenance expenses. As regards these vehicles the increase is general, obviously so in the case of motor-cars, while the rubber-tyred commercial vehicle is not only used by the large shopkeepers in big towns, but is being adopted by brewers, millers, and others actively engaged in trades which are common to all parts of the country. The increase in the numbers of motor bicycles with trailers promises to develop into a "boom" in vehicles of this class, and cycle-cars, though it is difficult to foresee whether the cycle-car will succeed in ousting or forestalling its more useful if less luxurious competitor. Such traffic wears the roads much less under unfavourable conditions than that of ordinary motor-cars, while the range of conditions under which the wear is insignificant is much greater than in the case of heavier vehicles generally. As regards ordinary motor-cars, a development of considerable importance is the increasing weights of vehicles used as private carriages. The average weight of touring cars and of cars kept for long-distance journeys is possibly decreasing, but the cars kept at large private houses in the country are not only increasing in numbers, but include many heavy vehicles which are used to meet trains and bring home passengers and luggage, as well as for week-end visits and the like. This development is of importance as regards secondary and by roads, for a few heavy vehicles, used regularly in all weathers on these roads, sometimes wear them very fast, an individual vehicle causing much more wear and tear than one of the week-end cars. The latter are principally used in fine weather and when the roads are in good condition, on the main roads chiefly, and to a much less extent on secondary roads, and this usually when they are in a good condition. To a considerable extent also the use of secondary and by-roads by the heavy delivery wagon *in any weather* is a feature of traffic development which affects the same roads as those used by the local motor-cars. Compared with these developments, a large increase in the numbers of light vehicles used chiefly on the main roads and much more in fine weather than in bad weather, is rather a matter of traffic accommodation here and there than one affecting the costs of maintenance generally. In all traffic developments, however, the main roads have their share, and a matter claiming immediate attention is the collection of main road traffic statistics. A number of very useful returns were made last year, some for county main roads and some for smaller areas. In the case of county main roads the returns show very wide differences in the proportions of motor vehicles at different stations, which emphasises the importance of the consideration that the main road system cannot be regarded as a system apart, for, however well the classification of roads has been done, there are considerations affecting the roads of certain small areas rather than those of certain classes in the larger area including these.

The subject of road width received a good deal of attention during the past year (see page 214, February 2). Mr. Ryves' doctrine of emergency width is now almost generally recognised, and this doctrine, as applied to a road and its margins, may now be regarded as having developed so as to include the recognition of a type of carriage way which will include a central portion used by the bulk of the traffic, and two marginal strips within the carriage way proper, and used either for passing purposes or to give emergency width. Regarded as a development of a primary type such a road would be provided in these portions of its width with a crust sufficient only for the purpose indicated, hard and strong, but not provided with a wearing surface and not necessarily kept entirely free from grass and weeds; and some development of roads of this type, especially in the class more important than by-roads but less important than secondary roads proper, is to be expected, partly as a result of greater frequency of passing occasioned by the wider range of speeds on these roads, and partly as a consequence of the increase in wheel loads and the resulting damage to turf margins. The division of the carriage way proper into a central portion and two marginal strips may be desirable apart from the matter of emergency width; for such a carriage way may be made in order to meet an important development largely due to motor traffic, namely, the concentration of a large proportion of the traffic upon the middle half or middle two-thirds of the carriage way. A certain width may be necessary and proper for the accommodation of traffic, and the whole of the carriage way may be used regularly, yet the wear on the middle portion may be so much greater than that on the shoulders that it is not economical to make a single crust of one character right across the carriage way. Accordingly, several surveyors have recently made road crusts with a central por-

tion designed as a crust capable of enduring hard wear, and marginal portions designed for strength and only for moderate wear. A reference to Mr. J. F. Hawkins' reconstructed roads in Berkshire will be found in another part of this article. An important principle affecting this matter has been recently pointed out by Mr. R. J. Thomas, namely, that the less the amount of traffic passing along a road the more does it tend to concentrate in the middle part of the carriage way, so that as the amount of traffic increases the proportion using the middle part is less. This has, as Mr. Thomas pointed out, an important bearing upon the use of traffic statistics, and especially upon the item "Vehicles per yard width," or "Tons per yard width."

The subject of the "tear" of roads by skidpans received attention during the year, and we are indebted to Mr. C. H. Cooper for interesting photos and facts relating to such damage. Our readers will find it easy to look up the references in the index. It seems to be the general experience that suitably designed skidpans properly adjusted seldom inflict damage, except by accident, and that the provisions of the model by-law substantially meet the requirements. As suggested in our own comments on this subject, there is, for given materials and conditions, a limiting gradient for the normal braking of heavy vehicles, and for steeper gradients the provision of a strip of loose stony material, well drained to prevent it from freezing and without sufficient soft material in it to cake together under other conditions, is generally desirable and widely adopted. The question whether any developments in the methods of shoeing horses are desirable, in view of certain changes which are taking place in the methods of crust construction and surface treatment, is one which is engaging the special attention of THE SURVEYOR; but owing to pressure upon our space towards the end of last year we have been obliged to defer the consideration of this subject, which, however, will be dealt with in due course from several points of view. A preliminary article which appeared in our issue of November 1, page 597, may be referred to as suggestive of the way in which the subject may be approached, and any contributions of fact or opinion which our readers are able to send us will be very welcome.

Let us turn now from the consideration of developments affecting road traffic generally, or that on rural roads, to a matter affecting urban and suburban areas, the application of electric traction to ordinary roads and streets without the provision of a special surface for these vehicles to run upon. A trackless trolley system was described in a paper by Mr. H. M. Boot in the issues of December 22 and 29, 1911 (not 1912); the R.E.T. system in the issue of January 19, 1912; and a paper on the subject was read by Professor H. C. Adams before the Society of Engineers (see March 8, page 397). So far, experience in this country covers only a small range of conditions, and is confined to a few places, but as far as it goes it is favourable, the latest reports from Leeds and Bradford being distinctly encouraging. The really important question is whether the system will ultimately replace the electric tramway in definitely urban areas. It is a very difficult point on which to make a forecast, because, on the one hand, the trolley omnibus has some of the advantages of the tramcar and some of those associated with the motor omnibus; while, on the other hand, conditions which give the trolley omnibus an advantage over the tramcar may be such as to carry us a little further, to a point at which the motor omnibus proper is better than either of its competitors. As regards urban conditions, then, the most promising field for the trolley omnibus is where the cost of electricity is low and the conditions are unfavourable to the tramcar, but do not tend to give any great advantage to the motor omnibus. As regards suburban areas, there must be some places where, tramways being undesirable, the trackless trolley system offers special advantages, and it may be suggested that the most favourable routes will be such as lead from a large business or industrial centre to a definitely residential town, such as those which are springing up around London, and particularly when the town or garden city is chiefly inhabited by one class. At the best, however, the trolley omnibus has to fear the rivalry of the motor-omnibus, even on its most favourable routes. Lastly, as regards rural areas, the motor-omnibus may be reckoned the better vehicle on the ground of efficiency and from the point of view of the highway engineer. Road surveyors do not want the complication of more poles and wires added to the problems with which they have already to deal, and it does not seem likely that in rural districts, or even in outer semi-suburban districts, the tied vehicle can compete with the fully developed road carriage. The clause in the Light Railways Bill intended to safeguard the interests of road users and ratepayers as regards the wear and tear of roads by trackless trolley vehicles was rejected in Committee, the effect of the omission being that the law with respect to these systems of road transport will remain as it is, trackless trolleys being left out of the Bill. At the same time, the principle on which this decision was come to is a good one—namely, that the subject should be dealt with comprehensively and not piecemeal. This statement, coming from the Parliamentary Secretary of the Board of Trade, may be considered as significant of much.

A matter affecting traffic generally is the proposed provision of mirrors at the street corners, where there is otherwise no view of vehicles approaching from the right or left, and this subject is discussed on page 756 on April 24 (see also page 760). Experience at Folkestone and Malmesbury seems favourable to the device, but its adoption does not seem to extend rapidly, and its usefulness is probably very limited. The past twelve months have not furnished any important results of experimental work on traction problems, the main features of which have, with certain important exceptions, been carefully worked out at intervals during the past seventy years or so; but a mathematical study of resistance to rolling, which goes more deeply into the subject than studies which do not take account of elasticity, is worthy of special mention. It is contributed by Professor H. Chatley, of Tangshan, and records of the experiments furnishing some of the data appeared in the June number of the *Journal* of the Society of Engineers, a few of the main features of this valuable paper being referred to on page 752 of our issue of November 29.

LONDON TRAFFIC.

London traffic has been much discussed during the year. For a "broad view" of some of the main problems the reader may turn to page 341 of the issue of February 2, and to pages 647 and 658 of April 3. With respect to the management of dense traffic the principle of the intermittent "rapid" was explained in a "minute" on page 236 of February 9, and it may be remarked that the Metropolitan Police Authorities take the same view as that expressed therein. The difficulty of dealing with the traffic in very busy streets is less than it would be if the average speed of all vehicles taken together were less, the high average speed being a favourable factor; but another factor now coming into play is unfavourable, namely, the tendency for the speeds of a large proportion of the vehicles to approach the same average, which results in a considerable extension of the average time taken for one vehicle

to pass another. A noteworthy example of this is afforded by the taxi-cab and the motor-'bus. A taxi-cab can pass a horse 'bus quickly, and the old hansoms found little difficulty in spurting past the old horse 'buses, but the motor omnibus is so speedy, and is capable of moving with such rapid acceleration that the taxi-cab often takes a long time to pass it, sometimes after several attempts, each of which adds a little to the checks imposed upon other vehicles. As regards the costs of maintenance on the streets used as motor omnibus routes, this is a serious matter in some of the London boroughs. The traffic in the south-west of London is very great, and is, of course, concentrated on routes leading to the Thames bridges. On Tuesday, November 5, which was a wet day, 1,401 motor vehicles passed over Richmond Bridge, 822 of these being motor omnibuses, and there were 862 horsed vehicles. On August Bank Holiday 1,286 motor omnibuses passed over this bridge. Holiday statistics must be used with due regard to the limitations to the deductions to be made from them, but they are under modern conditions sometimes of considerable importance, because the large amount of traffic continuing through several days without periods of rest causes rapid wear of the road surface. The position as regards damage or very heavy wear caused by motor omnibuses has cleared considerably on account of the decision of the Road Board with respect to improvements to road crusts on motor omnibus routes. In this matter several technical points demand attention with respect both to the design of the vehicle and to the methods to be followed in making up the road crusts and pavements on the principal motor omnibus routes, and in this connection reference may be made to page 522 of the issue of October 18.

MAINTENANCE.

While the total cost of maintenance of roads is increasing, neither the amount of increase during the last few years nor the actual rate of increase in cost of maintenance at the present time can be regarded as excessive in view of the greater total value of the services performed by the roads. The above sentence must be read in the light of the facts as regards efficiency generally in public undertakings: the counties and districts could do a good deal more to promote efficiency, and the nation as a whole could do more still. It is not often realised that the "maining" of district roads tends to reduce the apparent cost of maintenance of both county and district roads in the county concerned, and that a period during which maining has been carried out cannot, therefore, be compared with an earlier period unless the arithmetical corrections are properly made. The more costly district roads being taken over by the county council, those that are left to the care of the district councils cost less per mile on the average; but when the roads taken over by the county are less important than those which the county was already maintaining, the average cost of maintenance of county roads is also reduced. This is worked out numerically on page 388 of September 20, and has a bearing upon some of the figures set forth in the Road Board's annual report, and upon the inferences drawn from these figures.

That the wear of the road is not the sole criterion of maintenance costs is the burthen of an editorial of September 27th, page 409, in which the importance of taking into consideration the wear and tear of rubber and leather as a matter of highway economics is pointed out. The importance of keeping a sufficient proportion of moisture in the road bed and road crusts in dry weather is now more generally recognised. A striking example of this is afforded by the practice followed in the Imperial Valley of California, where the road is divided by a little bund or ridge along the middle line, and, a similar small embankment being made along the margin of the road, each half of it can be flooded in turn by irrigation water while the other half is being used. It may be suggested that in many cases it would be sufficient to bring the level of the water up to that of the road bed, omitting the central ridge, and relying upon capillary action to supply the crust with sufficient moisture. The use of sea water at Blackpool was extended during last year, and the cost of watering has now been reduced to £7 a mile. The disposal of road detritus is the subject of an article on page 851 of June 14th, in which reference is made to the excellent way in which the embankments, cuttings, and hedges and margins of some of our railways are maintained, reducing the dust nuisance, mitigating the heat and glare of hot summer days, and often providing scenery excursions which are cheap at the rate of a penny a mile. Surveyors were exhorted to emulate the railway engineer in this respect. In this connection, editorial articles in the April issues may be worth a reference; the way in which road dust is sometimes manufactured as a result of work done by the surveyor being referred to on page 648, and some notes on the removal of dust forming the subject of an article on page 720. As regards the disposal of road detritus, the effect of the presence of tar on the soil value of road sweepings is a matter of importance, as to which some notes will be found on page 154 of the issue of August 2nd. The subject of weeds on roadside wastes is dealt with in an article in the issue of June 7th, in which a distinction is drawn between ordinary growths and those often very unsightly patches of weed which are the result of work done by the surveyor, but often, it must be added, in consequence of a lack of facilities for carrying out road repairs.

A problem with which road engineers in many parts of the Empire are familiar—the prevention of sand drifts on roads—has been faced in Pontefract rural district, and a few suggestions as to the ordinary means of preventing sand from drifting on to roads are made in an editorial article in the issue of September 6, page 315. Factors affecting cost of maintenance of roads are discussed in an article on page 208 of the issue of August 9, and brief sketches of some of the conditions of particular areas will be found in other issues. For instance, the effects of climate and soil—important factors in the cost of road maintenance and in the choice of methods to be followed—may be considered in the light of studies such as that based on a comparison of the conditions in Herefordshire and those in Kent, sketched briefly on page 197 of the issue of August 9, and a similar study of the conditions in Wiltshire (page 257, August 23), in connection with a review of Mr. J. G. Powell's annual report on the roads of that county. For notes of the same character in reference to Mr. J. Willmot's annual report on the county roads of Warwickshire, see page 341, September 13.

Tree planting continues to receive attention in the United States. Following the example of Massachusetts, the Highway Department of New York State is systematically planting trees along the roads under its management, the two species particularly mentioned being red oak and white birch. The Massachusetts Highway Commission employs a forester, and has its own nursery for young trees. The suggestion that Highway Departments should employ foresters was, it is believed, first put forward in the pages of THE SURVEYOR some six years ago.

THE ROAD CRUST AND ROAD SURFACES.

The consideration that reconstruction of the road as an earthwork must in some cases precede crust improvement if that improvement is to be effective has probably led to some salutary delay in expenditure upon road crusts, while in other cases, where no heavy work of reconstruction was

necessary, it has been recognised that consideration should be given to the strength of the crust as a whole and its protection from injury before money was spent on the provision of a more costly crust or upper course than was previously used. Among such matters are general thickening of the crust and its foundation regarded as a whole, the protection of the edges, or their design in a manner which will prevent actual breaking down or chipping away of the materials, local protection against damage by water, and widening in places where the width is insufficient for economy. An important circular issued by the Road Board at the end of 1911 was reproduced in our issue of January 5, 1912, and our own comments thereupon will be found in the same issue. A development which is directly due to changes in the nature of wear which have been brought about by fast motor traffic is referred to in the issue of May 24, page 758. The new method is designed to meet the difficulty of adequately providing for surface wear at sufficiently short intervals without putting down, or disturbing and replacing, an amount of material which is unduly large relatively to the amount actually worn away. Patchy wear representing only half an inch of an average reduction of thickness may be so serious in form as to make re-rolling necessary; and the new method consists in rolling in a very thin surface layer instead of disturbing the crust to a considerable depth. This allows of re-surfacing being done every year effectively, and is, in fact, a modern development in one direction from small constant repair, and in the other direction from general rolled repairs. The article in which this method is described is a special SURVEYOR article, and another such, in this case a study of "Mass and Bulk in Highway Engineering," will be found on page 706 of the issue of May 10. The road crust as an arch is discussed on page 130, July 26, with calculations of thrusts in the arch and thrusts against the margin, in typical cases. It is hoped that this may prove useful as showing the limitation of the crust as an arch and the kind of situation in which arch strength is of some account.

Useful figures relating to the making up of road crusts were furnished by Mr. C. S. Morris, page 73, July 12. Practical tests of Portland cement as a road binder have recently been made, but as pointed out in a "minute" there are certain drawbacks which are essential to the nature of this material, which does not easily re-set when the bond is broken. See page 787, May 31, and page 893 of June 21. Amongst the results of systematic tests of road stones recorded during the year the figures published by the New York State Highway Department may be mentioned, a useful table from this source being given on page 302, February 16. Important generalisations based upon the results of tests made by the United States Office of Public Roads, as well as upon the experience of highway engineers in different parts of that country, are contained in a Bulletin the most important parts of which are summarised on page 799 of the issue of December 6, and the possibility of there being some differences either in the meanings of words or in the average qualities of materials used respectively in the United Kingdom and America is suggested in a "minute" on page 770. The testing apparatus which is being installed at the National Physical Laboratory, in Bushey Park, was briefly described in the issue of March 29, and some criticism of the "whirling table" appeared in the same issue.

As regards the problem of providing economical and efficient crusts for roads with very heavy traffic, such as those of Middlesex, Mr. H. T. Wakelam makes in his annual report an estimate of the annual costs, all told, of creosoted deal paving (page 461 of October 4), which definitely establishes this form of paving as one to be reckoned with as a competitor for roads of an inter-urban character and for those parts of main roads which are near great traffic centres and have therefore much heavier traffic than the definitely rural portions of these routes. Mr. Wakelam points out that it would be difficult to find any paving, except perhaps random setts, which would give equally good financial results, and he found that creosoted deal costs less than 1s. 2d. per square yard per annum for a fourteen-year period. The square yard cost is not the only criterion, a sett-paved road might be narrower or a road paved with tar macadam might be wider, the width in each case being the economic width. Where, however, the width is not in any case greater than that sufficient for traffic requirements the square yard cost is a measure of the whole cost, and this probably applies to the roads under Mr. Wakelam's charge.

TAR MACADAM.

The experience of the past year has confirmed that of 1911 as regards the materials which are most promising for use with bituminous binders. Generally, porous materials and those which have rough or gritty fractured surfaces offer considerable advantages over more dense and smoother road metal, and attention has been turned in this direction the more willingly inasmuch as tar macadam is not yet a serious competitor with the three or four kinds of paving which have been found suitable for really severe city traffic. It is possible, and in some situations desirable, to make tar macadam crusts with very hard road metal, and for certain classes of urban streets there is a steady demand for bituminous-bound crusts. In Sheffield some thirty miles of streets have been paved with tar macadam, and this mileage will be extended, the surface being finished on gradients with dry materials rolled into the final coat. At York cobble-paved streets have been improved by paving them with tar macadam on the top of the noisy and insanitary cobbles. Eighty-six streets, or 44,500 square yards, are being dealt with in this manner, and about 21,000 square yards of tar macadam have been laid in a more ordinary fashion in other streets. Tarred slag, in the familiar form of "Tarmac," has been put down in Bolton and other towns, and more or less experimental work or test work has been done in London with several kinds of bituminous-bound road crusts. Trinidad Lake bitumen has been used as a binder in Fulham and Hammersmith, while tar-slag macadam was put down in Hampstead and in considerable areas in non-residential streets of Holborn and St. Marylebone. An interesting piece of test work in which tar binding and water binding were compared, carried out in the Oundle Urban District by Mr. G. B. Chilvers, was described in the issue of March 1 (see page 368 and comments on page 351). In Newark Rural District both tar slag and ordinary tar macadam were used.

As a material for country roads tar macadam has received considerable attention; some experimental work has been done, and lengths of road with crusts made in various ways are now being tested under various conditions. In some areas materials with well-known characteristics have been definitely chosen as the most suitable for use in making up considerable lengths of road, and a good deal of tar-slag macadam has been put down in the ordinary course of making up road crusts in Nottinghamshire and Warwickshire. In Berkshire tar-slag macadam is being adopted for the central 12 ft. of the carriage way on the more level portions of the roads included in the scheme of reconstruction in that county, where about seventy miles of roads now have their middle 12 ft. made up with 4 ins. of "Tarmac" on a suitable foundation. The chief of these roads are those from

Reading to Hungerford, Reading to Maidenhead, and Reading to Ascot.

A reference to tarred limestone macadam will be found on page 300 of the issue of February 16. The fact that tar is less serviceable in the presence of clayey matter than it is on sandy soil is becoming generally recognised, and Mr. W. Stubbs, of Blackpool, recently expressed the opinion (page 262, August 23) that it is a mistake to use pitch on a clay subsoil, expressing a preference for a binding or packing material, such as millstone grit for such situations. Materials for the general study of the subject are provided in a paper by Mr. W. C. Maclean, on Tar-Concrete Pavements in Ontario, page 41, January 12, and brief comments on page 34 of the same issue, and in a report of a committee of the American Society of Civil Engineers (page 564, and 553, of April 12). Some of the causes of failure of oil-bound roads are referred to in the issue of March 29. Clauses suggested as suitable for use in a specification for a bituminous bound carriage way (Mr. J. S. Brodie) will be found on page 260, with the discussion which followed the reading of the paper, and some criticism on page 257 of the issue of August 23.

SURFACE TARRING.

A very large mileage of roads was tarred during the year, the practice extending in some counties to secondary roads and to those with soft and porous crusts. The experience of the autumn strengthens THE SURVEYOR's opinion that surface tarring as a seasonal treatment has a wider range than tarring with a view to the continuous maintenance of a bituminous surface. It also becomes more evident that, as suggested in last year's Annual Issue, the high cost of tarring points to the economic advantage of omitting from the lengths to be tarred those portions of a road which can be effectively maintained by watering and sweeping at a lower cost per mile per season than that of surface tarrings. This is especially the case when the portion of road requires extra scraping in the autumn and sanding in the winter as results of tarring. It is necessary to take into account a number of factors, some of which have a two-fold effect on the issue, since, while they decrease the value of tarring in dry weather, they increase the cost of sweeping in drizzly weather in the autumn and winter. Such factors are: situation in a deep cutting; dampness due to walls and close palings, walls being the worse of the two; lack of gradient, especially when accompanied by dense shade; and dampness due to a high level of subsoil water, or to seepage. These factors may be classed together as tending to decrease the value of tarring as a dust-abating process, and to increase the nuisance of a tarry surface in the autumn and winter; but some of them reduce the frequency of surface frosts, and are, therefore, favourable on steep gradients in climates where frosts often occur on the open ground. It may be observed that a shady road with wide margins has much less tendency to become dusty than narrow and open roads, especially if the shade is that of well-grown trees and the wind can sweep across the road, depositing the dust in the grass. If such a road has a fair gradient, tending to the removal of dust by rain, it is hardly likely to be worth while spending some forty pounds a mile every year in tarring it. To some extent the objections to the use of tar macadam on gradients apply, in the winter, to surface-tarred roads, but in the latter case the matter may be tested without involving capital expenditure. Generally a clay soil is less favourable to surface tarring than is a sandy soil. Where the road runs through pastures the nature of the crust materials is more important as a rule than the nature of the soil, but where the road is bordered by arable fields which have their carting gates opening into the road the nature of the soil may be more important than the nature of the crust. The presence of clay on a tarred road tends to the formation of a plastic clay-tar mud, which is with difficulty removed without resorting to the scraper, and this mud forms ridges which are dangerous to cyclists, and sometimes turn the whole road surface into a lake. Various methods of surface tarring, painting, smearing, and spraying are found suitable on different kinds of crusts, and costs vary considerably. At Exmouth tar-painting was done for about eight-tenths of a penny per square yard. At Uxbridge, where the cost without chippings had been less than a penny per square yard, it rose last year, with the use of chippings, to more than 1¼d. In Warwickshire the cost was nearly 1½d. per square yard. Surface tarring has been tried in many climates, and has given satisfaction at Shanghai and Cape Town.

The limitations of the process are suggested by passages in Mr. Moncur's annual report (Staffordshire), and Mr. Wakelam, in his report on the main roads of Middlesex, referred to the way in which tarred surfaces went to pieces in the wet autumn of 1911, and, taking the same view as that expressed above, wrote: "Its life is only expected to last through the 'dust' season, in which connection (if the work be properly carried out) its efficiency and results need no comment." Various aspects of the subject are dealt with in our "Minutes" and in papers reproduced or summarised in our pages. A general article in the issue of December 29, 1911 (not 1912), may, perhaps, be regarded as embodying leading points, and reference may also be made to page 524, April 5, 1912, and, with respect to weather effects, to page 341, September 13. The results of tests of a tar film exposed to traffic and weather (Mr. W. W. Crosby) are given on page 526, April 5, with comments on page 524. Experience, in the United States, with concrete road crusts, coated with a thin layer of bitumen and sand, points to the importance of special preparation of the road crust so that it may present an even and unyielding surface (see July 19, page 94). Extracts from a useful paper describing the use of bituminous materials in the United States (Prof. Blanchard) will be found in the issue of July 12. The subject of the effects of tarred roads on fish life was dealt with in a paper by Mr. W. J. A. Butterfield, page 277, February 16, with comments on page 271, and a further reference to the subject is made on page 719 of May 17.

ROAD MAKING AND IMPROVEMENT.

The principles and practice of road making, as distinct from maintenance, are now receiving more attention than in the last two generations. This is partly due to a demand in some places for the construction of by-pass roads, but is also, we believe, a result of the conviction that THE SURVEYOR policy, in advocating the study of roads as engineering works before undertaking crust improvements, is a sound one. While road surveyors are naturally anxious to avail themselves of Road Board grants for crust improvement, they may in many cases, we think, do better by making application to the Board for grants in aid of primary reconstruction, with a view to the permanent reduction of annual maintenance costs.

A covering specification for road-making, prepared by a Committee of the Canadian Society of Civil Engineers, is reproduced, with a criticism specially written for THE SURVEYOR on p. 481 of the issue of March 22, and a further reference to Canadian highway engineering will be found in the issue of April 6. At home, with the aid of Road Board funds, a considerable amount of work has been done in widening and in alterations to bends and corners. The amounts spent on the latter class of work are not separately given in the reports. The setting back of hedges, at bends, cross roads, and turnings, is a very different thing

from the easing of the curve of the carriage way itself, which may have the effect of increasing, sometimes very much, the speeds at which vehicles travel at these places. This leads to increased wear and tear of the road, the surface of which is sometimes "rubbed out" by the tyres of motor-cars. Our own idea of the manner in which bends and turnings ought to be taken is definitely opposed to that of most users of motor vehicles, who attach undue importance to the saving of time, and do not sufficiently consider the matter of cost. Adapting a passage from "John Gilpin" we may say: "So round they go, for loss of time would surely grieve them sore; yet loss of pence, they know full well, will trouble us much more." At some bends, where the hedge is low, the half of the road on the outside of the curve is hardly used at all by motorists, and the other half is badly pot holed or rutted.

An important work has been undertaken in Berkshire—the reconstruction of the crust of a considerable portion of the main road system. A typical section for level stretches shows an 18 ft. carriage way on a slag foundation, the depth of which no doubt depends on the nature of the sub-soil. The middle 12 ft. has a crust of tar-slag macadam, which is 4 ins. thick, except near the edges, where it is is carried down several inches deeper, to give extra strength at the joints with the 3-ft. strips. The latter consist of a wearing layer of about 1½ ins. of water-bound granite, upon a 2-in. intermediate course of broken slag, under which is a slag foundation. This is 3 ins. thick at the junction with the central strip of tar-macadan, and 6 ins. thick where it abuts the turf margin. A typical section for gradients shows a wearing crust of water-bound granite, extending the whole width of the carriage way, 4 ins. thick for the middle 12 ft., and 2½ ins. thick over the 3-ft. shoulders. Here the depth is made up to 4 ins. by a middle course of broken slag. There is thus a 4-in. wearing course for the full width of the carriage way, and this rests on a foundation course of broken slag, 4½ ins. thick in the middle and 6 ins. thick at the edges. Mr. J. F. Hawkins is to be congratulated on these designs, which provide for the greater wear in the middle portion, effect some saving of the wear-resisting material on the shoulders, but provide here the extra depth needed to resist concentration of stress near the edges of the crust, and the effects of the tilt and sway of heavy vehicles. Under conditions tending to make the surface of the tar-slag crust slippery the water-bound shoulders will be a useful feature, all the more since their depth will prevent the sharp local increase in camber, which is such a nuisance to cyclists.

The issue of August 9 contains extracts from the annual report of Mr. G. H. Jack (Herefordshire), and in the following issue a method of carrying out crust renewals is suggested in an editorial on page 225. The idea is that, as a last resource, the money for effective crust making may be got by carrying constant small repairs to the last gasp, starving the road of general renewals for the time being.

TOWN PAVINGS.

While there have been no striking developments in town paving during the past year, municipal engineers have been able to draw certain conclusions from the behaviour of various classes of paving under the severe traffic conditions of the present time, and have been confirmed in some of the opinions which they had previously formed. In the London area the 9-in. concrete foundation is regarded as necessary for a considerable mileage of streets, and as regards the wearing carpet the virtues of creosoted soft wood are now generally recognised. Attention is being paid to small sett paving with asphalt joints, which, with the rapid diminution in the numbers of horse-drawn vehicles, offers advantages which could not be claimed for it a few years ago, while this new kind of paving is, in several respects, much better than the old setts once so prominent in North London. (See the issues of April 5 and June 7.) As a general review of London paving that valuable document, the Metropolitan Paving Committee's report, may be consulted (page 463, March 22). References to tar-macadam will he found in another part of this article.

In the United States a good deal of attention has been paid to the expansion of pavements, and a paper on this subject, by Mr. W. P. Blair, will be found on page 773 of December 29, 1911 (not 1912). Reference may also be made to the issue of July 5, page 3 and page 32. The advantage of laying pavements at a chosen temperature instead of leaving the matter to chance is pointed out in an article in the issue of December 29, 1911.

As a matter of general interest the superiority of pure creosote oil over other materials used for treating wood paving blocks, and included in New York and Chicago specifications for street works, may be noted, those materials having been specified on other than engineering grounds. The subject was carefully studied by Col. W. J. Howard, and some references to the main facts as disclosed by that engineer is made in the issue of February 16.

MACHINERY AND PLANT.

The makers of plant and machinery for use in highway work have continued to supply equipment to meet the special requirements of individual engineers, and to put on the market those well-conceived and carefully tested appliances which are a notable feature of British road engineering work. A tar-macadam plant at Belfast is briefly described, with an analysis of costs, on page 831 of June 7, and the Stourbridge plant is referred to on page 53 of July 12. In this connection a road-heating apparatus, described in the issue of April 19, deserves mention, as a means of extending somewhat the range of weather conditions under which work with bituminous materials can be carried out. The advantage of being able readily to ascertain whether vehicles using the roads are loaded within the legal limits is now grasped in a number of districts. A weighbridge for testing "axle-weights" is mentioned in the issue of May 17, and the method of using the machine is described (page 745). Another weigh-bridge, erected by the Darwen Corporation, is described in the issue of November 29, this machine being specially designed for the rapid testing of the 8-ton limit of axle-weight for "heavy motor-cars," the axle-weight and that of the whole vehicle being separately shown at the same time. The usefulness of the roller is extended by various devices, amongst which a water-sprinkling attachment claims attention, the invention of Mr. E. van Putten, and described on page 262 of February 9. A scarifying attachment, designed to distribute the strain over the whole width of the roller, is described and illustrated on page 272, August 23, a traversing motion, worked by hand-wheels and gear, being a feature of this device. To meet the needs of small local authorities, the combined vacuum cesspool emptier and water cart is offered, a description of such a vehicle being given on page 331, February 23. Numerous references to motor vehicles for surveyors' work are to be found in last year's issues, and a vehicle for urban district purposes was described by Mr. G. Symon (Blaydon Urban District) in a professional paper. This is a steam vehicle of the tip-cart kind, and weighs just under five tons. The back wheels are nearly 4 ft. in diameter. See page 745, November 29, for details, and a summary of expenditure and earnings.

SEWERAGE AND SEWAGE DISPOSAL.

The most important events connected with sewerage and sewage disposal during the past year were undoubtedly the publication of the Local Government Board's report upon the intercepting trap and the eighth report of the Royal Commission on Sewage Disposal. Apart from these the record is one of steady progress in the development of systems and methods which were already in use, and the continued increase of activity in these branches of engineering in America. Some of the most valuable and interesting reports of preliminary investigations and of actual work carried out came to us from the United States and Canada, and a notable addition to the literature of sewage disposal has been made by an American engineer.

SEWERAGE.

In connection with sewer construction several large schemes have recently been brought a stage nearer to practical execution. In Manchester very large extensions to the sewerage system have been approved, and the work of construction will shortly be commenced, and at Bradford a contract for a large tunnel outfall sewer has been let at a cost of over £100,000. At New York the proposals made by the Commission which has been investigating the pollution of the harbour will involve the construction of large intercepting sewers to pick up the numerous existing outlets and bring the sewage to single outfalls in the separate districts. At St. Petersburg, where the provision of a modern system of sewerage has been under consideration for a number of years, an engineer has at last been appointed and the work of preparing a definite scheme has now been taken in hand.

Special types of sewer construction have been described in the technical journals on several occasions, notably reinforced concrete sewers of large size in our American contemporaries, and at home the large L.C.C. southern outfall sewer constructed partly of brickwork and partly of cast-iron.

SPECIAL TYPES OF OUTFALL SEWERS.

In addition to these, several unusual forms of sea-outfalls have been carried out. One of these was described in a paper by Mr. J. S. Brodie, M.INST.C.E., borough engineer of Blackpool, at the Sanitary Congress at York. It consisted of an extension to an existing sea-outfall, and was made up of steel tubes 3 ft. diam., which were bolted together and the ends closed. The whole length was then floated into the sea, towed for three miles by a steam tug, and adjusted at high-water over the position for which it was intended. As the tide ebbed the complete length of sewer dropped into its permanent position, the plugs were removed, one end was bolted to the flange of the existing outfall sewer, and the new extension was then ready for the passage of the sewage. Another case was an effluent pipe 66 in. in diam. laid at Rochester, N.Y., to discharge the sewage effluent into Lake Ontario at a point 7,000 ft. from the shore in about 50 ft. of water. An interesting description of the pipe and the special method devised for fixing the outlet end permanently on the bed of the lake was given in the *Canadian Engineer* of September 29th, 1912.

A novel feature of the new sewage disposal works at Baltimore is the effluent outfall, which consists of two lines of pipes, 5 ft. diam., and each 2,500 ft. long, constructed of wood-staves, and laid on pile trestles in the river. Each length of 2,500 ft. was prepared in two sections of 1,250 ft. each on the top of the trestle work. When one section was ready to be lowered into position steel bands were passed round it at about 20 ft. intervals and hung from vertical rods, threaded for the greater part of their length, and carried by nuts from the timber work at the top. One man with a wrench was stationed at each of these points of support, and at a given signal all the nuts were simultaneously given one complete turn, thus lowering the pipe very gradually. Weights, consisting of boxes filled with sand, were placed on the top of the pipe to assist in sinking it. When in position the pipe was fastened down by timber caps bolted to the piles, and the two sections of each pipe were joined together by bolting up flanges attached to the ends of the wood-staves. This type of pipe for large sizes has been used in considerable lengths for water supply mains in America, and several firms appear to make a speciality of manufacturing it, but this is the first instance of which we are aware in which it has been adopted for a submerged sewage outfall. Cases are frequently cropping up where brick sewers, constructed some years ago without due regard to the volume of sewage they would have to take, have been found to be considerably too large in diameter, and consequently difficult to keep clean. This problem has been solved at Hampstead by the Borough Engineer, Mr. O. E. Winter, ASSOC.M.INST.C.E., in an interesting manner. He constructed smaller pipe sewers *inside* the brick sewers, the space between the two being filled in with concrete. Full details of this work were given in a paper by Mr. Winter, which appeared in these pages on August 16th, 1912, and it was considered sufficiently interesting to be printed in full in one of our American contemporaries.

THE INTERCEPTING TRAP.

One of the most important events of the past year was the publication of the report of the Departmental Committee appointed by the President of the Local Government Board to consider the question of the use of the intercepting trap in house drains. The conclusions arrived at by the Committee affect the construction of house drains and the ventilation of sewers, and will undoubtedly have considerable influence upon these branches of sanitary work in the future. The conclusions of the report were printed in full in these columns on September 6th, 1912, together with various extracts from the report itself. The main feature of the report is the expression of opinion that the necessity of the intercepting trap, on bacteriological or epidemiological grounds, has not been established, and that it is only in exceptional circumstances that it may be required. The investigations carried out by the Committee, and the various experiments made by others on previous occasions in connection with the bacteriology of sewer and drain air, are all extremely interesting, and are well set out in the report. Even more interesting are the results of the experience gained in the town of East Grinstead, where the intercepting trap is non-existent, and the particulars given of the practice in Germany.

The great point is that the Departmental Committee were satisfied that the intercepting trap can safely be omitted from house drain connections to sewers, and if this policy is adopted by the Local Government Board several important advantages will result in the future. In the first place a large number of blockages of house drains will be prevented. Secondly, fresh-air inlets will not be required, and the possibility of a large number of outlets for drain air close to doors, windows, and paths, due to defective mica flaps, will be avoided. Thirdly, the problem of sewer ventilation will be solved and sewer ventilating columns will be rendered unnecessary. Some time will, of course, elapse before the effects of the

omission of the intercepting trap can become apparent to any great extent, but the facts brought out by these investigations must have considerable influence upon sanitary work generally. The recommendation that iron drains should be used for house connections will alone help to raise the standard of house drainage work, and thus tend to improve the quality of this class of work, while the use of closed inspection boxes in the manholes instead of open channels will do away with the insanitary condition due to foul manholes and prevent the possibility of sewage leaking into the subsoil under houses from defective inspection chambers, unknown to the occupier, at times when the drain becomes blocked.

This report has naturally formed the subject of discussion at a large number of meetings of various institutions during the last three months of the past year, and although in one case a praiseworthy attempt was made to lead the discussion into a practical direction, it has in nearly all cases degenerated into a repetition of arguments for and against the use of the trap, together with criticisms of the report and the methods of investigation adopted by the Committee. From the printed reports of these discussions there would appear to be quite as many in favour of the abolition of the trap as those who wish to retain it, and we felt it necessary to point out, in a "Minute" on November 15th last, the futility of repeating the pros and cons after the Local Government Board Committee had been considering them for four years, and that it would be much more useful to discuss the best method of putting the recommendations contained in the report into practical effect. The wastes from sinks and baths are already disconnected from the drains at the gullies, and it is not to be supposed that the inventive ingenuity of our experienced sanitary engineers and sanitary appliance manufacturers is unequal to the task of discovering some means of effectively disconnecting the water-closets and rain-water pipes from the drains without having recourse to an appliance which would perpetuate the defects of the intercepting trap.

The ultimate result of the meeting arranged to discuss this subject by the Royal Sanitary Institute was more practical than most of the other similar meetings. It was found impossible to hear all those who wished to speak on one evening, and at the adjourned meeting on November 19th the points raised in our "Minute" of the previous week were dealt with by some of the speakers, and it was pointed out that the provision of a second trap on the outlet of each w.c. would effectively disconnect all the sanitary fittings in a house from the drain. This meeting had the advantage of hearing a contribution to the discussion from one of the members of the Local Government Board Committee, whose report was being dealt with, and he considered that a weak trap on the drain and a puff-pipe between the trap of the closet and the connection with the soil-pipe might form a suitable safeguard which would avoid the difficulties of the intercepting trap.

It is remarkable how many sanitarians appear to be unable to appreciate the teachings of this report, and have apparently made a shibboleth of the intercepting trap. We anticipate, however, that the realisation of the requirements of the Local Government Board will make it possible for those who have the courage of their convictions to omit the trap in the future, and that before long an increase of evidence, such as that which is already available at East Grinstead and some foreign towns, will convince even the most conservative sanitary engineer or surveyor that the Local Government Board Committee have done their work thoroughly, and that their conclusions are sound.

The excellent paper by Mr. E. Willis, ASSOC.M. INST.C.E., engineer and surveyor to the Urban District Council of Chiswick, which was printed in these pages on December 13th last, dealt with the report in an able manner. Mr. Willis agreed with our own opinion that the report is a valuable one, and he not only expressed the opinion that the death-blow of the intercepting trap had fallen, but suggested some useful points for consideration when these traps are omitted from house drains in the future. Among these points the most useful were that effective double seals should be provided on water-closets and all other sanitary fittings; that all ventilating pipes should be carried up above the ridge of the roof; that all waste pipes should be treated as soil-pipes; and that statutory regulations should be issued requiring the examination of house drains not less than once in every six months.

SEWER VENTILATION.

This subject, of perennial interest to all municipal engineers, has been dealt with on several occasions recently, notably in a paper prepared by Mr. T. de Courcy Meade, M.INST.C.E., city surveyor of Manchester, for the Congress of the Royal Institute of Public Health in Berlin. This paper is full of information on the subject, and the results of the experiments carried out in London and Manchester are particularly valuable. The observations on air currents in sewers showed that, where sufficient free openings were provided, the direction and force of the wind exercised a great influence, and overbalanced all other local conditions due to temperature, gradients, character of sewage, and so forth. This fact is now becoming more generally known, and is being recognised as the most important factor which has to be taken into consideration in any attempts to solve the problem.

Methods of deodorising sewer air have also been referred to in this and other journals. One of the most interesting descriptions is that of a test covering a period of three months, which was made at Winnipeg, in Canada, in 1910, to determine the efficiency of ten Beeman sewer deodorising machines fixed in manholes. Each machine consists of a reservoir containing wood alcohol, the fumes from which impinge upon a platinised porcelain disc about 1½ in. in diameter. The disc is first heated to cherry redness, and remains incandescent as long as the alcohol fumes are supplied to it; and the combustion of the alcohol fumes produces formalin in sufficient quantities to deodorise the sewer air when it emerges from the manhole. The cost of operation per day is stated to vary between 4½d. and 9d. for each machine, not including capital charges. It was found that the machines will deodorise the sewer air, but the city bacteriologist reported that no bacteria were found in the sewer air either before or after passing through the machine, and that the formalin is not in sufficient quantities nor in contact with the air a sufficient length of time to have any effect upon them, even if they did exist in the sewer air. However, the city authorities ordered a further fifty machines and had them installed, and they are presumably all now in work.

By far the greatest influence upon the question of sewer ventilation will be caused by the report of the Departmental Committee of the Local Government Board upon the use of the intercepting trap in house drains. The chief argument brought forward by those who advocate its abolition is the liability of the intercepting trap to become blocked, thereby causing the sewage to back up in the manhole and leak out into the soil around and under the house. Incidentally, of course, the omission of these traps would provide a very large number of ventilating shafts for the sewers, practically one on each house, and this is exactly the method which has been advocated by a number of people in the past

as the only practical solution of the problem of sewer ventilation.

A considerable amount of the investigations of the Local Government Board Committee was devoted to sewer and drain air and sewer ventilation, and among their conclusions the following have an important bearing upon this subject. In the first place, they state that "the bacteriological evidence undoubtedly indicates that the bacterial danger of sewer air is incomparably less than the bacterial danger of drain air, and that therefore the entry of sewer air into a house is of correspondingly smaller importance bacterially than the entry of drain air." Secondly, they express the opinion that "too much importance has been attached to the question of sewer ventilation, for there is a considerable amount of evidence which indicates that the necessity for ventilation of sewers has been exaggerated." The report also mentions towns in this country, particularly East Grinstead, and in Germany where the intercepting trap is not used, and the records demonstrate that its omission has had no evil effects. This report undoubtedly supports the arguments of those who advocate the ventilation of sewers by means of the soil or vent-pipes on house drains. Naturally all intercepting traps cannot be taken out at once, or even in a few years' time, but if they are in future omitted in new house drains and the other recommendations of the Local Government Board Committee are also carried out, we can imagine a state of affairs some years hence when all sewers will be more efficiently flushed and cleansed than they are at the present time, all house drains will be of cast iron with closed inspection boxes in the manholes, every house will ventilate the sewer, and there will be no fresh air inlets and no open manhole covers or openings leading to the sewer except the open ends at the tops of the soil or vent-pipes on the house drains. Under such conditions the problem of sewer ventilation would be solved, as far as we can judge with our present knowledge of the subject. If that be the case, then, although the intervening period of transition may be of considerable duration, it behoves everyone who has anything to do with the matter to put aside all minor criticisms, avoid perpetual discussions of the pros and cons, drop the *non-possumus* attitude, and set to work to bring nearer the time when the conditions described above shall have been attained.

INFILTRATION OF SUBSOIL WATER INTO SEWERS.

This is a subject of importance in all systems of sewers, but particularly in those where the sewage has to be pumped and purified. It varies considerably in different towns, and is naturally highest where the sewers are laid in waterlogged grounds. From some details published in the early part of last year, it appears that much trouble has been experienced from this source in American towns. In some cases the amount of subsoil water has been found to be as much as the daily dry weather flow of sewage, while in others it has been as high as 40,000, 50,000, and even 70,000 gallons per day per mile of sewer. These difficulties have led to greater care being taken in making sewers as water-tight as possible, and this subject was dealt with in considerable detail in an interesting article which appeared in the *Canadian Engineer* of January 25th, 1912. A number of causes of failures and leaks in pipe sewers are given, and three general ways of applying waterproofing are given, viz.: (1) To have the material of the structure and the joints impervious, which will prevent leakage in either direction; (2) to coat the outside of the sewers if the object is to prevent infiltration into the sewers; and (3) to coat the inside of the sewer if it is required to prevent leakage of the sewage into the surrounding ground. The various methods of applying these three systems and the question of the best materials to adopt under varying conditions are dealt with in detail, and should be useful for reference by anyone who has to contend with this difficulty.

SEWAGE DISPOSAL.

The following quotation from a paper on "The Chemistry of Sewage Purification," by Dr. Arthur Lederer, chemist and bacteriologist to the sanitary district of Chicago, expresses very clearly the state of affairs in connection with sewage disposal at the present time and the needs for the future:—

"The deeper the writer progresses into the field of sewage disposal the more he realises the amount of work that is still required to make it an exact science or art. The co-operation of biologists, entomologists, chemists, and sanitary engineers is required. The sanitary chemist is mostly concerned with the investigations of the biologic features, a thorough knowledge of which will materially aid in bringing about a better understanding of the facts already accumulated, as well as the solution of new problems. For the industrial chemist the most fertile field for investigation is the ultimate solution of the sludge question. At present we are able to reduce the quantity of sludge to a minimum, and to prevent offence, but we realise that certain constituents, even though small in quantity, may some day prove of commercial service. The economies to be obtained, however, will be available only in large plants, where careful operation is possible."

SLUDGE DISPOSAL.

The sludge problem still remains unsolved. Taking the word "disposal" in the sense of "getting rid of," the method described by Mr. H. W. Coales in our correspondence column of February 2nd, 1912, would appear to be very effective. In this case it was found possible to burn air-dried sludge without the addition of coal or wood, leaving only an inoffensive fine red ash, easy to handle and of such a character that it served to lighten clay soil. On the other hand, attempts are still being made to produce a marketable manure from sewage sludge, and this is done successfully by the Native Guano Company, which continues to take the pressed cake from the Kingston-on-Thames Sewage Works, where the A B C process has been retained under municipal management since the termination of the agreement with the Native Guano Company. At Oldham Dr. Grossmann's process has been adopted for dealing with the whole of the sludge, and at Norwich a special company has been formed to take over the sludge produced by the hydrolytic tanks. In both these cases we believe it is proposed to produce marketable manure, in addition to the extraction of the grease in the case of Oldham. The published particulars available to date with reference to the cost of disposal by these methods are, however, insufficient to allow of a definite conclusion as to the economical value of these processes from the point of view of the total cost of getting rid of the sludge. We have also heard indirectly of an additional method, in which it is proposed in the process of precipitation to use special chemicals whereby the resultant sludge would be enriched, and thus rendered exceptionally valuable from a manurial point of view. Dr. Grossmann's system of treating the sludge by distillation with superheated steam and the process in use at Bradford may be suitable for exceptional cases, such as at Oldham and Bradford, but it may be gathered from the last annual report of the Leeds sewerage engineer that special methods of these types will not necessarily be successful when dealing with other kinds of exceptional sewage or even with ordinary domestic sewage.

It is fairly evident that in all schemes where attempts are made to secure some income from the

sale of a product from sewage sludge the cost of the process is high, both for initial outlay and for maintenance, and, so far as we know, in no case does the return from the sale of the product do more than cover a portion of the cost of production. Where it is important that the sludge should be got rid of—*i.e.*, taken completely away from the place at all costs—there may be some justification for high expenditure. On the other hand, it will probably be found more satisfactory in many cases to avoid excessive outlay, and rather to endeavour to secure the utmost reduction by natural means of the quantity of sludge produced, and its production, also by natural means, as far as possible, in an inoffensive state. In this direction the best results are being obtained by two methods—the Imhoff tank and Dibdin's slate beds.

The Imhoff tank has found much favour in America, where it has been adopted for a number of schemes. Particulars have appeared from time to time in our columns of the results obtained with this tank, and the chief feature is that by leaving the sludge to accumulate for from three to six months in a separate chamber, undisturbed by the flow of fresh sewage through the tank, the originally slimy, sticky, suspended organic matters undergo a process of digestion whereby their character is largely changed, and the solids in the sludge discharged are of a granular nature, which rapidly gives up its liquid content upon a suitable draining bed, and leaves behind an inoffensive, easily handled residue of an earthy nature, which is very suitable for use as manure. In such a process the quantity of dried sludge is naturally much less than in the case of any process where the sludge is produced by chemical precipitation. This applies also to the humus discharged from the Dibdin slate beds. Only a few weeks ago we printed particulars of the amount of humus produced by this process at High Wycombe. Reference to these details (THE SURVEYOR, December 6th, 1912) shows that 1·66 cubic yards of dried humus (72 per cent. water) per 1,000,000 gallons of sewage treated was produced from the slate beds. In the case of the Imhoff tank it is generally estimated that the quantity of sludge of 50-60 per cent. water content per head per annum would amount to 0·06 cubic metre, which represents approximately 6 cubic metres, or about 8 cubic yards, per 1,000,000 gallons of sewage, as against the 1·66 cubic yards of humus with 72 per cent. moisture from Dibdin's slate beds. The experiments made with the latter by the eminent firm of horticulturists, as described in these pages, indicate that it had a distinct value for horticultural purposes, and it must also be observed that the slate beds alone, of all methods, work under aerobic conditions, and are the least likely of all known systems to cause a nuisance from smell. This is confirmed by the reports of the Royal Commission on Sewage Disposal, which state definitely that no nuisance from smell could be detected during the investigations made at Devizes, and Machynlleth. Apart from the question of the actual amount of solids in suspension discharged from these slate beds in tons or cubic yards, the actual cost of the sewage disposal at Devizes when the system of treatment was chemical precipitation was £700 per annum. Since the slate beds have been in use this figure has dropped to £200. This comparison is one that can be understood even by the most ignorant layman, and cannot well be brushed aside by even the most highly educated scientific expert. Further, at Devizes, when chemical precipitation was in use, there was an enormous accumulation of pressed sludge cake, which it was impossible to get rid of, while with slate beds there is no large accumulation of sludge.

In this connection it may be useful to compare the quantity of sludge produced at several places. In the following table the volume of sludge is reduced in each case to a 72 per cent moisture content in order to form a correct comparison with the humus from the slate beds at High Wycombe:

	Type of treatment.	Sludge 72 per cent water content per million gallons of sewage.
Manchester ...	Septic and sedimentation tanks ..	7·8 tons
Withington ...	Detritus and sedimentation tanks .	6·0 tons
Leeds	Chemical precipitation	6·0 tons
High Wycombe ...	Slate beds	1·26 tons

ROYAL COMMISSION ON SEWAGE DISPOSAL.

Another important event of the past year was the publication of the eighth report of the Royal Commission on Sewage Disposal, dealing with standards and tests for sewage and sewage effluents discharging into rivers and streams, and the intimation contained therein that the next report will be the final, and will deal with methods of disposal not involving water carriage, and with standards in regards to trade effluents. We discussed the eighth report at some length in a "Minute" on November 29th last, so that it is not necessary to go into minute details in this review, but the following observations may be recapitulated. It is pointed out that under the Rivers Pollution Prevention Act of 1876, in the case of sewage entering non-tidal waters, the duty is imposed on the local authority of adopting the best practical and available means to render the sewage harmless before it enters the river, and no local circumstances may be taken into account. The effluent by itself is alone to be considered. The data now obtained indicate clearly that the volume and other conditions of a stream are factors which in ordinary circumstances go far to determine whether obvious nuisance would or would not be caused by the discharge of sewage liquids into that stream, and the Commissioners reiterate their recommendation that the law should be altered so that local authorities should not be required to purify their sewage more highly than is necessary to obviate the risk of actual nuisance arising from its discharge.

This alone is a valuable result of the labours of the Commission, as it opens the way for more reasonable methods of dealing with local authorities discharging sewage effluents into rivers and streams under a great variety of conditions. The Commissioners, however, go a step further, and recommend standards in order to facilitate the practical working of the above recommendation. The general standard requires an effluent to be of such purity that it does not contain as discharged more than 3 parts per 100,000 of suspended matter, and with its suspended matters included must not take up at 65° F. (18·3° C.) more than 2 parts per 100,000 of dissolved oxygen in five days. This general standard is to be prescribed by statute, or by order of the proposed Central Authority, and should be subject to modification after an interval of not less than ten years. Special standards are also recommended, and these may be more stringent or less stringent than the general standard, the chief factor to be taken into consideration being the dilution afforded by the stream into which the effluent is discharged. Relaxation from the general standard would commence in cases where the dilution exceeds 150 volumes, and the requirements would be less and less stringent until, in cases where the dilution exceeds 500 volumes, it is suggested that crude sewage might be discharged direct to the river, subject to possible requirements of screens or detritus tanks. Valuable observations are included in the report upon the manner in which these standards should be administered by the proposed Rivers Boards and Central Authority.

In this connection it is interesting to note that within three weeks after the publication of this

report complaint was made by a county council with regard to the sewage effluent discharged by a town into a river under its jurisdiction. The town authorities immediately referred to the recommendation made by the Royal Commission in its eighth report, to the effect that even crude sewage might be discharged without treatment beyond screens or detritus tanks where the dilution afforded by the river was over 500 volumes, and in their case it was 1,400 volumes! From this incident it is obvious that if confusion is to be avoided it is incumbent upon the Government to take steps to introduce legislation for the purpose of placing the recommendations of the Royal Commission upon the Statute Book as quickly as possible. Up to the time of writing nothing appears to have been done in this direction, although the Prime Minister, in reply to a question in the House of Commons in November last, stated that he understood that the President of the Local Government Board was preparing a Bill dealing with the protection of water supplies. Possibly this may be brought forward in the next session of Parliament, when the Government may be less fully occupied with contentious measures than in recent sessions.

Consideration of the proposed standards shows that the amount of suspended solids in a sewage effluent is to be strictly limited in order to prevent deposits of sludge in streams, and the consequent nuisance which is bound to arise when they occur. This is very necessary, and is not difficult of attainment if suitable tanks and other works are provided and properly managed. On the other hand, the organic matters in solution are to be reduced to such an extent that the dissolved oxygen present in the river water will be sufficient to satisfactorily oxidise them without being depleted to such an extent as to cause a nuisance. This is exceedingly practical and very reasonable and just as between the various towns and districts in the same watershed, and should have the eventual result of preventing the pollution of all water courses without involving the local authorities in unnecessary expense, or causing a public nuisance. It is distinctly stated, further, that whatever be the standard adopted, under no circumstances must compliance with that standard be held to justify the use for drinking purposes of streams receiving those effluents without subsequent treatment by the waterworks authority.

With regard to the dissolved oxygen absorbed test, while admitting that it requires a longer time and is somewhat less easy to work than the test for oxygen absorbed in four hours from permanganate, the Commissioners consider that it is to be preferred, because they have found in practice that it reflects more accurately than the permanganate test the observed conditions of the streams, that it represents more naturally the actual process which takes place in the river water, and that laboratory experiments have shown that it is the more delicate test of the two, *i.e.*, it shows smaller differences in quality of water. Among other valuable suggestions made in this report is one requiring the provision of suitable tanks or other works so constructed as to facilitate accurate gauging and drawing of average samples. With regard to tidal waters, it is not suggested that the general standard should apply automatically to these as in the case of non-tidal waters, but where a standard is considered necessary the Commissioners think that the principle recommended in regard to special standards for streams might usefully be applied. It is not proposed that the standards should apply to storm-water sewage, but the recommendations made in the fifth report are repeated, as it is considered that the adoption of these would prevent the occurrence of nuisance.

Although no formal discussion of the eighth report at any meeting of importance had taken place up to the time of writing, several expressions of opinion were voiced incidentally at one meeting towards the end of the year, when two medical officers of health and one consulting chemist referred to the proposed standards as retrograde in character. This is curious, in view of the fact that the Commissioners must have been influenced very largely, if not entirely, by their official chemists in recommending the prescribed standards and tests. When chemists disagree in a matter of this kind engineers must use their own judgment and act accordingly.

STANDARDS FOR SEWAGE EFFLUENTS IN THE UNITED STATES.

Considerable discussion has taken place in America during the past year upon the question of standards, and in several cases the purity of effluents discharged under various conditions has been fixed. In one case an agreement has been made with a Sewerage Commission (Bronx Valley) under which the quality of the sewage effluent is to be 10 per cent. better than that of the raw sewage "upon an absolute putrescibility scale." In the case of New York Harbour the Metropolitan Sewerage Commission has issued a report, giving its opinion as to the degree of cleanness which is necessary and sufficient for the water of the harbour. Among the stipulations set forth in this report we find (a) the discharge of sewage shall not materially contribute to the formation of deposits injurious to navigation, and (b) except in the immediate vicinity of docks, piers, and sewer outfalls the dissolved oxygen in the water shall not fall below 3·0 c.c. per litre of water. With 60 per cent. of sea water and 40 per cent. of land water, and at the extreme summer temperature of 80° Fahr., 3·0 c.c. of oxygen per litre corresponds to 58 per cent. of saturation.

In addition to the above the results were recently published of an inquiry into this subject made by a committee of the United States National Association for Preventing the Pollution of Rivers and Waterways. In this report it is not considered possible to establish a universal standard of purity for sewage effluents, but it is believed to be feasible to establish and maintain appropriate standards of a general nature for waters that fall within certain groupings. This matter will be dealt with in detail in a later report, but meanwhile a statement is made of the general principles which should govern the discharge of sewage and waste matters into rivers and waterways. These general principles were printed in detail in these pages (THE SURVEYOR, November 29th, 1912, page 744), and apply to streams and lakes from which water supplies are taken without purification, those from which water supplies are taken and used after purification, and those which are not used for water supply. In all the instances here cited it will be noticed that the chief factor taken into consideration is the condition of the water into which the sewage effluent is discharged, and the standards thus rest upon the same basis as the standards proposed by our own Royal Commission.

Incidentally we may mention the fact that our contemporary the *Engineering News*, of New York, in its issue of December 19th last, contains the following very appreciative note upon the eighth report of the Royal Commission:—"The new standards for sewage treatment and for sewage disposal without treatment announced a few weeks ago by the Royal Commission on Sewage Disposal are as revolutionary for England as they are rational, scientific, and practicable for that or any other country. . . . The basic principles underlying the standards recommended by the Royal Commission are in complete accord

with the ideas and practice of most of our best American engineers. The standards themselves, however, seem to be far in advance of any yet proposed for general adoption in any country—not in severity, but in point of scientific analysis of the sewage nuisance problem, and in correlation of nuisance prevention with degrees of dilution and degrees of treatment."

RIVERS POLLUTION.

It is only within the last few years that the problem of preventing the pollution of rivers and other waterways by sewage has arisen in other countries, but it has recently become urgent both in America and Germany. The authorities in these countries are, however, fortunate in that they have our bitter experience of failures in the past and the work of our Royal Commission on Sewage Disposal, now nearing its end, to guide them to some extent in arriving at a solution of the problem. We say "to some extent" advisedly, as each country has special conditions which do not exist in others, and this is particularly the case in America, with its large rivers, land-locked harbours, like that at New York, and its great lakes. From time to time, especially during the past year, we have printed extracts from the reports of engineers, associations, and others which have appeared in our American contemporaries, and we have also dealt with them editorially as, although they are making use of our past experience in this country so far as it applies to their conditions, we also can learn from their experience in several directions.

One of the most valuable reports dealing with the discharge of sewage into tidal waters is that which has been issued by the Metropolitan Sewerage Commission of New York upon the state of the water in New York Harbour, and the supplementary reports which have been and are still being issued dealing with the question of the best means of removing the present pollution and preventing its recurrence in the future. From these reports it is evident that the condition of the water in New York Harbour is very serious, and so far as we can gather up to the present the recommendations for its improvement include the construction of large intercepting sewers for the purpose of collecting the sewage and bringing it to central stations in separate districts and there treating it by screening through coarse and fine screens or by sedimentation tanks or Imhoff tanks in order to remove the suspended solids before discharging into the harbour. Judging from other reports, the conditions are very bad in the case of the Great Lakes, where the water is highly polluted for some considerable distance from the shore in many places, and is of greater importance than at New York, because most of the towns discharging sewage into the waters of the Great Lakes derive their water supply for drinking purposes from the same polluted source, and often within a comparatively short distance of the sewer outfall. As may be imagined, this state of affairs is extremely serious, and it would appear that in these cases it will be necessary for a number of large towns not only to purify their sewage, but also to take steps to render their drinking water safe. Both these requirements will undoubtedly involve the construction of works of considerable magnitude and the expenditure of sums of money which, in the aggregate, will be enormous. These remarks apply to some extent to Canada as well, where some sewage disposal works are in course of construction and a number of others are projected.

Legislation for the prevention of rivers pollution in America is a matter for the separate States at present, and it can easily be imagined that complications occur when some States have passed suitable laws for the purpose, while other adjacent States have not done so. In one case a law of this kind in one State was held up and prevented from being put into operation for about two years by appeals on the part of local authorities against its constitutionality.

DISPOSAL BY DILUTION.

From the particulars given elsewhere in this review it will be seen that the purification of sewage by dilution in large bodies of fresh or salt water has been the subject of much investigation during the past year, and the importance of removing the solids in suspension prior to the discharge of the sewage, referred to in the previous review (THE SURVEYOR, January 26th, 1912), is emphasised. The most important report is that dealing with the sewage of New York and the prevention of the pollution of the harbour, and from the most recent reports of the Metropolitan Sewerage Commission it appears that detritus tanks and coarse and fine screens are recommended where the least amount of preliminary treatment is required, while Emscher (Imhoff) tanks are suggested where a greater percentage of the solids is to be removed. The same recommendations appear in that part of the eighth report of the Royal Commission which refers to the discharge of sewage into tidal waters and in the report upon the pollution of the Great Lakes in America. In the latter case the problem is complicated by the fact that in many cases the cities which discharge the sewage into the lakes draw their drinking water from the same source, and as there are no well-defined currents to carry away the polluting liquids in any definite direction, it becomes a difficult matter to arrange the water supply intakes in positions where pollution can be avoided. In one case—that of Albany, on the Hudson River—it is proposed to use Imhoff tanks for the preliminary treatment of the sewage before it is discharged into the river, and this precaution should render the scheme perfectly suitable for the existing local conditions.

A system of treatment by dilution in a river already highly polluted would, of course, be unsatisfactory, even if the amount of dilution is high, and in this connection it is interesting to note that in calculating the number of dilutions which would be required in order that the dissolved oxygen content of the mixture of sewage effluent and water should not fall below a certain figure, the Royal Commission in their eighth report have taken as a basis the rate of absorption of atmospheric oxygen by the water and the rate of de-oxygenation by the admixture of various sewage liquids.

SEWAGE DISPOSAL IN THE UNITED STATES.

Among the special features of engineering practice in connection with sewage disposal in America may be noted the extraordinarily rapid manner in which the Imhoff tank has been taken up and adopted, not only for experimental works, but for permanent works of considerable size. The results obtained by the use of this tank must have been known to engineers in this country as early, if not earlier than to American engineers. As long ago as May, 1909, a detailed description of this process appeared in these pages, yet, so far as we are aware, not a single tank of this type in any considerable size has been put into operation in this country up to the present. In America, on the other hand, it has become naturalised to such an extent as to have received the characteristically American name of "Two-storey" tank to distinguish it from the ordinary "one-storey" septic or sedimentation tanks.

Again, we find that the fixed spray-jet is still adopted in almost every scheme in America for distributing tank effluents over percolating or "trickling" filters. Contact beds are seldom mentioned, except occasionally in giving results obtained from installations constructed some years ago. On the other hand, a number of

schemes have been carried out in which the purification is carried to the highest degree of perfection, involving not only percolating filters and humus settling tanks, but additional final sand filters and, in quite a number of cases, sterilisation or "disinfection" of the final effluent by means of hypochlorite solutions from bleaching powder. In the very large scheme for dealing with the sewage from the city of Baltimore arrangements are made whereby the final effluent can be sterilised if found necessary, and in other cases sewage effluents are regularly treated with hypochlorite solutions in order to ensure a high degree of bacterial purification. Many of these schemes have been referred to in our columns during the past year, and have been described and illustrated in detail in our American contemporaries—notably the *Engineering Record*—to whom we are indebted for most of the interesting particulars we have been able to present to our readers from time to time with regard to American practice.

PERCOLATING FILTERS.

It is unfortunate that the methods generally adopted for estimating the working capacity of filters are still unsatisfactory. In this country it is usual to allow for a certain volume of sewage per cubic yard of filtering material. In America the usual basis is gallons per square yard or per acre of superficial area without regard to the depth. The latter is very misleading, but both methods are unsatisfactory, as they do not take into consideration the variation in the strength of the sewage due to the larger or smaller amount of water used in different places. When it is borne in mind that in some of our industrial districts as little as ten gallons of water is used per head of population per day, while in purely residential areas as much as thirty to forty gallons, and in America 100 gallons, is the regular rate of consumption of drinking water per head per day, it is obvious that any calculations based upon volume are apt to be untrustworthy and to lead to trouble in the future. Where sewerage systems are in existence it is possible to have analyses of the sewage made so as to ascertain its strength and use this as a basis in making the calculations for the filters. Where no sewers exist, however, it would seem to be advisable to calculate the cubic capacity of the filters upon the basis of the number of persons contributing to the sewage.

In connection with the question of uniformity of distribution upon percolating filters, a series of experiments were made, according to a report of the Massachusetts State Board of Health, with a rotary distributor upon a filter which had previously been fed by means of fixed sprays of the dash-plate type. With the latter the rate of distribution varied between 500,000 and 7,500,000 gallons per acre per day upon different parts of the same filter, whereas the rate of distribution provided by the rotary distributor varied between something under 1,000,000 and 3,250,000 gallons per acre per day. The nitrates in the effluent from the rotary distributor were very much higher than when the fixed sprays were in use, and the conclusion drawn from these results was that the higher degree of purification could only be attributed to the improvement in the uniformity of distribution of the sewage. This subject of the relative value of fixed sprays and revolving or travelling distributors was dealt with in great detail, including comparative cost of construction, in an able paper by Mr. Reginald Brown, A.M.INST.C.E., Engineer and Surveyor to the Southall Norwood Urban District Council, at a meeting of the Association of Managers of Sewage Disposal Works in June last (The Surveyor, June 28, 1912). In addition to the information contained in the paper, many interesting and valuable particulars were given in the course of the discussion, chiefly by the President of the Association, Mr. J. D. Watson, M.INST.C.E., of Birmingham.

The question of the grading of the filtering material for percolating filters has also received some attention during the past year. The preliminary experimental work which was carried out in connection with the preparation of a scheme for the disposal of the sewage of the city of Baltimore, U.S.A., included investigations with regard to the most efficient grade and depth of material for the percolating filters. These results agree with the generally adopted practice in this country. It was found that the finer the grade of material used the greater was the degree of purification obtained, but the liability to clog was also greater. On the other hand, although the coarser material did not become clogged, the degree of purification was not high enough. After a number of experiments with material of grades varying between ½ in. to 6 ins., it was decided to adopt stones broken to pass through a 2½-in. circular opening and be retained upon a screen with 1-in. circular openings, as this gave the required degree of purification without undue clogging. The question of depth of material was also dealt with, and it was observed that while the amount of purification increased with every foot of depth up to 9 ft., there was relatively very little increase from 9 ft. up to 12 ft., and ultimately 9 ft. was the depth adopted for the filters at Baltimore.

CONTACT BEDS.

Although contact beds are now seldom adopted for new schemes, it is interesting to note the results obtained from those already in existence, particularly in the cases of such large works as those at Manchester, Sheffield, and Leicester. At Manchester the percentage of purification obtained during the year covered by the last annual report was the highest that has been obtained so far at these works, but as the figures given apply to the average effluent, which includes unfiltered tank effluent, it is not a correct index of the work done by the contact beds, and further improvement is expected as the additional works now under construction come into operation.

At Sheffield excellent results are already being obtained by the complete process of tanks and contact beds, and even better results will doubtless be shown as the beds become matured. An interesting feature of the latest report of the city engineer and surveyor, Mr. C. F. Wike, is the inclusion of the results showing the proportion of samples of the effluents which comply with the dissolved oxygen standard of the Royal Commission. In the latest cases all, or nearly all, have satisfied this test, a clear indication of the good work which is being done. At Plainfield, U.S.A., an installation of septic tanks followed by double contact beds has been in operation for a number of years, and a recent report shows that at present about 85-90 per cent. of the suspended solids and about 80-85 per cent. of the organic matter as determined by the oxygen absorbed test is removed. Experience with these works has shown, as in this country, that the material for the primary filters must not be too fine, and that better underdrainage, to the extent even of a complete false bottom, together with a better fall on the floor, will ensure a longer life for contact beds.

LONDON SEWAGE DISPOSAL.

The question of the disposal of the sewage of London was dealt with in a very interesting manner in a revised edition of a report by Sir Maurice Fitzmaurice, C.M.G., M.INST.C.E., chief engineer of the London County Council, which

was issued in October last, and from which we make the following extract:—

"The conclusions which I came to in a report to the Main Drainage Committee in December, 1909, in my opinion still hold good, viz.:—

"(a) The state of the river is at the present time not such as to necessitate the immediate further purification of London sewage, and I do not think it will necessitate it for some years to come.

"(b) I consider the different installations for the treatment of sewage on the bacterial system which have been laid down, and are being laid down, by many of the largest towns and cities which have only comparatively small rivers to take away their effluent will ultimately afford the Council sufficient information as regards the best way of dealing with London sewage, and thus the Council will be enabled to embody in any scheme which might be adopted the latest satisfactory results which have been obtained in other places. Such information will also enable an estimate to be made of the cost of such works, which cannot be calculated with accuracy by means of experiments even on a fairly large scale.

"(c) When the time does come to commence bacterial treatment, all work done should be a portion of a large scheme which has been carefully thought out, as otherwise there would be an expenditure of considerable sums of money on works which might not be used in the future.

"(d) An investigation as regards the best material for bacteria beds in London ought to be undertaken."

In connection with the question of sludge disposal, the following paragraph in the same report is worthy of note:—

"At the present time, owing to the diminution in the number of horses in large towns, it is becoming increasingly difficult to get manure for market gardens; and if this difficulty becomes accentuated the time may arrive when it will be worth while to consider the manufacture of fertilising material from the London sewage."

PROFIT FROM SEWAGE.

From the previously mentioned report it appears that the ratepayers of London on one occasion received the sum of £25,000, forfeited security, which had been deposited by a company formed in 1865 to take the sewage at the Barking Outfall and apply it to the fertilisation of land to be reclaimed from the estuary of the Thames. The prospects of the undertaking were not sufficiently promising to induce investors to subscribe the necessary funds, so that the works were not carried very far, and were ultimately abandoned. Various proposals for utilising the sewage of London have been made in the past, and are even now still being put forward, but none of them have ever come to anything. One inventor proposed to supply the United Kingdom with alcohol from the London sewage, and a number of samples of sewage have been taken by enthusiasts on the subject without any practical result. It is true that in a few cases, such as Bradford and Oldham, grease is extracted from the sludge, but this is doubtless due to the exceptional character of the sewage, and would not be economically possible from ordinary sewage. Sludge undoubtedly contains various substances which can be extracted and utilised, but the general opinion appears to be that the cost of extraction will, in the majority of cases, be greater than the value of the material extracted. Fertilisers are being manufactured from sewage sludge in a few places, but so far as we are aware in no case does the income derived from the sale of the product approach the cost of production together with the expenditure upon the tank treatment, and the only thing in favour of this process is that it does effectually get rid of the sludge.

In one case some value is derived from the disposal of the sewage. At Baltimore, U.S.A., where a very complete scheme of sewage treatment is in course of completion, there is a fall of 18 ft from the effluent outlet to the discharge point in the river, and the effluent will be utilised by means of turbines to generate enough electric current to light all the buildings on the works, operate the sludge pumps and screens, and raise purified sewage into an elevated tank for use in cleaning the tanks and flushing out the under drains of the filters.

TRADE WASTES.

The discharge of crude manufacturing wastes into sewers in ever-increasing volume is rendering the maintenance of sewage works in many places more and more difficult and costly, and several councils are taking steps to petition the President of the Local Government Board to introduce a Bill in the next session of Parliament to amend the existing law on the lines recommended by the Royal Commission on Sewage Disposal so as to secure suitable preliminary treatment of all such wastes prior to their discharge into the sewers or the payment to the local authority of a reasonable charge by the manufacturer.

LITERATURE.

Although there have been several additions to the literature of sewerage and sewage disposal during the past year, there is only one book that deserves special mention, and that is "Sewage Disposal," by George W. Fuller, M.AM.SOC.C.E., the well-known American engineer. We reviewed this book at some length in these columns on June 21, 1912, and we need do no more on the present occasion than repeat that this volume surpasses all previous works on the subject in its comprehensiveness and value to the engineer, and we can strongly recommend it to all who may be interested in the subject. It can be obtained from the Book Department of the St. Bride's Press, Limited.

A number of interesting and valuable papers were read at various meetings of societies and institutions. Some of them have already been referred to in these notes. Others of special interest are:—

"Operating Results at the Columbus (U.S.A.) Sewage Works" (*Engineering Record*, January 6th, 1912).

"Sludge Disposal," by W. Naylor, ASSOC.M.INST.C.E. (THE SURVEYOR, June 7th, 1912).

"Smells from Sewage Works," by H. D. Bell, manager of the Stratford-on-Avon Sewage Works (THE SURVEYOR, July 12th, 1912).

"Methods for Differentiating Soils for Sewage Purification," by G. J. Fowler, D.SC., F.I.C., and W. Clifford, ASSOC.M.INST.C.E. (THE SURVEYOR, July 19th, 1912).

"The Ventilation of Sewers," by T. de Courcy Meade, M.INST.C.E., city surveyor of Manchester (THE SURVEYOR, September 27th, 1912).

"Sewage Disposal by Oxidation Methods," two papers on the same subject, by J. D. Watson, M.INST.C.E., and by G. J. Fowler, D.SC., F.I.C., respectively (THE SURVEYOR, October 4th and October 11th, 1912).

"Sewage Pollution of New York Harbour," by G. A. Soper, President of the Metropolitan Sewerage Commission of New York (THE SURVEYOR, October 25th, 1912).

"Chemistry of Sewage Purification," by Dr. Arthur Lederer, chemist and bacteriologist to the Sanitary District of Chicago (*The Canadian Engineer*, October 31st, 1912).

APPLIANCES.

The general business done during the past year by the Ames Crosta Sanitary Engineering Co., Limited, of Nottingham, compares favourably

with previous years. The Ames Patent "Gripmac" Manhole Cover has been in great demand, and the sales are increasing, one order just completed being for 600 covers and frames. The special features of this cover are now being recognised by surveyors, and the repeat orders show the appreciation of its merits. The Ames Patent "Adaptable" Rotary Horse Broom is now well known, not only in this country but abroad, orders having been executed for brooms complete in the following countries: New Zealand, the Argentine, East Indies, South Africa. The business during the past twelve months in these brooms in this country has also shown a large increase, many repeat orders having been received. Crosta's Patent Surface Water Gully still holds a high position in the market. At the present time large orders are being executed in some of the principal towns in the United Kingdom, and recent large orders have been obtained for extensive work now being carried out under the Port of London Authority at the docks in the East end of London.

In sewage disposal work this company has obtained a very strong position. Their various specialities are now recognised as being the best of their respective types. Among the new specialities we notice Ames' Patent Auto-Dose Valve, Ames' Patent Auto-Control Valve, and Ames' Patent Auto-See-Saw Series of Valves. Other new features we may mention are the two new patent types of washers for cleansing filtering material, one known as the "Ogden" Patent Washer for dealing with very large quantities of material, the other the "Arnold" Patent Washer, which can be made in sizes to suit varying requirements, and can also be made portable. There is an increasing demand for these washers, especially at works where contact beds are being converted to percolating filters. Many important installations have been carried out during the past year, and among recent orders secured in competition is one from Leeds for heavy grit doors and other ironwork in connection with the new sewerage works now being carried out. On the whole, the past year has been satisfactory, and the prospects for the coming year appear to be promising.

Dibdin's slate beds have been, or are being, installed during the past twelve months at Halstead (completion), Sidford, Sidbury, Borstal Institution, Feltham, and Rampton Criminal Asylum, for the Home Office, Faversham, Harpenden, Herne and Reculver, H.B.M. Legation, Pekin, for H.M. Office of Works, Bitterne Manor near Southampton, Holt Sanatorium near Cromer, and a large number of private houses. Plans are before the Local Government Board for complete installations at High Wycombe, Crediton, Rough Close, and a county council asylum, and slate beds have been adopted by a considerable number of municipalities for schemes in the near future.

Ham. Baker & Co., Limited, of Westminster, and Municipal Engineering Works, Langley Green, near Birmingham, report a successful year. They have been kept extremely busy in all departments, necessitating working overtime. Considerable additions have been made to their works and to the plant, giving greatly increased facilities for dealing with large orders for all classes of material, including specialities and fittings for both sewerage and water supply. They have in hand at the present time large and important contracts for distributors of the four types of which they are well-known makers, viz.:—Patent travelling distributors for rectangular sewage filter beds, both automatic and power-driven; automatic revolving distributors of the Ham Baker-Candy-Whittaker type, and patent fixed sprays. In addition to orders and contracts for the home trade, they have been kept extremely busy on large works abroad, notably in Canada, India, Russia, Egypt, New Zealand, United States of America, and South America. During the past year we understand this firm have turned out some large sluice gates, for which they have special facilities, also screening and elevating plant of large capacity for sewage disposal works.

Messrs. Hartley, Causton & Richmond, Limited, of Stoke-on-Trent, have during this year completed an installation of patent power-driven and wind-balanced rectangular sewage distributors for the town of Ilkeston, as described in our issue of October 4th, and a set of power-driven screens and sludge elevators at Longton. At Walsall this firm has supplied twelve of Hartley's patent circular power-driven sewage distributors on beds 109 ft. diameter, and they are now engaged upon a further order for eight similar distributors for the same town, as well as five similar distributors for the town of Willenhall. They also have in hand the alteration of contact beds, including a new type of distribution by variable sprays with a special dosing chamber. This conversion of contact beds into intermittently dosed filters will be of great interest in view of the many similar works that might be brought up to date in the same manner at a moderate cost.

Messrs. Jones & Attwood, Limited, Stourbridge, whose name is chiefly associated in municipal engineering with the "Fiddian" type of sewage-wheel distributor, and fixed sprinklers of the "spray jet" type so largely adopted for Birmingham, have now added a "power-driven" type to their specialities, and have installed one at Minworth on the well-known filter bed "C" 120 ft. diameter. It is driven by electricity, and is designed on the "mono-rail" principle now generally adopted by this firm for all their travelling and rotary distributors, including sixteen of the water-wheel type now being erected at Southend-on-Sea on four acres of new filters. The latter type has also been largely adopted during the year for use in the conversion of bacterial "contact" beds into percolation filters, including six large distributors covering nearly two acres at Barrhead, N.B., and two at Leeds, each of the latter being capable of sprinkling 600,000 gallons per day. They are controlled automatically or by hand to meet any variation of flow. Other large installations completed or in hand during the year include Evesham, where six more travelling distributors are being installed, three at Maltby, two at Kiveton Park, two at Blaydon, two at Annbank, N.B., also the following rotary distributors:—Two at Milnathort, N.B., two at Dereham, two at Raunds, two for Barnt Green, three near Belfast, and others at Eaglesham, Grimethorpe, Thornton Hough, and in connection with thirty smaller schemes. The Yeovil Sewage Works have also been remodelled by Mr. Charles Hawksley, M.PRES.INST.C.E., and the "sewage-wheel" adopted. At Clacton Cemetery drainage is treated in the same way. The extension of the Cheltenham Sewage Works is now in hand, and eight more distributors for filters 101 ft. diameter; also a further 6¼ acres of fixed sprinklers for the Birmingham Tame and Rea Drainage Board. During the year some 6,000 fixed sprinklers have been sold, mostly of the new "Crown" type. The foreign business in sewage-wheel sprinklers is also well maintained, and includes many orders from Russia, South Africa, New Zealand, Australia, Canada, China, and Siberia. In addition to the above the firm has done a good business in general sewerage ironwork and sewage lifts.

Messrs. Manlove, Alliott & Co., Limited, of Nottingham, have during the year 1912 been responsible for a considerable amount of work in connection with sewage disposal. With regard to the sewage raising plant for the town of Napier, New Zealand, which was referred to in our last

year's Special Issue, we understand that all the machinery, &c., has now arrived at its destination, and is in course of erection. This scheme comprises the installation of ten of Manlove, Alliott & Co.'s well-known automatic pneumatic ejectors, with capacities varying from 200 to 800 gallons per minute. These ejectors are arranged in pairs at five stations. We understand that when these ejectors are arranged in pairs the whole process is automatic and continuous. The inflow of the sewage operates the valve mechanism which admits the compressed air, and results in the discharge of the contents of one ejector; meanwhile the other ejector is receiving its charge of sewage preparatory to the automatic repetition of the same process. A special feature to which Messrs. Manlove, Alliott & Co. have given considerable attention is the method of securing the covers on the inlet and outlet flap valves of the ejectors. The method employed enables the valves to be examined quickly and without undoing any bolts, requiring spanners or loose tools. As the examination of the valves has to be carried out in an underground pit, the advantages gained by this facility are obvious.

The compressed air for working the ejectors for the Napier plant will be supplied by four sets of double cylinder motor-driven air compressors, which are also supplied by Manlove, Alliott & Co., Ltd. The plant also includes two sets of plunger pumps, each set consisting of three throw single-acting pumps. The whole of the air piping for this contract, of which there is about 17,000 ft., has been supplied by the contractors.

At Bedford Messrs. Manlove, Alliott & Co., Ltd., have this year completed an ejector plant, consisting generally of a pair of ejectors, each having a capacity of 50 gallons per minute, motor-driven air compressor, ejector chamber, cast-iron tubbing, rising main, and air pipes. This firm is also engaged upon a contract for sewage pumping machinery for the corporation of Bath. The contract includes sludge pumps, water pumps, centrifugal pumps, lime mixers, and gas and oil engines.

The Meadow Foundry Company, Limited, of Mansfield, report that they have supplied a considerable quantity of sewage and sanitary work. One of the largest contracts which they recently had to do with was the new sewage works for the Mansfield Corporation, where they supplied and fixed practically the whole of the sewage ironwork, consisting of penstocks of various sizes and shapes, sludge valves, and floating arms, also two large combined sewage screens and rakes, with self-cleansing arrangements. These screens are arranged to work by hand, but an arrangement was also fitted so that they can be driven electrically when required.

Messrs. Whitehead & Poole, Limited, of Manchester, report that they have had an exceptionally good year, and the sale of their mechanical appliances for sewage purification works has been very gratifying.

Mr. F. Wallis Stoddart, of Bristol, advises us that the preponderance of orders during 1912 for his distributing apparatus was in connection with mansions, institutions, and villages. The orders for larger works are mainly from the colonies, where the absence of skilled labour makes a simple and effective distributor a necessity. A significant and interesting fact is the number of requests received for designs showing the application of the fixed Stoddart Distributor to circular beds where revolving distributors have proved unsatisfactory. The orders and business in hand in connection with schemes for the War Office, water companies, villages, and towns, both at home and in the colonies, give promise of another successful year's working.

Messrs. Tuke & Bell, Limited, of 69 Leadenhall Street, London, E.C., inform us that they have had a very good year. They have taken larger works at Tottenham, in North London, and have installed electrically driven plant and tools for dealing with their increasing trade in all kinds of sewerage and general engineering work, including machine, forge, and sheet metal work. The company's business has more than doubled during the past year. The firm has been reconstructed and registered as a public company with an authorised capital of £21,000. The business has developed very rapidly during the last two or three years, and the long experience of the various members of the firm enables the company to keep fully abreast of all developments in the patenting of new and the improving of existing apparatus for the sewerage and sewage disposal work and sewage lifting and ejecting plant in which they specialise.

Their "Carlton" distributors, varying from 40 ft. to 100 ft. in diameter, have been erected in many places in this country. The company's "Ideal" revolving distributor, introduced some eighteen months ago, has proved a great success, and a large number of these machines in use are giving satisfaction, and the type has been adopted for work abroad, where it is particularly suitable owing to the simplicity of its action, which is mechanical, and does not require attention from a skilled man. During the year the company patented and introduced an improved sewage lift, in which the efficiency is very considerably increased and the maintenance charges reduced. It has been installed at home, including Regent's Park, London, and abroad. Improvement in sewage ejectors has been a feature of the company's work, and they have installed ejectors for the Folkestone and Orsett Councils. The company's well-known patent "Grip" manhole cover has been so effective in actual use that the demand for it has increased tenfold during the year. The following are a few of the places where apparatus manufactured by this firm has been supplied and fixed:—Harpenden, Alfreton, Henstridge, Ashby-de-la-Zouch, Dublin (Asylum), India, Marlow, Shepton Mallet, Frant, Goudhurst, Newbury, Winsford, Hunstanton, Leatherhead, Knebworth, Kirkham, Aberford, Sandling, Broomfield, Yatton, Bishopsbourne, Orpington, Caerwent, Crawley (Hants), Ashtead, Dunsfold, Didcot, Bedwin, Tenby, Melton Mowbray, Llanelly, Colwall, Bletchworth, Bath, Penzance, Wallingford, Brookwood, Purton, Ewhurst, Storrington, Frome, Capel (Essex), Woodhay.

STREET LIGHTING.

It happens that 1912 was the centenary year of the first public supply of gas in this country, and it is interesting to observe that, far from becoming antiquated, the industry appears to have been rejuvenated, for there was probably no period in its history in which it made more rapid progress than during the past few years. We are here concerned only with its employment for the lighting of the streets; but it is perhaps in this department that the most remarkable advances have been made, and although Mr. Jacques Abady, a specialist in such matters, suggests that the limit of efficiency has been nearly reached, there seems to be no sign of cessation in the stream of inventions and improvements. During the past decade, spurred on no doubt by the growing competition of electricity, gas engineers have given more attention to the scientific aspects of their work, with the result that the

illumination of the streets is measured and analysed and subjected to the keenest scrutiny in all respects; the importance of the subject has also gained due recognition, and a far higher standard of illumination is demanded by the public.

MODERN GAS LAMPS.

To meet the new conditions a great variety of lanterns and burners and of methods of feeding them has been developed. The flat-flame burner is looked upon as utterly antiquated, and nothing short of an upright incandescent mantle is tolerated in any up-to-date community. But this in turn is being beaten out of the field by the inverted type of burner, which is peculiarly well adapted for street lighting, and is almost invariably used in all new work, while in numerous instances it has been substituted for the upright type. The candle-power of single burners is continually being raised, and 250-c.p. has already been attained, so that with four burners a low-pressure unit of 1,000-c.p. is available. A minimum of 90-c.p. per lamp is now a commonplace standard for side streets. Great improvements have also been made in the lanterns, and the value of efficient reflectors is gaining appreciation, though in this respect there is considerable scope for further progress.

But it is in connection with high-pressure lamps that the greatest advances have been made. In spite of the fact that their use necessitates the laying of special mains, or the installation of a compressor in the neighbourhood of the lamps supplied, there are more than 10,000 high-pressure lamps in operation in London alone, and all the large towns are adopting them to a greater or less extent. From a single high-pressure burner a light of 1,000-c.p. can be obtained, and thus four-burner lamps of 4,000-c.p. have been made possible, and are employed when necessary, though units of 400-c.p. to 1,800-c.p. are more usually installed. Thanks largely to the initiative of the City of London, the central suspension of high-power gas lamps has been developed, and it is now possible to obtain apparatus which enables the lamp to be lowered to the sidewalk for cleaning and inspection, and afterwards to be hauled up into position without the use of a ladder. Moreover, the lamps are lighted in position, and all or a portion of the burners are extinguished by manipulation of the supporting rope. This is accomplished without a flexible tube, the gas supply being automatically shut off when the lamp is lowered. A similar arrangement for lowering lamps supported on standards or brackets—an easier problem—is also available. In order to overcome the difficulty of obtaining high-pressure gas, a remarkably ingenious lamp has been devised, in which the pressure of the vapour from heated mercury is utilised to compress gas and air, thus enabling a single high-pressure lamp to be burnt on a low-pressure system.

CONTROLLING SYSTEMS.

In the majority of cases the lamplighter still goes his rounds, but he is better equipped for his work than formerly, being provided with a torch charged with calcium carbide to supply acetylene gas to a burner giving a flame which cannot be blown out. But in many towns automatic controllers have been installed, or the pressure-wave system of lighting the lamps has been adopted, and the use of such methods is extending, though occasionally unsatisfactory results are reported. In Newcastle-on-Tyne 7,300 automatic controllers are in use. But gas engineers as a whole still seem somewhat chary of adopting any such system of control, apparently preferring to await further developments. One reason for delay is that in many cases the street lighting is not in the hands of the department controlling the gasworks, so that the gas engineer is not in a position to deal with the matter at both ends. It must be admitted also that there are certain drawbacks to the use of control systems; by-passes are required, and these consume a very appreciable quantity of gas—at least ¼ cubic ft. per hour—which more than neutralises the saving of gas due to simultaneous lighting and extinguishing; insects interfere with the operation of clockwork controllers, and the pressure wave is liable to cause trouble with private consumers. Some engineers also fear the result of any slight derangement in the pressure-wave system, which might cause a general failure of the street lighting for a time.

But, judging by t' e progress so far made, and the highly satisfactory results reported by many managers, the system has come to stay, and these minor troubles will eventually be overcome. A special advantage of distance control is that part of the lamps or burners can be extinguished at midnight, and the rest at dawn. The mantles also last longer, and usually there is a material saving in labour.

RECENT DEVELOPMENTS.

During the year the lighting of the City of London, which was divided between the gas and electric companies, has been reorganised, though the work is not quite finished. Instead of standards, central suspension and brackets are being used as far as possible, and a large number of high-pressure lamps have been installed. Glasgow has carried out experiments on similar lines with forty-one lamps of 3,000 and 4,500 c.p., working at the high pressure of 80 in. of water. Instead of hanging the lamps in the centre, trials have been made with them staggered, and the effect is said to show an improvement over the rigid central arrangement. Birmingham, Leicester, Belfast, and Bradford are making trials of the high-pressure system. The Holborn lighting contract, which also was shared between the gas and electric companies, has been completed, both high and low pressure gas lamps being used of candle-powers ranging from 90 to 1,800.

ELECTRIC LIGHTING.

Few changes worthy of note in the means and methods of electric street lighting can be credited to the past year, but improvements in detail have been made. For the lighting of the borough of Holborn, mentioned above, new types of lantern have been installed, with very satisfactory results, employing metallic-filament lamps of 90 to 600 c.p. each, the latter being mounted in groups of three, giving 1,800 c.p. At Barrow a road has been equipped with fittings suspended over the roadway by span-wires stretched between the tramway standards, and carrying metallic-filament lamps. The cost of installation is exceptionally low and the effect quite satisfactory. The life of the lamp appears to be unaffected by the vibration due to the passing cars. In many towns metallic-filament lamps have replaced the old open arc lamps, and flame arc lamps have also been used freely in important streets.

The use of electricity in general for street lighting is rapidly extending, not only in the larger towns but also in small towns and villages, its adoption in the latter being greatly facilitated by the growing use of overhead wires for the purpose, by which means a very considerable economy is effected. Some towns which own electricity supply undertakings have converted the whole of their street lamps from gas to electricity. In America many of the larger cities have adopted electric lighting on a lavish scale for their principal thoroughfares, which now are known as "white ways," owing to the flood of light from very numerous standards carrying groups of lamps. The latter are designed rather for artistic effect than for efficiency of illumination. So far there is no indication of the fashion being followed in this country, but in parts of the larger towns it is not uncommon to find an important shopping street brilliantly illuminated with high power gas lamps or flame arcs by private initiative, and this may perhaps represent the beginning of a similar movement.

COMPARATIVE TESTS.

One of the most interesting incidents of the year was an important experiment carried out by the Corporation of Manchester, which has at last yielded to the representations of the Electricity Committee and placed the street lighting in the hands of a special committee instead of the gas department. Two streets were equipped respectively with flame arc and high-pressure gas lamps, and two experts—Mr. H. T. Harrison and Mr. J. Abady—were appointed to report on the results obtained. Their joint report was to the effect that the illumination in both streets was approximately equal, but the cost of the arc lighting was less than that of the gas lighting. The experts agreed, however, that the results were vitiated by the unfortunate fact that the gas lamps were working at an efficiency very much below what should have been obtained. In his separate report Mr. Harrison stated that if the gas lamps had given double the efficiency, the electric lighting (for equal illumination) would still have been the cheaper. Mr. Abady, on the other hand, questioned the validity of the charges made for electrical energy, criticised the installation and adjustment of the gas lamps, which, he said, should have given over 50 instead of 27 c.p. per cubic ft., and drew attention to the superior quality of the illumination given by the gas-mantles for street lighting. So far as the comparison is concerned, the position seems to have been stalemate; and it will be interesting to watch future developments.

What is urgently needed is clearly a standard specification for street lighting. The Joint Committee which is investigating this question is still engaged in the preparation of a report, but has already decided to reject candle-power measurements in favour of measurements of the minimum illumination on a horizontal plane 39 in. from the ground as a fundamental basis. Probably the report will soon be issued, and will, it is hoped, provide a satisfactory criterion of the very vexed question of adequate illumination of the streets

TRAMWAYS.

The feature of the tramway world last year was surely the remarkable chorus of self-congratulation upon the results of the working of the year 1911-12. While there were certainly exceptions, in the majority of cases the reports were that the revenue had established a new record, and that the working expenses had increased very little, so that the financial result was thoroughly satisfactory. It would serve no useful purpose to give a list of undertakings in this fortunate position, but we may mention that the London County Council tramways, on which over 12 millions sterling has been spent, had a total income of well over 2¼ millions, and a surplus of £934,212, most of which was swallowed up by capital charges; 533 million passengers were carried—truly a colossal number. At Glasgow the income was almost a million, and 275 million passengers were carried—over 120 millions for ½d. each. Leeds had an income of nearly £400,000, an increase of £25,000, while the working expenses only went up £2,200. Manchester received £850,000, and allocated £85,000 to aid the rates, while the working expenses actually decreased; Birmingham, Newcastle, Bradford, Oldham, Belfast, and other towns also had an exceptionally good year, and some tramways which had never paid before were enabled to show a surplus.

Various causes contributed to this happy result—the remarkably fine summer of 1911, the coal strike of 1912 (which led to restricted suburban train services, and thus diverted large numbers of passengers to the tramcars), and the brisk trade revival, were among the principal factors. It is to be hoped that the wave of prosperity will prove lasting, and that advantage will be taken of the opportunity to raise reserve and renewal funds to a satisfactory level—a precaution which is not observed by all municipalities conducting tramway undertakings. Bournemouth, for instance, in March last had only £7,000 standing to the credit of the reserve fund, whereas, on the basis of experience gained elsewhere, the fund should have amounted to over £45,000. A better example is shown by Ipswich, where there was only a small net surplus, but the Corporation are putting by £3,422 annually out of the rates to form a renewals fund. This is a sound practice.

MOTOR-OMNIBUS COMPETITION.

The keen competition which tramways are meeting with from motor-omnibuses has attracted close attention during the year; the stress is felt more especially by the London County Council, and that body has investigated the question very fully. There is no doubt that the working costs of the omnibus have been materially reduced in recent years, and even the Board of Trade appears to hold the view that it can be run more cheaply than the tramcar; but many of the comparisons which have been made assume that an omnibus is equivalent to a car in carrying capacity. The Highways Committee of the London County Council, reporting on the subject, pointed out that in fine weather more than twice as many 'buses would be required to do the work of the tramcars, and in wet weather the number would be more than quadrupled, as the 'buses are not provided with top covers. Moreover, the omnibus companies are not called upon to carry passengers at workmen's fares—that is, at a loss.

The relative contributions of the two classes of vehicles to the upkeep of the roads have also been brought under consideration. The tramways pay rates on the track, while the 'buses pay the petrol-tax (amounting to about half as much per car mile), but the proceeds from the latter, strangely enough, are not applied to the maintenance of the roads used by the 'buses! There is no doubt that the working costs of the omnibuses are little in excess of those of the tramcars per car-mile; but when seating capacity is taken into account, the 'bus is out of the running, and it is impossible to believe that the omnibus can supersede the car in places where the traffic is sufficiently dense to justify the laying of a tramway. But as a feeder or auxiliary to the tramway there is a wide field for the omnibus, and several authorities have made use of it for this purpose with satisfactory results.

In order to mitigate the severity of the competition of the motor-'buses in London, proposals have been put forward with a view to handicapping them to some extent by legislation; but if they are patronised by the public in preference to the tramcars, it is difficult to see how reactionary measures of this kind could prove more than temporarily successful, and impossible to justify them on economic grounds. It is interesting to observe, in this connection, that the petrol-electric omnibus is making great progress; a large number have been put to work in London, and several provincial authorities have adopted them as feeders to their tramways, or in order to provide connections between points where it is not considered desirable to lay down tramways.

THE TROLLEY OMNIBUS.

This naturally brings us to the system of railless traction, which has recently become popular, and which is more directly in competition with the motor-omnibus in the provinces than is the tramway. Some of the undertakings on this system have now been at work long enough to furnish useful working results, and these appear to be very gratifying. At Leeds, for instance, the manager, Mr. J. B. Hamilton, reports that the cost of energy per car-mile is only half that of a tramcar, and the cost of renewing the tyres is not over 1d. per mile. The working costs vary according to local conditions,

being about 6½d. at Leeds and 7½d. at Bradford per 'bus-mile—practically identical with the working costs of the motor-omnibus.

The Board of Trade holds the view that trolley-'buses cause no more wear of the roads than do motor-'buses, and there appears to be no evidence to the contrary. The success of the system is best proved by the fact that both Leeds and Bradford have decided to carry out considerable extensions, and, in addition to the sections which are now working at Dundee and Rotherham, numerous others are in progress or are about to be commenced. Among the latter is the Brighton and Hove system, which presents some curious features. Brighton wanted to provide a railless service to Hove, while the latter preferred motor-omnibuses, but rather than permit the Brighton Corporation to obtain authority to carry out their scheme the Hove Council promoted a Bill for a railless system on their own account. The Parliamentary Committees were much puzzled by the position in view of the hostility of the people of Hove to the railless system, but eventually granted each authority the powers sought for within their own boundaries, leaving them to come to an agreement for the working of the joint undertaking.

Including eight proposals for railless traction sanctioned by Parliament before 1911, about a dozen have been approved in all, and eleven municipal Bills will come before Parliament next session, in addition to a few private Bills.

THE LIGHT RAILWAYS ACT.

In April last year a Bill was brought forward by the Board of Trade to amend the procedure for obtaining powers to carry out schemes for the construction of light railways, and to reduce the difficulty and cost incurred under the existing procedure. The Bill also would have facilitated the construction of railless trolley systems, and was welcomed by the Municipal Tramways Association. Unfortunately it was bitterly opposed in Standing Committee of the House of Commons, on the grounds that it placed too much power in the hands of the Board of Trade, and that the interests of the local authorities were not sufficiently protected. A clause was inserted, in spite of the opposition of the Board, requiring promoters of railless schemes to contribute to the cost of maintaining the roadways used by the trolley 'buses. This clause would have had very serious consequences, and when the Bill as amended came before the House of Commons, on the motion of the representative of the Board, railless systems were withdrawn from the scope of the Bill. The measure passed through the remaining stages without further alteration, but will not be of much service towards removing the obstacles which hamper the development of light railways.

THE RATING OF TRAMWAYS.

One of the most important events of the year has been the decision, on appeal, of the question whether a tramway is entitled to be rated on the same basis as a railway—*i.e.*, in the proportion of one-fourth part only of the net annual value. The matter was raised by the Metropolitan Electric Tramways, Ltd., who appealed against a ruling of the Divisional Court to the effect that though a portion of their undertaking, which was laid down under the Light Railways Act, was therefore classed as a railway and was entitled to the abatement, another portion, which was laid down as a "tramway," but was identical in construction with the other portion, was not so privileged. This decision followed a judgment delivered in 1892, but more recent decisions in the House of Lords had changed the situation, and the Court of Appeal decided that there was no physical difference between a light railway and a tramway, and therefore the latter must be rated as a railway. The action related to a tramway in the Urban District of Tottenham, and the judgment is consequently known as the Tottenham decision. It has, of course, an important bearing upon the finances of tramways, whether owned by municipalities or in private hands, and the Tottenham Urban District Council appealed to other local authorities for assistance in carrying the case to the House of Lords. It is very questionable, however, whether anything will come of this, as the decision of the Court of Appeal was based upon previous decisions of that court and of the House of Lords in connection with light railways which, the Court pointed out, were unquestionably tramways.

RECENT INNOVATIONS.

While no important changes have been effected during the year in tramway working or construction, a number of minor improvements have been introduced. The P.A.Y.E. (*i.e.* pay-as-you-enter) system has been experimentally adopted on one route at Aberdeen. This system has attained to a considerable degree of popularity in the United States and Canada; but in this country, where the fares usually vary according to the length of journey, there are difficulties in the way. It can, however, be employed on tramways of short length of route, and has undoubted advantages. Leicester Corporation has also ordered ten cars of the P.A.Y.E. pattern. The uniform fare system—one penny all the way—has been adopted at Dundee, and was to have been tried at Belfast, but was eventually negatived. This also is only applicable to a system of very limited extent, as it would be impossible to charge more than 1d. in this country.

A portion of track has been laid down at Bradford on a new system of foundation devised by the city engineer, for which greatly increased strength is claimed at a small increase in cost. Several authorities are trying wind screens for the protection of their drivers with satisfactory results, and at Walsall a number of cars fitted with vestibules have been purchased. Certainly there appears to be no valid reason why the driver should be compelled to endure all weathers when there is nothing whatever to gain by it. Two new types of car were designed by Mr. Mallins, Liverpool Corporation tramways manager—one a bogie car with a platform at the centre, and double staircases inside the car, enabling passengers to board the car while others are leaving, and thus saving time; the other a single-truck car, which has double staircases at each end. "Toast-rack" cars have been used with great success at Blackpool, and the number is being increased to eighteen.

In order to cope with the enormous traffic at certain periods, the London County Council have obtained powers to attach trailer-cars to their ordinary cars at such times, and the example is about to be followed elsewhere, although the trailers are not yet in use in London. The London County Council are also experimenting with petrol-electric tramcars in order to ascertain whether it would be advisable to utilise this system in districts where the local authorities will not agree to the adoption of the overhead trolley system, and the Council will not go to the expense of a conduit tramway.

TRAMWAY EXTENSIONS.

No new tramways were inaugurated during the year, but numerous extensions to existing systems were carried out. Belfast put in hand new routes, and accepted the arbitrator's second award for the purchase of the Cavehill and Whitewell Tramways, which has been the subject of keen controversy for some years. Birmingham took over the whole of the tramways in the Greater Birmingham area, at a cost of £151,000. The London County Council are purchasing the part of the London United Tramways which is within the county, the award of the referee being £248,653, more than half of which relates to the power station and depôt at Chiswick. The Council also contemplate applying for powers to construct 10 miles of tramway and 5 miles of railless trolley at a cost of a quarter of a million in the next session. The Coventry tramways were purchased by the Corporation for a

sum fixed by arbitration at £202,132, and the Corporation are also seeking powers to run motor-'buses.

FARES AND WAGES.

As usual, experiments with fares have been in progress at various places. Glasgow, in particular, has taken the bold step of doubling the length of the halfpenny stages, with the result that the number of passengers showed an enormous increase (one million a week), the total for the six months ending on November 30th being 150 millions. While the halfpenny passengers represented over 60 per cent of this total, the receipts derived from them were less than 40 per cent of the whole. The stages are now over a mile in length. The London County Council inaugurated a system of return tickets, and a few towns fixed the maximum fare at a penny. Various changes in wages systems were also put in force; Belfast adopted a profit-sharing system, and Bournemouth a co-operative bonus scheme, the benefits of which in each case were not limited to drivers and conductors, but extended to all classes of employés. The bonus question is intimately connected with the use of meters on the cars, which is now regarded as essential to economy by many managers, savings of 10 to 20 per cent and even more in the energy consumed being recorded. In addition to the economy of power, the meters greatly assist in the maintenance of the cars, indicating at once the occurrence of any defect which interferes with economical running, and reducing the time the cars have to spend in the shops.

GENERAL DATA.

The annual return of the Board of Trade, recently issued, shows that the tramways of the country now aggregate 2,637 route miles, of which 1,777 are owned by local authorities, representing a total capital expenditure of 52½ millions sterling on 172 undertakings. In 1911-12 the whole population was carried sixty-nine times, so to speak, and the percentage of working expenses to receipts was 60·6. The net receipts of local authorities owning tramways were 4¼ millions, and nearly half a million was paid in relief of the rates. The capital expenditure altogether amounted to £13,623 per mile of single track, for lines and works; but including all items, the total was £18,005.

WATER SUPPLY.

To review the water supply work of the past year is to treat of a comprehensive and difficult subject. In order to be complete such a review should include reference to those sciences which enable the engineer to procure a supply of adequate quantity, and such matters as rainfall, evaporation, percolation, physical geography and geology would come under this heading. Next, the methods by which the water obtained is rendered of suitable quality would be considered, including the work of the chemist, bacteriologist, and engineer. Later would follow a review of the progress in mechanical and constructional engineering affecting the raising, storage, and distribution of water supplies, together with due reference to works of importance designed or constructed in all parts of the world. But before dealing with such matters there are, as every waterworks engineer knows, questions of policy, law and finance which govern every scheme and which will in the future require more and more study.

Probably the methods of purification deserve the most attention, as it is in these that the greatest and most useful advances have been made during recent years; but, important as these are, it is open to question whether the improved methods of distribution and the practical scientific investigations as to the quality and nature of the best conduits for water do not show an advance of equal importance, while the improved methods of construction, which are making it possible for the engineer to construct his works with rapidity, accuracy, and thoroughness formerly impossible, are in themselves worthy of a long and careful review. The consideration of storage and service reservoirs, concerning which much knowledge has been acquired, and of which many practical illustrations of success and of failure are to be observed in the past year's work and occurrences, is in itself a very large subject. There have been many cases of failures of reservoir dams, due chiefly to insufficient knowledge of the geological strata upon which they were built. It must also be remembered that the review to be complete must give attention to waterworks in every part of the world, for it is abroad rather than at home where many of the greatest works are being constructed and where the full applications of the latest scientific knowledge are to be seen. This study of works abroad includes not only some of the most important successes, but also a number of failures, which are still more instructive.

On the principle that more is to be learned by failure than by success, a careful study of the work done in America is to be recommended, for such failures are not only frequent, but are reported with frankness in the Press, and this frankness is to be commended. It is not for the English engineer to sneer at failures, for the successes absolutely outweigh in their importance any conservative sentiment which may result from the study of failures, and if the failures in this country were reported with equal frankness and honesty we also should learn more, and probably be safeguarded from falling into the errors which may well result from our greater reserve. In new countries risks have to be taken which are not required at home, and it is very foolish to belittle the work done by the great American engineers because, owing to the special conditions of the country, men of insufficient knowledge have sometimes in the past been allowed to make very daring experiments, some of which resulted in failure, but many of which have added materially to our knowledge. We do not condemn the aeroplane because its development has been attended with loss of life and failure, neither should any intelligent man condemn the methods adopted in new countries, seeing that they mark considerable progress.

Enough has been said to demonstrate the extreme difficulty of including in a few columns a review of water engineering during the year 1912. Such comments as are made can only be superficial, and it is only possible to deal with certain points to the exclusion of much that forms part of the year's work, owing to the greatness and importance of the subject under review.

LEGISLATION AND POLICY.

There has been considerable delay in acting upon the recommendations of the Royal Commission on Sewage Disposal with regard to water-supply legislation. A national water authority is required, and it is interesting to learn that a Bill is now in preparation with regard to this question. As a preliminary, the Local Government Board have been for some time past engaged in collecting information as to the existing sources of supply. A geologist has been appointed on the staff of the Department, and we may at last congratulate ourselves that some progress towards the necessary legislation has been made.

The Municipal Waterworks Association, which represents the leading municipal waterworks undertakings in this country, and which was formed for the purpose of affording opportunities for conference and co-operation, held its first meeting during the past year. It is probable that the Association will take a leading part in promoting necessary legislation.

Little or nothing has been done with regard to carrying out the recommendations made by the

Royal Commission on Canals and Waterways, but the Waterways Association have decided to make every effort, by means of questions in the House of Commons and otherwise, to induce the Government to bring in a Bill on the lines recommended by the Royal Commission. It will be remembered that the report included recommendations for the general improvement of canals and waterways throughout the country, involving a very large expenditure.

RIVERS POLLUTION.

The eighth report of the Royal Commission on Sewage Disposal, issued last November, has a very important bearing upon the question of water supply. It is advised that the law should be altered so that a person discharging sewage matter into a stream shall not be deemed to have committed an offence under the Rivers Pollution Prevention Act, 1876, if the sewage matter is discharged in a form which satisfies certain requirements, and these requirements are of such a character that the degree of purification required will depend very largely upon the amount of dilution.

The matter will rest entirely in the hands of the Rivers Boards and Central Authority when these are established. It is quite clear that there is no intention of making local authorities, as a rule, purify their sewage to such a degree that it cannot pollute drinking water. The purification of the water is left to the water authorities who abstract water from the rivers. There is therefore no chance of rivers becoming purer in quality from the bacteriological point of view. Dr. Houston, in his sixth annual report to the Metropolitan Water Board, states that while it is possible that improved methods of purification will in a chemical sense keep pace with the increasing pollutions of the rivers, the outlook bacteriologically is less hopeful. It certainly looks as if the chemical standard were the only one to which sewage effluents will have to conform; and, dilution being taken into account in arriving at the chemical standard, it follows that with a dilution of over 500 volumes all tests might be dispensed with and crude sewage discharged, subject to such conditions, as the provision of screens or detritus tanks, as might appear necessary to the central authority. Thus the importance of methods of purification for water drawn from rivers will be greater than ever, for it is not to be expected that rivers from which water supplies must be drawn will ever regain their former purity. Rivers form the natural drainage channel of every district into which the sewage must ultimately flow. More and more sewage is entering the rivers, not only because the population increases, but because more and more houses in the watershed areas are being drained, and towns and villages hitherto improperly drained are being sewered.

We have still to wait for the formation of river boards, and a central authority and a legislation which shall do away with the present inequalities and uneconomical working throughout the country. It is possible that the publication of the eighth report, or, failing that, of the ninth final report, may tend to advance matters in this respect.

OWNERSHIP OF WATERWORKS BY LOCAL AUTHORITIES.

The general national policy is undoubtedly towards the ownership of waterworks by the local authorities rather than by companies, and the compulsory purchase of such works by municipalities and district councils is common, and certainly receives the favourable consideration of Parliament and Government Departments. Such work is therefore more and more coming within the province of the municipal engineer. The formation of Rivers Boards and of a central authority will no doubt tend in the same direction. There will be many cases where it will be convenient, however, to form joint water boards, for it often happens that the whole or parts of several districts may be combined with advantage under one scheme. Water companies may still undertake such work, but, as Mr. E. J. Silcock recently pointed out in a paper read before the Institution of Water Engineers, the Parliamentary Committees almost invariably favour the formation of a joint water board to the formation of a company, and even when companies have carried out their obligations to consumers properly, the municipal authorities have often obtained compulsory powers of purchase.

This is no doubt for the ultimate advantage of the ratepayer. Under ordinary circumstances a waterworks undertaking is not profitable, as the capital expenditure is out of proportion to the number of consumers; but as the number of consumers increases, the work becomes profitable, and ultimately, as in the case of the New River Company, enormous profits may be obtained. The Waterworks Clauses Acts prevent any company from making too great a profit, for after all back dividends have been paid off, the excess revenue over and above a certain rate of interest paid to the shareholders may not be retained, but the charges to consumers have to be lowered. It is, however, clear that it is better finance for the ratepayers to benefit to the fullest extent by their waterworks. It is true that the immediate effect of this policy may be dissatisfaction to those who have to pay the rates, while the large consumer frequently makes his own waterworks in the middle of the district. Thus in London there are an increasing number of private wells and supplies, which item ought to receive serious consideration, seeing that it means a loss to the community, and that the ordinary ratepayer has still to pay for the establishment and maintenance of fire mains and hydrants outside the private properties, which do not pay anything to the water authority.

AFFORESTATION.

An important statement of policy has been issued by the Development Commissioners during the past year. This statement is to the effect that the Commissioners will be prepared to consider applications from waterworks authorities for assistance in the afforestation of water-catchment areas. If these schemes for afforestation are carried out in accordance with expert advice, and if the work is open for inspection at all times, and the areas made available as required for purposes of research, education, and demonstration, the Development Commissioners are prepared to recommend loans on the general principle that repayment commences as soon as the work becomes remunerative.

This new national policy should have a very beneficial effect upon the quantity and quality of the available water supply, and should also provide employment for a large number of persons. Afforestation is of course only possible for that part of the country which is unsuitable for cultivation; but this, after all, includes a very large area. The effects of planting trees will tend to equalise the run-off from the land and to lessen the loss by evaporation; the result should be to equalise the discharge of rivers and streams. It has been stated that every forest in a catchment area may be regarded as a storage reservoir in comparison with the lands around it. Hitherto for many years past the tendency has been to remove the trees from the land and to take every possible means of hastening the natural drainage, so that an enormous proportion of the rainfall which formerly percolated into the ground and found its way into the water-bearing stratum, or which flowed slowly to the rivers and sea, is now drained away in the quickest possible manner.

The afforestation of large areas of land should certainly conserve the rainfall, and it will be entirely their own fault if the municipal water authorities fail to take advantage of the offer of the Development Commissioners. Nor to all appearances will they be slow to do so. It seems already that Edinburgh and Liverpool are taking steps to obtain loans for tree-planting. The Edinburgh and District Water Trustees' application is said to be

likely to result in terms being made which will be acceptable to all parties. We are told that the Trustees have been in negotiation with Sir William Haldane, who has taken up the afforestation scheme enthusiastically. Thus it is hoped that the work of tree-planting will begin this winter. The terms upon which the Trustees apparently expect to work are that the Development Commissioners should authorise a financial advance for the capital required to plant the trees, to maintain the woods during growth, and ultimately to provide for the marketing of the timber. Although the work to be done in the first year is necessarily small, the scheme contemplates the planting of several thousand acres of land with trees. At Liverpool it is expected that the conditions upon which the Treasury would grant a loan for the afforestation of the catchment areas at Lake Vrynwy will be acceptable, and that the necessary steps will be taken to press the matter forward.

These appear to be the first instances in England and in Scotland respectively in which public bodies, acting on behalf of the ratepayers, are proposing to undertake, by arrangement with the Development Commissioners, the planting of catchment areas with trees. It should, however, be noted that the Torquay Town Council have applied for a grant in aid of the establishment of a school of afforestation upon the catchment area of the Torquay waterworks. The report of the Development Commissioners should be carefully studied by local authorities, for although the facilities exist for carrying out works of afforestation, it is possible to waste a great deal of time and money if the conditions under which loans are likely to be granted are not properly understood. It is clear that water engineering schemes are considered as being within the scope of economic development for which the fund dealt with by the Development Commissioners is intended.

PRESERVATION OF RECORDS.

It has been pointed out upon other occasions in these pages that though the general rainfall of this country is recorded in a very systematic manner, there are other matters relating to water supply which require the same attention. Gaugings of rivers and streams are required, and the proportion of the rainfall available or the "run-off" in catchment basins overlying various geological strata in different parts of the country ought to be ascertained. It is left to private individuals or to public authorities to make such records, and even then these records are not available for general use. Legislation is still waited for. The formation of a central authority to deal with such matters is much needed. Then, again, from the point of view of the public, it is much to be regretted that exact information is not recorded with regard to every shaft sunk or boring made in the country. It is true that we have the excellent work of the Geological Survey to aid us, but the information could be supplemented by records of the very large number of borings made about which no information is sent to the Geological Survey.

The policy of holding back information is very short-sighted, and is certainly not to be commended. It is true that the well-sinker may here and there be in a stronger position by having his own exclusively private records, but he is always liable to have fresh work to do in an unknown locality, and if all well-sinkers gave away their information to the Geological Survey, they would gain thereby. More wells would be sunk, there would be fewer failures and fewer losses to the contractors, and the public advantage would be enormous. Apparently the advance made in obtaining or in taking steps to obtain such records during the past year has not been great.

As is well known, the "run-off" of a catchment area and the quantity of water to be obtained from a water bearing stratum is influenced by many complex conditions, including not only the amount of rainfall, the nature of the soil, the slope of the surface, and the amount of artificial drainage, but it may also be influenced very considerably by artificial means—namely, by afforestation. In this the past year has shown some advance.

BILLS IN PARLIAMENT.

Among the water bills in Parliament in the forthcoming session, the Metropolitan Water Board are seeking powers for the construction of a service reservoir to hold 1,000,000 gallons of water at Shooter's-hill. It will supply Belvedere, Woolwich, Plumstead, Abbey Wood, and Sidcup. These works also include a new pumping station. Two other reservoirs, each of 250,000 gallons capacity, are to be built on Westerham-hill and at Knockholt respectively, including a long 10-in. main, connecting the two reservoirs. The Mid-Kent Company are seeking to extend their limits and to erect new pumping stations. The Wey Valley Company are proposing to make a pumping station at Frensham. The Northampton Corporation are seeking to extend their area of supply, and are proposing to construct a new reservoir. Huddersfield proposes to take over the Deanhead reservoir. The Southend Waterworks Company propose to purchase the works of the Rochford Urban District Council. The Bournemouth Gas and Water Company propose to purchase the works of the Wimborne Minster Company, and the South Hants Company wish to purchase the Bishops Waltham works. Weirs at Llangwynidr across the Claister and the Ffynnon Caerhos Stream are included in the application of the Ebbw Vale Urban District Council. The Pontypridd and Rhondda Joint Water Board propose to secure a supply from the Corporation of Merthyr Tydfil; the Bury Urban District Council, the South Staffordshire Waterworks Company, the Portsmouth Waterworks Company, the Leeds Corporation, and the Aberystwith Corporation are making similar applications. The Dunfermline Water Committee propose to form a new impounding reservoir on the river Devon at Glendevon, and a service reservoir at Beath. The District Committee of the Middle Ward of Lanarkshire propose to construct a storage reservoir on the Camps Water and Grains Burn, at Crawford, while the Kirkcaldy and Dysart Water Commissioners wish to enlarge their reservoirs at Ballo, Holl, and Arnot.

It will be observed that the combination of works belonging to different authorities is a notable feature of the forthcoming Parliamentary proceedings.

WATER PURIFICATION.

In a paper read before the Indiana Sanitary and Water Supply Association, an attempt was made to prove the money value of pure water to the community by assuming a certain value for each life saved. Figures were given showing that the total cost of water supplied to 105 cities in America, having a total population of nearly 20 millions, was about £1 0s. 10d. per head per annum, and on this basis it was reckoned that a saving of 5½ lives per 100,000 would balance the cost of filtration. In making this calculation the author reckoned on a consumption of 100 gallons per head per day and took the total cost of filtration at 1s. 6d. per head; but whatever money value may be taken as being equivalent to the life of an individual, it is certain that, when pure water is supplied instead of an impure water, the death rate is lowered, and not only this, but that an immense amount of sickness involving expense is also prevented. It may also reasonably be urged that life is beyond price; but whatever view we take of the matter, it is clear that for every reason, including sentiment and finance, it is well worth while to safeguard the purity of water supplies.

The simple methods by which purity of water may be ensured are among the most important of the developments which have taken place within recent years. Sand filtration still continues to be largely used, but the superior efficiency of the pressure filter has led to its general adoption, and many of

these filters have been installed in this country during the past year. The use of coagulants is general in America, and is found useful in this country under certain conditions.

STERILISATION.

As pointed out by Dr. Houston in one of his recent papers, there is in the United Kingdom an almost invincible repugnance to the use of chemicals for the purification of water, with the exception of lime, the use of which is "hallowed by precedent," and for this reason alone the sterilisation of water by means of hypochlorite, which has been universally adopted in America, does not appear to have found much favour at present at home, or perhaps it would be more correct to say that where it is used as little is said about it as possible. There are, however, several places in this country where its use has been essential in order to prevent the spread of typhoid. Dr. Thresh mentioned more than one instance in a paper read recently before the Institution of Water Engineers, but even he appeared to find it politic not to mention the exact localities. Notwithstanding this reserve, we are able to say that the sterilisation of water by means of hypochlorite is being adopted in this country much more extensively than is generally supposed. Ozone treatment, on the other hand, does not appear to have made many advances in the past year, neither do the results seem to warrant the large extra expense which this method seems to demand. Mr. Adolf Kemna pointed out that "the ozone people at Petersburg felt so sure of being able to destroy the coli that they accepted a clause by which a fine of 1,000 roubles was incurred for each detection, with the result that in June last they had to pay 26,000 roubles."

Statistics, which have been quoted in this Journal, clearly prove that where hypochlorite sterilisation of water has been adopted by cities suffering from periodical epidemics of typhoid, there has been a very large reduction of the typhoid death-rate, which has in some cases been reduced to nil. The fact that the typhoid death-rate has not been reduced to nil in every case is doubtless due to the fact that there were sources of infection other than the water supply, Some advance has been made with the ultra-violet ray sterilisation. There has been a considerable amount of work done in France. Water sterilised in this manner is being used in certain long-distance railway trains. Bottled water sterilised by means of the ultra-violet rays has been supplied where the city supply was known to be polluted in America, and there are various other developments, but figures are yet wanting to prove that this method can be used economically on any large commercial scale.

NEWER METHODS.

In France very good results have been obtained by the use of non-submerged sand filters, over which the water is sprayed by means of a rotary distributor, and, considering the excellent results obtained, it is to be regretted that engineers in this country have not as yet given the system a trial. Dr. Houston, in several reports and papers published during the past year, has dealt with the purification of the London water supply; and while he finds the method of storage thoroughly satisfactory for the removal of disease germs, he has drawn attention to the fact that we do not as yet possess reservoirs of sufficient capacity to give the full period of storage, and that in the case of flood waters, which may have to run into depleted reservoirs, some additional storage is desirable. At first the doctor suggested coagulation, but later he has brought forward and advocated a new method for the sterilisation of the water by an overdose of lime.

Dr. Houston found that one part of quicklime added to 5,000 parts of raw Thames water kills the B. coli within a given period, and thus we get not only the softening and mechanical precipitating effects, but also sterilisation. The water is, however, unfit for human consumption, being overdosed with lime, and to neutralise this, not less than 25 per cent of untreated water must be added. Thus the sterilised water must be mixed with the water purified by storage, and the mixture would be of a much purer and incidentally of a softer quality than that at present used.

A further method of sterilisation adopted in America is the use of chlorine gas liquefied under pressure. This gas is mixed with water. There is no doubt as to the ease with which it can be applied, but chemists do not agree that the admixture of chlorine gas with water produces the same result as is obtained by the application of hypochlorite solution. The sterilisation of water by means of chlorine gas is due to the fact that the chlorine combines with the hydrogen in the water and forms hydrochloric acid, while the oxygen is liberated, and it is this nascent oxygen which performs the work of sterilisation; but with hypochlorite there is a certain amount of oxygen present, and this, with the oxygen produced by means of the chlorine present in the hypochlorite, sterilises the water. Thus with chlorine gas twice the amount of chlorine is required, and presumably twice the amount of hydrochloric acid remains in the water. Also with hypochlorite the gas is given off in minute bubbles, and is therefore more readily dissolved in the water than chlorine gas, which, if blown through in bulk, must escape in bubbles.

DIFFICULTIES OVERCOME.

In the earlier experiments and trials waters were frequently overdosed with hypochlorite to a degree which produced an unpleasant taste in the water. Also, while the process was new the human imagination was active, and hence there were complaints which were often quite unwarranted. Experience during the past year has shown that where the process is properly carried out, there is no unpleasant taste or smell in the water, and the complaints have ceased. The water must be free from organic matter before the hypochlorite is added, and instead of adding hypochlorite to the water in comparatively large quantities, as was done at one time, we find that a dose of from ·7 to ·5 parts per million of available chlorine give good results at Cleveland, ·35 parts per million at Jersey City and in Cincinnati, and ·5 parts per million at New York.

As to the cost of filtration, considerable attention has been given to this matter during the past year. The chief working cost with sand filters is the washing of the sand, and with mechanical filters that of the labour and chemicals. These costs must vary considerably per head at different places, according to the nature of the water to be purified and the magnitude of the scheme; but there is sufficient evidence to show that even at the highest prices the cost is a very small one to pay in proportion to the benefits received.

ABSOLUTE STERILISATION.

A French firm has recently brought forward a small water sterilising device that will be useful in households, schools, hospitals, and similar buildings. In this plant sterilisation is produced by heating water under pressure to a temperature of 115deg. C. without causing boiling. The ordinary boiling temperature—namely 100deg. C.—is insufficient to produce absolute sterilisation, hence the higher temperature. The water, being under pressure, cannot boil. The apparatus is composed of a cylindrical tank, enclosing at its lower end a part of a coil and topped by a small boiler, which can be heated by gas. The raw water enters at the bottom of the cylinder and rises around the coils to the boiler, where it reaches the temperature of 115deg. C. It then rises through a tube at the top of the boiler and descends through the cooling coil at the bottom of the cylinder, whence it rises through an outside tube to the discharge. It is capable of treating from 100 to 125 gallons per hour. Larger appliances

of the same kind are also employed. The company makes a portable steriliser capable of treating 1,000 gallons per hour, which is mounted on wheels and can be used for the service of troops in the field. A thousand cubic feet of gas are required for treating 3,330 gallons of water. Thus the cost of treatment, taking gas at 4s. per 1,000 cubic ft., would be a little over 1s. 2d. per thousand gallons. Its price, therefore, does not compare favourably with the prices of other methods of sterilisation, but the process is undoubtedly applicable to conditions where the absolute purity of a small quantity of water is essential.

PREVENTION OF LEAD POISONING.

We hear less now than formerly of the injurious effect produced by the action of soft water upon lead pipes. Towns deriving their supplies from moorland sources have benefited by the advance of knowledge, and by treatment of their water supplies have overcome the difficulty due to the plumbo solvency of the water. At Sheffield, after a long series of experiments, it was ultimately decided to treat the water with finely-powdered chalk, and the treatment has been so successful that it has been adopted by a large number of northern water authorities, and also by the Birmingham Corporation in connection with their supply from Wales. Further, the Derwent Valley Act of Parliament provides that all water shall be efficiently treated so as to prevent it acting on lead in such a manner as to endanger the health of the consumers.

Thus it is clear that there is no longer need to fear lead poisoning from soft water supplies provided that this very simple treatment is adopted. This is an advance upon which we may congratulate ourselves, especially as the means by which safety may be ensured proved to be so simple.

WASTE OF WATER.

The excessive use and waste of water in America has lead to great attention being given to the methods of detecting waste. In this country the loss of water by waste and leakage is generally not so excessive, but there are many instances where a great economy might be effected by discovering leakages of water supplied. When a supply is found to be insufficient, the general plan is to endeavour to increase it rather than to reduce the waste; but it is clear that there must be a great deal of unnecessary expenditure of public money whenever the shortage of supply due to waste is made up by the construction of new works, and this is particularly the case where the water has to be pumped. In England the most usual method for the detection of leakage is the use of the Deacons Meter, while in America the Pitometer is now very generally used.

The house-to-house inspection is apt to account for a good deal of waste water in any district. In a paper read before the Illinois Water Supply Association it was shown that after all the services in a certain town of Illinois had been metered the quantity of water pumped per head was 125 gallons, as against 266 gallons in preceding years. This actually resulted in a reduction of 30 per cent in the average householder's bill—a clear proof of the fact that consumers were deliberately wasting water is here given, which waste they took good care to prevent as soon as they found it worth their while to do so. It is not practicable as a rule to place meters upon all services. In many of the American cities the waste and reckless use of the water is being checked by making thorough surveys of the mains in order to detect waste and leakage.

This work is done chiefly by the use of the Pitometer, which instrument is of great value, because it enables the engineer to ascertain how much water is flowing at any point in the pipe system. The instrument consists of a Pitot tube, which can be inserted through a 1-in. stop-cock into any water main. By means of this tube and its attachments the quantity of water flowing along the main can be accurately measured and registered. The instrument is portable, and can be used at any point required without interfering with the main in any way beyond tapping a 1-in. hole in it. Thus, by the use of the Pitometer, accurate information can be obtained as to the amount of water being used in any main or section. The delivery of pumps can also be checked and the loss due to slip ascertained.

FIRE SERVICES.

The disastrous effects of fire, and the need for its speedy extinction inside the building at whatever point it may start, has led to considerable development in the practice of applying automatic sprinklers, and there has been a considerable amount of thought and ingenuity devoted to the subject of interior fire mains and extinction appliances recently. For instance, where it is necessary to protect valuable papers and records, or where the building contains goods of a highly inflammable nature, it is essential that the fire appliances should consist of something that will be immediately effective, and the fact has been exemplified by several great fires involving loss of life under most distressing circumstances and destruction of property during the past year.

In America sprinklers have been applied in one building at a point 500 ft. above the street level, the method adopted being to place large steel pressure tanks on the upper floors holding about 1,000 gallons each, so arranged as to give a pressure of at least 75 lbs. upon the square inch at the sprinklers, it being recognised that to be thoroughly effective a high pressure is necessary. In addition to the steel tanks, high-pressure pumps drawing water from the city mains are installed in the basement, while a third source of supply consists of a connection outside the building at the street level into which the fire-engines can pump water from an outside hydrant. The result is that the sprinklers are first fed automatically from the pressure tanks; next they can be fed from the pumps in the basement; and lastly, assuming that the fire has taken such hold on the premises that interior pumping is impossible, water can be directed immediately where it is most required simply by pumping from a safe point outside the building.

CORROSION OF PIPES.

The causes of corrosion in pipes is a matter which is receiving considerable attention. It is now generally accepted that ordinary corrosion is due to the action of acids, to electrolytic action, and also strong electric currents are destructive because they set up electrolysis, resulting in rapid corrosion. Where the soil contains acid or acid salts, these also prove to be destructive. With regard to the electrolytic theory, all experience points to the fact that irregularity in the composition of the metal causes corrosion, and thus the greater uniformity of wrought-iron as compared with steel is sometimes thought to render it more resistant to galvanic activity.

The recent experiments of Messrs. George and Melville Whipple, however, seem to prove that the pitting of steel pipes may be prevented entirely by the removal of the black oxide scale or "mill scale," and that the corrosion of steel mains is due to electrolytic action set up owing to the differences in potential between the steel and the mill scale. Apparently it is unsafe to rely upon any protective coating, for it has been pointed out that no permanently effective coating is at present available. This statement, made by Mr. W. H. Maxwell, will probably not find general acceptance, but there is considerable truth in the statement that some of the coatings intended for protection may become sources of danger, and in the case of some paints the coarser particles of the pigment may induce galvanic activity under the paint. Mr. Maxwell is apparently in agreement with the theory of electrolytic action set up by "mill scale," and urges the importance of seeing that the "mill scale" is

removed before coating, as "otherwise rust will form under the paint."

It is at present extremely difficult to estimate the serviceable life of cast-iron, wrought-iron, or steel pipes. We are told of the cast-iron pipes at Versailles, which have been in use for 227 years; while in other cases uncoated mains appear to have failed in twenty years. We have read of the rapid deterioration of long lengths of steel pipe of large diameter in Australia, America, and elsewhere, and also of steel pipes, which show no signs of corrosion after many years of work. The chief results of investigation at the present time point to the importance of preventing irregularity of composition, of making the coating more effective, of removing the "mill scale," if possible, and of taking care that no stray currents of electricity pass through the mains. One of the most satisfactory linings yet discovered for steel mains of large diameter is Portland cement.

REINFORCED CONCRETE.

Considerable attention has been devoted to reinforced concrete during the past year, and there has been a prolonged discussion in the technical Press, notably in the Engineering Supplement of the *Times*, in which the policy of the Local Government Board in granting short periods for loans for reinforced concrete works has been criticised and in which the merits of the material have come under discussion.

Reinforced concrete is a material which possesses enormous advantages and which is perfectly trustworthy when the work has been properly designed and constructed; but, owing to the fact that its strength and enduring qualities must depend entirely upon good workmanship, and that without the best workmanship this material is absolutely worthless, the position of the Local Government Board is one of some difficulty. Further, it is useless to deny that there are numerous failures of works which have been improperly designed or improperly constructed. In this country it is not customary to record failures, and, further, it may also be stated that there are not many failures to record; but in America, as may be seen in the technical journals, failures are of frequent occurrence; but it is to be noted that when a reinforced concrete structure does fail, this happens directly the strain comes upon it, and frequently before the work of construction is finished.

Serious as the results of such bad engineering may be, there is one very important point to the good to be noticed, and this is that the faulty structure fails at once; if the work has not been properly done the whole structure collapses utterly. Thus the danger of any permanent structure failing some time after erection is more remote in the case of reinforced concrete than in the case of any other material. A steelwork structure will lose its strength by corrosion in the course of years, but as far as the result of a good many years' working goes reinforced concrete increases in strength and does not deteriorate. Thus it is urged that the policy of the Local Government Board in granting loans to be repaid during a short period is inconsistent. If the material is not trustworthy loans should not be granted at all. The Local Government Board apparently do not make this contention, but they act as if the life of reinforced concrete were short, which is against all experience.

The difficulty which is before us, and which undoubtedly hinders the progress of reinforced concrete work in this country, is that, while the design can be checked, there is not the same assurance to be obtained with regard to the workmanship. If the work were actually carried out by approved firms of contractors after the engineering designs had been prepared by competent persons there would be no risk at all, and it is to be desired that steps should be taken to bring this about. It appears that the permissible unit stresses in reinforced concrete have been increasing, and it has been freely stated that there are many designers who use stresses in excess of those generally permitted. During the past year considerable disagreement among experts has been apparent. There is a prevailing impression that engineers in private practice must to a great extent depend upon information given by experts in designing their works, the chief reason for this being that a certain number of persons incapable of making their own calculations and lacking sufficient knowledge of the subject obtain their designs from manufacturing firms. Tests made by professors at Colleges are also sometimes referred to as having been impro perly made, and it is stated that there has therefore been insufficient proof of the strength of the material. There is a certain amount of mystery attached to calculations which are supposed to prove that ferro-concrete has a higher strength than that obtained in ordinary experiments, and for this reason it behoves engineers generally to rely more upon their own knowledge and upon simple calculations than to adopt elaborate designs which they do not thoroughly understand. Professors write books which create designers who would err on the side of safety, and it is exceedingly rash to allow commercial engineers and vendors of engineering materials to bring forward designs which do not conform to the professors' theories unless the full calculations are submitted with the design and checked by the engineer.

The reliance placed upon reinforced concrete and the saving to be effected in using the material is shown by the fact that at Luton the British Improved Construction Co. have made a 27 in. rising main about one mile long of reinforced concrete. This pipe has no lining of any kind and has withstood a test pressure of 60 lb. per sq. in. continuously. The cost of the main delivered at Luton was £1 7s. 7d. per lineal yard, whereas the cost of cast-iron pipes would have been £2 7s. 7d. per lineal yard. A better example could scarcely be found to demonstrate the uses of this material when properly applied. For the material that may be trusted to form a pumping main and that will stand a test pressure without any leakage, that will be incapable of corrosion and that is very much cheaper than cast-iron, which is ordinarily used for the purpose, possesses advantages which cannot possibly be overlooked, and if it were generally adopted for waterworks structures in this country reinforced concrete would show a great saving of public money, and better work would be done.

The value of Portland cement as a coating material for iron or steel in order to prevent corrosion has been frequently demonstrated, and the reliance placed upon it may be seen in the protection of the steel pipes in the Catskill Aqueduct for the supply of water to New York. The outside of the steel pipe is jacketed with concrete, and the pipe is lined with the same material. These mains have also been lined in some sections by means of the cement-gun.

The reinforced concrete conduits of the Los Angeles works are a further demonstration, for we see that in two of the greatest of the waterworks now in course of construction complete trust is placed in the protective qualities of Portland cement when applied to steel.

PUMPS.

One of the most remarkable developments in pumping machinery is the Humphrey Pump, which is being used for raising large quantities of water with moderate lifts.

In this pump an explosion of gas taking place in direct contact with the water to be lifted exerts the force necessary for raising it. Thus the pump may be best described as being of the internal combustion type. Large Humphrey pumps have been installed by the Metropolitan Water Board at Chingford. They are five in number, four having a capacity of 40 million gallons per day and one having a capacity of 20 million gallons per day, the lift being from

25 ft. to 30 ft. The pumps work on a 4-stroke cycle; starting with the working stroke, there is the ignition of the combustible charge compressed in the top of the pump cylinder. The charge is expanded down to a little below atmospheric pressure, and this results in a volume of water being drawn in and also in a charge of scavenging air being drawn in through automatic valves. At the same time water is delivered through the discharge main—by the force of the explosion—into the high-level reservoir. This working stroke is followed by a return stroke of the water column which first expels the products of combustion through the exhaust valves. The valves are then closed by the impact of the moving water, and the air entrapped is compressed into the head of the cylinder, where it forms an elastic cushion which gradually brings the moving column of water to rest. The re-expansion of this cushion produces a second out-stroke of the water, the pressure above the water again falls below that of the atmosphere, with the result that a charge of combustible mixture is drawn through the automatic inlet valves. When the momentum of the water is exhausted, a second return stroke takes place which compresses the charge in the cylinder for another working stroke. Producer gas is used.

There is a conical water tower above the outlet which provides for the fluctuating levels of the water due to the to-and-fro movements of the column of water in the play pipe and which maintains a continual discharge to the high level reservoir through the discharge pipe which branches out of it. For the producer gas anthracite coal is used with a guaranteed consumption of 1·1 lb. per actual water horse-power. Taking anthracite at 22s. per ton, the cost of fuel equals ·0196 pence per 1,000 gallons lifted. Some larger units have been designed by the Pump and Power Co., of 38, Victoria-street, Westminster for the Egyptian Government. Each pump is capable of delivering 100 million gallons per day, with a lift of 19 ft. The Humphrey pump possesses the merit of great simplicity, there being practically nothing to get out of order, and practically no lubrication being required, it appears that the only possibility of difficulty is with the valves.

At a demonstration given during May of last year by the Hydraulic Engineering Co., Ltd., of 9 Bridge-street, S.W., of a Humphrey explosion pump, constructed for experimental purposes at the Wapping station of the London Hydraulic Co., the suitability and economy of this type of pump for irrigation purposes was demonstrated. The pump worked against a head of 25 ft. on town gas at 2s. 3d. per 1,000 c.ft., and with this fuel the cost of pumping was said to be ·145 pence per 1,000 gallons. The explosion chamber of the pump is 21 in. in diameter, and from it the water is discharged through a 15-in. pipe.

THE DIESEL ENGINE.

The use of the Diesel engine for pumping purposes is shown by the new installations which are being laid down by the Metropolitan Water Board. At Cricklewood three units, each comprising a four-cylinder vertical Diesel engine developing 200 b.h.p. at 250 revolutions per minute, and driving a horizontal three-throw ram-pump, are being erected. Each unit will lift two million gallons a day to a height of 250 ft. A similar installation is being erected at Fortis-green. In both cases the engines are supplied by Messrs. Mirrlees, Bickerton & Day, and the pumps by Messrs. Glenfield & Kennedy. A Diesel engine, giving 100 b.h.p. when running at 250 revolutions per minute, is also being erected at Green-street Green, Dartford, to lift water from a 24-inch borehole.

The pump is of the concertina type, having two buckets actuated by bell-cranks on opposite sides of the well, the bell-cranks being connected by a rod, so that the upper and lower buckets approach and recede from one another alternately; the pump delivers directly into the delivery main. It is capable of delivering 750,000 gallons per day to a height of 520 ft. The engine is supplied by Messrs. Mirrlees, Bickerton & Day, while the pump is provided by the Lilleshall Company.

These are probably the first instances in which the Diesel engine has been adopted for pumping water supply in this country on a large scale. The Diesel engine has been in use for about fourteen years, and has been adopted for a variety of purposes. It has proved to be thoroughly trustworthy when properly built, and is in some respects more simple than other engines, since it does not require any auxiliary apparatus, and also because the fuel does not have to undergo any tranforming process, but is directly converted into work in the cylinder of the engine. It has been used for all purposes, including the propulsion of ships. It is estimated that considerably over 300 vessels have Diesel engines, some of these being of 3,000 h. p. A Diesel engine can use not only petroleum oil, but tar oils and oils produced by distillation of lignite and shale. It has the highest fuel efficiency of any commercial heat engine; it is therefore practically certain that this engine will be largely used for pumping purposes on a very large scale in the future. It is interesting to note that the first English Diesel engine built by the Mirrlees Watson and Yaryan Company at Glasgow fourteen years ago is still running.

The practice of using auxiliary pumps in order to create pressure in service mains is of interest. At Geresheim, Dusseldorf, motor driven pumps supply the local mains through storage tanks, where the pressure is held by compressed air. Any fall in pressure due to use of the supply automatically starts the pumps. Where a district is situated on high ground and the construction of a high service reservoir is difficult, the method referred to is likely to save a considerable amount of expense.

We can also by looking back over the past year, see that continual progress is being made by the invention and perfection of appliances by which water is obtained, purified, and distributed to consumers. We see the construction of great works and the advance towards better legislation, but, over and above all, the advance made by the engineer in the methods of construction and working is by far the most remarkable feature. It may be said that every day some improvement in methods of working takes place. This is a mechanical age, and probably the best and keenest intellects are now employed in engineering matters. It is, further, an age in which enormous development is taking place all over the world, giving free scope to the engineer. By the application of the great number of new appliances in the proper manner the engineer is now able to carry out works of a much greater magnitude at a much quicker rate than was formerly possible. It therefore is of the first importance that he should be acquainted with the new methods which are daily coming into use, but knowledge alone is insufficient—judgment, courage, and genius are also required, and herein lies the difference between the engineer and the simple draughtsman or mechanic. The one is a leader of men, while the other is merely a good machine, who does over and over again the same sort of work according to instructions or according to his previous experience.

The engineer, however, must not be content to do his work in this manner. It is possible for him to see, simply by reading the technical Press, some of the various methods which are adopted in different parts of the world, and unless he uses his judgment, and has the courage to take advantage of what he learns, he ceases to be an engineer and becomes a mere machine. We are said to be conservative in this country, and to continue carrying out work by antiquated methods which are altogether uneconomical and unsatisfactory. But this can only happen when the work is in the hands of a timid, inferior type of man unworthy of the name of engineer.

TRANSPORTATION OF MATERIALS.

Mechanical lifting and the transport of comparatively light materials has taken the place of an enormous amount of hand labour. Particular attention should be paid to the methods by which light trolleys running on an overhead track or wire are used on works of construction, much in the same way in which they are made to command an entire workshop area without encroaching on the floor space or occupying walls. Such articles as large water mains or sewer pipes can thus be picked up from a storage yard or from railway trucks, and run at once through the streets of a crowded town and deposited exactly in position where the joint has to be made. This means doing away with a great amount of inconvenience, waste of time, and unprofitable labour. There is practically nothing left to do but the slinging of the material to be shifted. These cableways are worked by electricity. There are, of course, hoisting machines, which embrace trolleys worked by hand by compressed air and by electricity in powers of from half-ton to, say, five tons. Wire overhead cableways have been employed with maximum loads of ten tons. The application of electricity has made the working of such appliances possible and economical.

CONCRETE MIXING.

The rapidity with which concrete can be mixed is amply demonstrated at the many large works upon which various mechanical concrete-mixers are used, and latterly it has been found expedient to make use of such mixers on small works also. A street mixer used at Toronto gave the following result :— 700 bags of cement, each weighing over 87 lb., were put through the concrete-mixer, and it was also fed with four car-loads of broken stone. Two hundred and thirty-five tons of concrete were thus produced in a day of 9 hours, so that a ton of concrete was made, handled, and put in place every $2\frac{1}{3}$ minutes. The 235 tons of concrete measured 175 cubic yards ; this would have formed a pillar 5 ft. sq. and 189 ft. high. This result was published recently in the *Canadian Engineer*.

Space does not permit of any detailed description of the many appliances which are in general use. Among them may be mentioned the trench excavator, which is a simple machine, driven by steam or other motive power, whereby water main or sewer trenches can be excavated quickly. The mechanical rammer also ensures the proper filling of trenches at a rate and with a thoroughness which is impossible with hand ramming. The oxy-acetylene cutting apparatus enables the engineer to cut large mains or plates quickly and easily by means of a very simple portable appliance. Cement grouting under pressure is being largely used for many purposes, and the work effected by a very simple machine is of incalculable advantage to the engineer and has numerous applications. The cement gun has also been found to be very valuable.

There are electrical appliances for tracing the exact position of underground pipes, machines for scraping and cleansing water mains (which ought to be in general use), and a host of similar appliances which wait for adoption in this country. Engineers should give particular attention to the uses of electrical power in works of construction. By the adoption of electrical carriage of materials in tunnels and elsewhere a great saving of labour and of time is to be effected.

PRESSURE FILTERS.

Perhaps one of the most instructive filter installations that have been completed in 1912 is the battery of De-Clor filters laid down at Truro under peculiarly interesting circumstances.

Open sand beds of the best type failed to bring the Truro water supply to the required condition of bacteriological purity, B. coli being present in quite small quantities of the sand-filtered water. The Truro Water Company for this reason had to face the laying down of very large and costly additional areas of slow sand beds, in the hope that such beds would remove the B. coli from the water (although it is now recognised that, according to Dr. A. C. Houston, Director of the Water Examinations of the Metropolitan Water Board :—"Sand filtration, although it reduces the total number of bacteria . . . allows excremental microbes (*e.g.*, Bacillus coli) to pass through the filter in much the same proportion as the ordinary water bacteria"), or to adopt some more reliable, and, if possible, more economical means of rendering the water bacteriologically safe. After thoroughly investigating the system used by the Reading Corporation to eliminate the B. coli in the water supply, which is taken from a navigable river, the Truro Water Company decided to adopt the same system, and accordingly laid down a battery of De-Clor filters.

The results from every point of view have been exceedingly satisfactory ; the "De-Clor" purified water being always of the highest degree of bacteriological purity, no B. coli being ever discoverable in 100 c.c.

The initial cost of the system was exceedingly moderate, while the working expenses amount to only three or four shillings per million gallons of water daily. The water at Reading, prior to passing through the De-Clor filters, is found to contain the B. coli in from 0·1 to 1 c.c., whereas it has *never* been found in the De-Clor filtered water.

The recent wet summer has, in many cases, been extremely unfavourable to high bacterial purity, and an excessive number of B. coli have been found in public water supplies hitherto considered above suspicion ; under such circumstances the De-Clor process is proving of the greatest possible value, as either on the gravity or pressure system it can be readily added to existing filtration works.

Towns having well supplies, as also those having river supplies, have adopted the system, while De-Clor plants have been shipped by the Candy Filter Company of Westminster to all parts of the world, including China, Japan, South Africa, America, and New Zealand.

The Candy Filter Company have supplied a large battery of twelve filters for the Torquay Corporation to deal with the moorland water supply from Dartmoor. These filters contain several important novelties, one being that the steel filter shells are lined with an imperishable and non-corroding vitrified granitic lining, so that the metal is protected against the peculiar iron-corroding action of this particular water. There are also special means provided for cleansing or scouring the filtering material, which is accomplished in a particularly effective manner—a minimum amount of water only being used in such washing.

The Candy Filter Company have also supplied filters to the Birmingham and Liverpool Corporations for purifying water required for public swimming baths, their "compound filter" with combined pre-filter and hydraulic scour being particularly useful for dealing with turbid, muddy waters, or waters which have been subject to chemical treatment.

The special feature of the Candy "Compound-Type" filter is the patent pre-filter that is combined with it ; the water thus undergoes a double and progressive filtration which not only produces a better filtered water, but enables the filter to work about three times longer than the ordinary mechanical filter without requiring cleaning ; this is a most important advantage when chemical treatment is employed, or if the unfiltered water contains a considerable quantity of suspended matter. It also means a very great reduction in the amount of wash water used.

For the removal of iron from water supplies Candy iron-removing filters are being laid down in a number of waterworks, as they do away altogether with the expense of aërating basins or subsidence tanks, as well as avoiding the necessity of any chemical treatment, the iron, both soluble and

insoluble, being removed by a special process of oxidation in the filter itself.

Messrs. Bell Bros., of Ravensthorpe, Yorks, have carried out a large amount of work during the past year. At Edinburgh, to conform with the wishes of some of the experts who desired to have the water hardened, a patent Venturi lime chamber for hardening the water has been erected. This is perfectly automatic in all its work, and can be regulated to add any desired quantity of lime, which is shown by a suitable meter. At Stockport Messrs. Bell's filter plant consists of twenty-four No. 5 filters, which were put into operation in the spring, and officially opened on July 11th. At Nelson the first plant, consisting of four No. 5 filters, have been put into operation. The second plant of twelve No. 5 filters has been erected, and will be put into work in the new year. At Lancaster the first twelve No. 5 filters are being erected by Messrs. Bell. At Alfreton the erection of the plant is now complete, and ready for starting. At Brymbo this plant has been put into operation, and is working well. An extension has been made to the filter plant at Hawarden. The Buxton Urban District Council have ordered a plant consisting of four No. 5 filters for the Lightwood Reservoir. Prestwick Burgh have ordered an extension to their plant. The plant for the Haddington County Council is now being erected, and will shortly be ready for putting into operation. Another plant has been erected for purifying an additional supply of water to East Grinstead. The filters for the Ilkley Urban District Council have been put into operation. Filters for Haileybury are in the course of construction and delivery. A plant has been sent out to Jamaica, and is now working.

Plants have also been supplied to Marton, New Zealand, Wetherby, Chailey, Malay States, &c. These works are all carried out by Messrs. Bell Bros.

As in previous years, the Turn-over Filter Co., Belfast, have supplied a number of filters for the purification of water for general industrial purposes, including a repeat order from Messrs. the Brookfield Linen Co., Belfast, for their dye works department, its purpose being the same as before—to purify the water drawn from a polluted stream in order to use it in place of the town supply for washing white linen yarns. They have also supplied several filtering plants for the purification of water in swimming-baths, including two installations for the Bradford and Brighouse Corporations, which were ordered some time ago, but are not yet quite completed. They have also supplied a large number of filters capable of dealing with from 100 to 500 gallons per hour for the purification of turbid waters for drinking and domestic purposes, one large shipping company having ordered fourteen small installations to be fitted on their fleet of passenger river steamers. Each plant is fitted with a complete treating apparatus. The "Turn-over" Filter has also lately been selected by two municipal bodies for the purification of their town water-supplies. Each of these plants will consist of eleven large filters, each filter being 8 ft. diameter by 12 ft. long, the total capacity of the plant being $2\frac{1}{2}$ million gallons per day. Each plant will be equipped with a complete apparatus for automatically treating the water with the necessary re-agents to decolourise it and give a high degree of purification.

In conjunction with the patentees, Messrs. Blakeborough & Sons are putting on the market the Turn-over Filter. They have been busily engaged making these filters during the last year, and have recently secured orders for two important installations for waterworks each of which will deal with something like 100,000 gallons per hour, and effectually remove all trace of peaty stain as well as suspended matter and bacteria. This filter has now been adopted for every conceivable duty, and has given the greatest satisfaction wherever it is in use. Many installations are at work continuously purifying bath-water in swimming-baths, rendering change of water unnecessary; manufacturers are using it for filtering badly polluted beck water, and afterwards in many cases are washing white yarns with the filtrate; paper-mills are using it in the manufacture of paper; collieries are using it in conjunction with softening plants for dealing with water for their boilers, and shipowners are using it for filtering drinking-water on board ships. During the past year Messrs. Blakeborough have completed two of the largest valves which have ever been made in this country—the valves are 94-in. bore and are operated by hydraulic cylinders. They are to be used in connection with the pumping plant for the New Alexandra Docks at Newport. Some idea of their size may be gathered from the fact that when full open these valves measure no less than 38 ft. 6 in. in height.

Messrs. Ham, Baker & Co., Limited, of Westminster, and Municipal Engineering Works, Langley-green, near Birmingham, report a successful year. They have been kept extremely busy in all departments, necessitating working overtime. Considerable additions have been made to the works and to the plant, giving greatly increased facilities for dealing with large orders for all classes of material—specialities and fittings for both sewerage and water supply.

In addition to orders and contracts for the home trade, they have been kept extremely busy on large works abroad, notably in Canada, India, Russia, Egypt, New Zealand, and South America, during the past year, and have turned out some large-size sluice valves and penstocks, for which they have special facilities. An important speciality to which they draw attention, and which is finding much favour with waterworks engineers, is their new patent No. 1 sluice valve, which has been adopted after extensive trials by several of the most important water authorities at home and abroad. It is also worthy of note that the London County Council have awarded this firm the contract for the supply of the whole of the fire hydrants required throughout the Metropolitan area for the next three years.

The Surveyors' Institution.—The annual dinner of this body will be held at the Whitehall Rooms, Hotel Metropole, on Monday, February 24th, at 7 p.m. At a ballot of council on the 4th inst. to fill the vacancy caused by the death of Mr. E. B. I'Anson, Mr. H. Herbert Smith was elected a vice-president, and Mr. Edwin Savill an ordinary member of council.

Regent's Quadrant Rebuilding Committee.—Statements have recently appeared in the Press to the effect that the committee, of which the Earl of Plymouth is chairman, appointed by the Lords of H.M. Treasury to consider the design for completing the rebuilding of Regent's Quadrant have approved of a particular design which has been submitted to them. We are officially informed that such statements are quite inaccurate, and that no design has been approved.

Vacuum Cesspool Exhauster for Estates. — The emptying of cesspools on the vacuum principle, owing to its sanitary and economical conditions of working, has been very extensively adopted of recent years, and in addition to its suitability for town and country districts, it has also been found extremely well adapted for service on estates. A plant of this description has just been supplied by Messrs. Merryweather & Sons to Mr. T. S. Hill, Langford House, Langford, near Bristol. It comprises a 350-gallon cylindrical tank mounted on a four-wheeled carriage arranged for horse draught, and provided with a hand-worked air pump. The apparatus, in addition to its services for emptying the cesspools on the estate, will also be employed for clearing out matter from piggeries. The contents of the tank will then be distributed on the land for the purpose of assisting cultivation. The wheels of the carriage are fitted with broad tyres for negotiating soft ground. At a recent test on the Langford House estate the plant amply fulfilled all that was required of it, and although some of the matter dealt with was of quite a solid nature, it was readily drawn up into the tank. We may add that Messrs. Merryweather have recently issued a new booklet dealing with this particular class of apparatus.

Sewage Purification in the East.

CORAL AS A FILTERING MATERIAL.

By B. Ball, Assoc.M.Inst.C.E., Deputy Municipal Engineer, Singapore.

In The Surveyor for April 26, 1912, there appeared an extract from a Singapore daily paper on experiments which had been carried out to determine the most suitable local material to use as a filtering material in the sewage works about to be constructed.

Some doubt was expressed in the "Minutes of Proceedings" as to the permanency of the working efficiency of the coral, and as considerable interest has been taken in the experiments, which are still in operation, the following notes may be of interest to engineers generally, and more especially to those engineers engaged on sewage purification in the tropics.

Singapore is a city situated on an island at the extreme south of the Malay Peninsula, a few miles north of the Equator. It has a moist climate and a very uniform temperature, averaging about 80 deg. Fahr., with little variation day or night, and practically no seasons. The city was founded about ninety years ago, the population at that time consisting of 300 Malays, living in huts, and it has grown by leaps and bounds into a big seaport of 260,000 inhabitants, of whom about 5,000 are Europeans, and the remainder Chinese, Malays, Indians, Arabs, and other nationalities, the Chinese largely predominating.

Up to the present time the city has been, and is, drained by means of open ditches constructed on both sides of the roads. These ditches discharge into tidal creeks and then into the sea, often assuming very large proportions owing to the town being flat and subject to flooding from heavy showers occurring at high tides. The night-soil is collected privately, and carried away to be used as manure on cocoanut plantations.

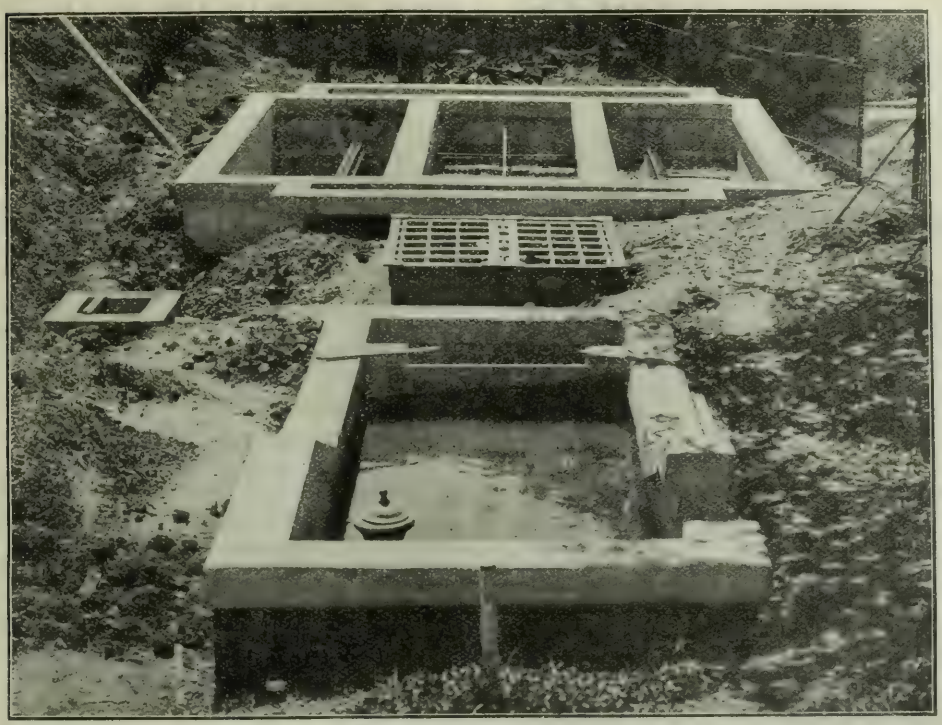
Although Singapore has fine roads and a good water supply, it still has a very high death-rate—40 per 1,000—which it is hoped will be considerably reduced by a modern system of sewers and sewage disposal works. The population consists of a people whose diet is largely vegetarian, rice being the staple food, and to what extent the sewage would be amenable to purification in ordinary tanks and filter-beds, as well as what would be the most suitable filtering medium locally obtainable, only actual experience could show. For this reason a small installation of experimental tanks and filters was constructed.

In a place where there is no existing water-carriage system the chief difficulty lay in procuring a sewage which should in composition approximate as nearly as possible to that of the ultimate sewage of the town when the water-closet system will have been installed. In order to do this, night-soil was taken from a public latrine and diluted with water to the strength of an ordinary strong domestic sewage. It was not practicable to obtain a continuous supply of slop water from sinks, as these are almost unknown here, the people cooking, eating and washing in the open air, the slop water being thrown into the nearest open drain or simply on the ground.

The installation was completed in March, 1911, and consisted of a night-soil mixing tank, a small liquefying tank, and three filter-beds. For comparative purposes the beds were first filled with different materials—coke, laterite and coral being used respectively. The sewage, after passing through the liquefying tank, was distributed equally over the surface of the three beds by means of tipping troughs, and the effluent passed freely away from the outlet. The night-soil of 200 persons was taken daily from a public latrine, and treated in this installation. The tank had a capacity of of 750 gallons, and each filter

Roadside Open Drains, Singapore.

an area of 108 ft. and a depth of 4 ft. Samples of the filtered effluent were taken weekly and analysed, and soon showed that the beds were beginning to get into condition, and the effluent to show a greater and greater degree of purification. From the first



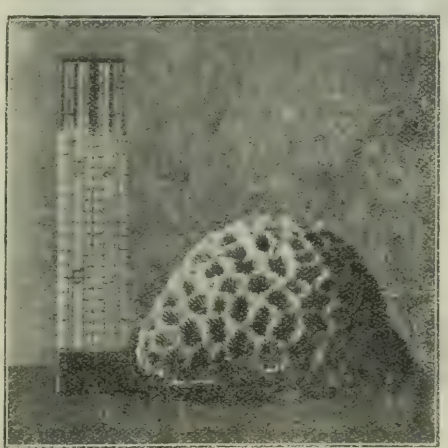
EXPERIMENTAL SEWAGE INSTALLATION, SINGAPORE.

LIVING CORAL COLONIES, TAKEN FROM SEA NEAR RAFFLES LIGHTHOUSE, SINGAPORE.

the effluent from the coral bed was superior to that from the other two, and this superiority was maintained during the next eight months, the beds working continuously all the time.

In December, 1911, the coke and laterite were taken out of the two beds, and granite and destructor clinker were substituted. The three beds then consisted of coral, granite and clinker. These have been working continuously for the last twelve months, and the effluent from the coral bed still shows a greater degree of purification than the other two. None of the beds have ever clogged or given any trouble whatever.

In appearance the coral has not altered at all since it



A DEAD CORAL COLONY.

was first put down, and the sewage apparently has not had the least effect on the structure of the material itself; it is just as hard and porous as the day it was first used. All the materials used—coke, coral, granite, laterite and clinker—were broken up to a 2-in. gauge.

The following analysis, expressed in parts per 100,000, shows the comparative purification of the coke, laterite and coral beds, the subsequent effluents

from the clinker and granite being very similar to that from the coke and laterite beds.

	Crude sewage.	Effluent from coke beds.	Effluent from laterite bed.	Effluent from coral bed.
Free ammonia	1·45	·15	·28	·085
Albuminoid ammonia	1·60	·05	·07	·005
Nitrites	trace	present	present	present
Nitrates	,,	,,	,,	,,
Oxygen absorbed in 4 minutes ...	2·61	·03	·15	·01
Oxygen ,, ,, 4 hours	6·14	·30	·41	1·6

Coral grows in great luxuriance in Eastern tropical waters that used for the experiments being hard, dead coral boulders broken to a 2-in. gauge.

A single live coral is termed a zooid. In appearance it is like a sea anemone with a calcareous skeleton. It has two distinct ways of reproducing itself: first, by larvæ extruded from the zooid; and, secondly, by asexual reproduction or vegetative growth. A larva is in appearance a small piece of yellow jelly-like substance about the size of a pin's head; it is covered with minute hairs, or cilia, by waving which it can propel itself through the water. After a few days the larva settles on something—such as a tree, a rock, or a dead coral, and when once it settles down it is fastened to that spot for life. As soon as it becomes attached it develops into an adult zooid; the end further away from the point of attachment develops a mouth, the body develops a sort of cavity—the stomadœum—and around it calcium carbonate is formed as a sort of skeleton. The adult zooid now begins to reproduce itself asexually, or to grow like a tree, with a new zooid at the end of each new branch. This forms what is called a coral colony; the so-called branches are all fastened together in a mass, and usually take the form of a half spherical boulder.

Sections of Coral Boulder.

One must not think that because the zooids are on the outside of the colony that the inside is dead; it is all alive, and all grows, the inside being very much like the stalks of trees and flowers, but with a network of calcium carbonate all through.

A piece of living coral picked out of the sea is hard to the touch, of a dark grey or green colour, and looks like a very prettily-marked porous rock, the pores of which are full of a living jelly-like matter; but as soon as it leaves the sea it dies, leaving only the calcareous skeleton, which bleaches and becomes of a whitish hue.

On the sea shores where sand is driven, various coral fragments are cemented together into boulders, and it is by these boulders that reefs and islands are formed.

HORSE AND MOTOR TRACTION COMPARED.

In an interesting article in the *Scientific American* for January 18th, Mr. H. W. Perry says that some of the advantages of the motor truck over the team-drawn wagon may be thus summarised:—

The average distance covered per day by a two-horse team varies between 16 and 20 miles, whereas the average distance covered per day by a 3-ton or 5-ton motor truck varies between 40 and 60 miles. Horses and wagons could serve daily an area of 314 square miles on a 10-mile radius; on the other hand, motor trucks, operating on a 25-mile radius, would cover 1,963 square miles.

The work done by a two-horse team per day varies from 48 to 60 ton-miles. On the other hand, motor trucks of from 3-ton to 5-ton capacity perform an amount of work measured by 165 to 225 ton-miles per day.

At $8.50 per day, the cost per ton-mile of hauling by team is 17·7 to 14·16 cents; but the cost per ton-mile of hauling by 3-ton or 5-ton motor trucks at $12.25 to $15.60 per day is 7·42 to 6·88 cents.

Equally remarkable is the amount of space occupied by the horse-drawn truck as compared with the motor truck. A team and wagon is about 26 ft. long, a 3-ton to 5-ton motor truck, 20 ft. long; a four-horse team and wagon is about 39 ft. long; and a 10-ton motor truck, its horse-drawn equivalent, only 25 ft. long. So far as areas are concerned, an ordinary team and wagon will occupy 182 sq. ft., but a 3-ton to 5-ton motor truck only 140 sq. ft.

In the matter of storage-space required for gasoline and feed the motor-truck engine displays an advantage. An amount of hay and oats sufficient to feed a team for one month occupies a volume of 100 cub. ft., but the gasoline required for a motor truck for one month will occupy only 20 cub. ft. The cost of hauling by motor truck is incomparably cheaper than by horse and wagon. Thus, the cost of hauling 1,000 tons 10 miles by horse and wagon is $160, but only $70 by motor truck.

The amount of work performed by one motor wagon is equivalent to the amount of work performed by three and one half average teams. To haul 585,000 tons an average distance of 1 mile in a year would require 100 teams, but thirty-nine motor trucks would theoretically be required to haul the same load an average distance of 1 mile in a year. The cost of keeping and using thirty-nine teams and wagons per year would be $99,450; but the cost of keeping and using ten motor trucks would be only $42,000.

Drainage Works and Sanitary Fittings.—A third edition, revised and brought up to date, particularly as regards the questions of concrete sewers, sewer ventilation and flushing, and the Public Health Acts Amendment Act of 1907, still further evidences the success of this little manual,* which manifestly deserves the attention and confidence of all concerned in the important subject with which it deals.—*The Bookseller.*

*"Drainage Work and Sanitary Fittings." By Wm. H. Maxwell, Price 2s. nett. London: St. Bride's Press, Ltd., 24 Bride-lane, E.C.

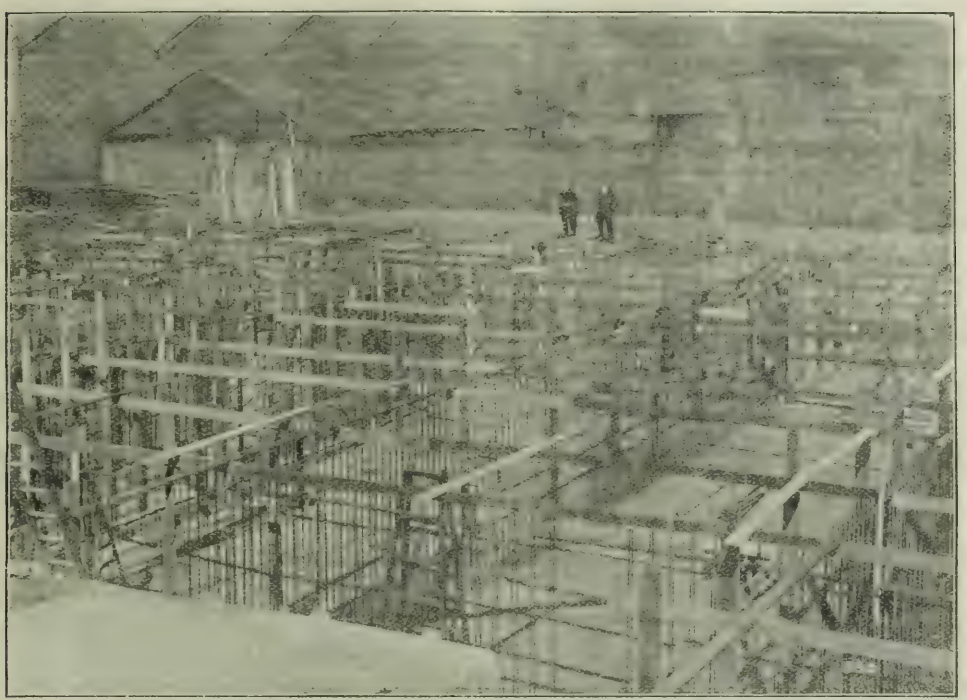
Linthwaite and Golcar Sewage Scheme.

REINFORCED CONCRETE WORK.

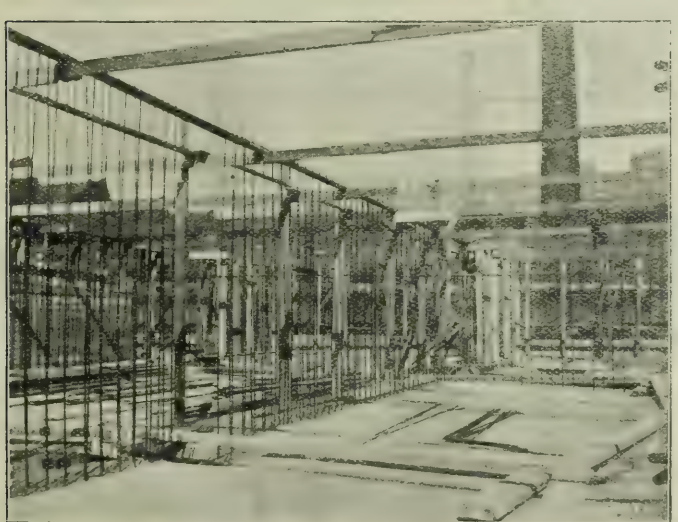
The accompanying illustrations show the reinforced concrete work which has been constructed on the indented bar system in connection with a large sewage scheme prepared by Messrs. Abbey & Hanson, 11 Cloth Hall-street, Huddersfield, for the Linthwaite and Golcar district.

The work includes nine precipitation tanks side by side, each 96 ft. by 20 ft. by 11 ft. average depth, two humus tanks, each 65 ft. 6 in. by 18 ft. by 11 ft. 6 in., and an underground sump 40 ft. by 30 ft. by 12 ft. The sump is of particular interest as the roof is 11 ft. below ground level, and a cross-section of this is given.

This form of construction was particularly suitable in this instance, as the ground on which the works have been carried out is of an exceedingly treacherous nature, the subsoil being soft and saturated with water. The tanks were therefore designed to withstand the pressure of water due to a head of subsoil water in addition to the ordinary earth pressure, and, owing to the fact that they are monolithic in character, no unequal settlement is anticipated.



LINTHWAITE SEWAGE SEDIMENTATION TANK.



LINTHWAITE SEWAGE: THE HUMUS TANK.

The sedimentation tank is particularly interesting, as all cross walls have to be designed so as to resist water pressure from both sides. In order to avoid the expense of making each wall self-supporting from the bottom, a system of horizontal ties was adopted. These ties run from wall to wall, the coping of each wall forming a horizontal beam which supports the top of the wall between the ties. An extremely economical design has thus been obtained. A cross-section of these ties appears herewith.

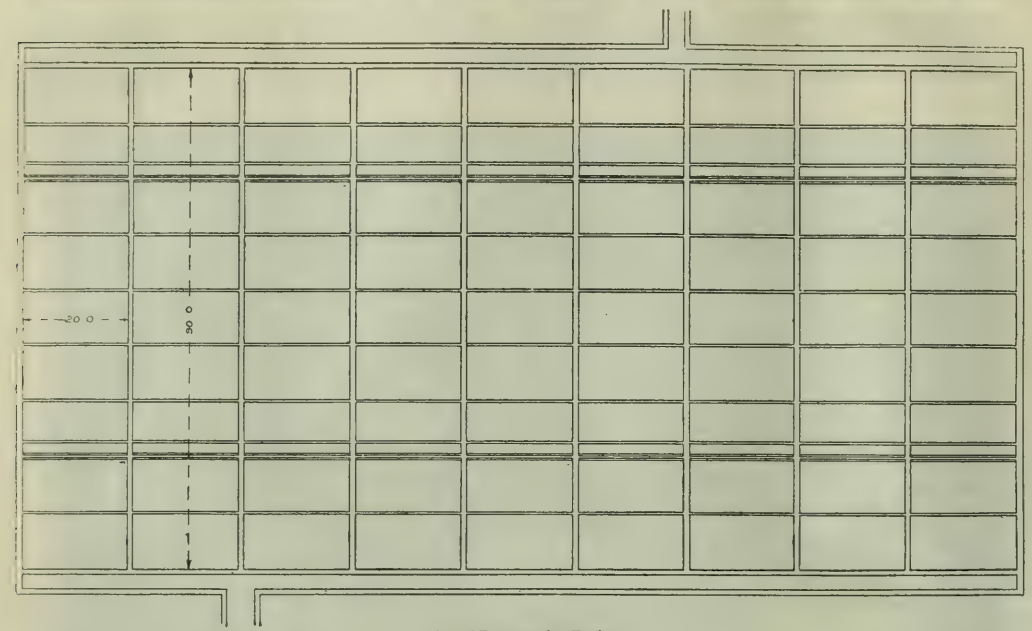
The humus tank also presents a few interesting features owing to the irregularity of the outside walls, some of which, as is shown in the cross-section, are utilised to form channels, &c. There is also an arch bridge, 50 ft. clear span, in course of construction, to carry road traffic and a pipe conduit over the river Colne, but this is not yet in a sufficiently advanced state for illustrations of it to be given.

Messrs. J. Cooke, of Huddersfield, are the contractors for the work, and the whole of the detail drawings and designs have been prepared by the Indented Bar and Concrete Engineering

Company, Limited, Queen Anne's Chambers, Westminster S.W.

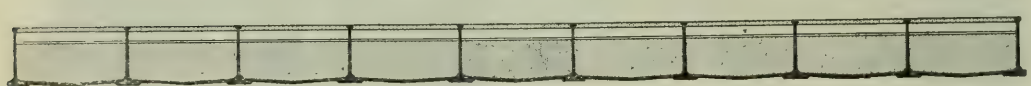
Society of Engineers.—The council of the Society of Engineers (Incorporated) announce that arrangements are being made for holding the Fellowship examination of the society during the second week of June next. Intending candidates should apply to the secretary of the society, at 17 Victoria-street, Westminster, S.W., for full particulars.

The York Town Planning Scheme.—The offer of Dr. Tempest Anderson to give £100 towards a prize fund for the best devised town planning scheme for the environs of York has been formally confirmed. The sub-committee of the Streets and Buildings Committee now recommend the York City Council to grant another £100 to the same object, making the premium £200. In the meantime the surveyor's department (the *Yorkshire Post* states) are busily surveying the districts in which building development outside the present boundary is most likely to occur.



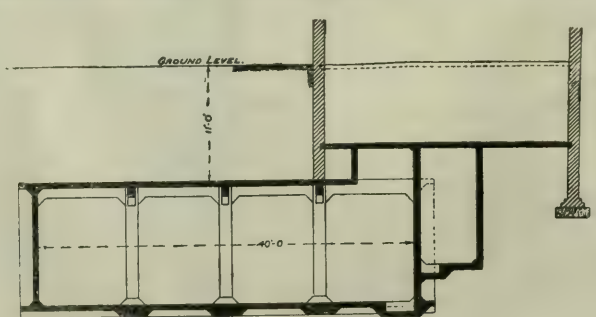
Plan of Precipitation Tanks.

Cross Section.

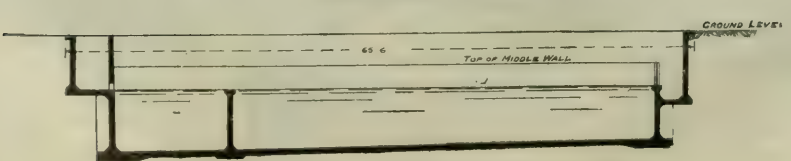


Longitudinal Section.

LINTHWAITE SEWAGE: PLAN AND SECTION OF SEDIMENTATION TANK.



Section through Sump.



Section of Humus Tank.

LINTHWAITE SEWAGE: SECTIONS.

The Legal Precedents of 1912 in Relation to Municipal Engineering.

By J. B. REIGNIER CONDER, a Solicitor of the Supreme Court.

The judicial decisions of the past year on questions interesting to municipal engineers have not been numerous. Among the enactments considered may be mentioned the Lands Clauses Consolidation Act, 1845 (sec. 92), the Public Health Act, 1875 (secs. 148, 174, 211 and 308), and the London Building Act, 1894, and the localities affected include Balby-with-Hexthorpe, Christchurch, Eccles, Islington, Kingsbury, Leicester, Peterborough, and Tottenham.

Compensation by Local Authorities.

An interesting and important point under sec. 308 of the Public Health Act, 1875, was decided in *Lingke* v. *Christchurch Corporation*, vol. xli., p. 769). In this case the corporation, in the course of executing certain drainage works, threw up a heap of soil in front of the plaintiff's shop, rendering the access thereto less convenient. It was held by the King's Bench Divisional Court that, in the absence of a finding that the plaintiff had been deprived of access to her premises to an unreasonable extent, or for an unreasonable time, she was not entitled to compensation under the section. In the Court of Appeal, however, this decision was reversed (vol. xlii., p. 362), it being held that the plaintiff must be compensated, on the ground that the obstruction was of such a nature that if it had been caused by a private individual there would have been a good cause of action against him.

Compulsory Purchase.

The decision in *Regent's Canal and Dock Company* v. *London County Council* does not directly affect local authorities, but it is interesting as a contribution to the numerous cases as to what does and what does not constitute a "building" for certain purposes. The Lands Clauses Consolidation Act, 1845, sec. 92, provides that no party shall be required to sell compulsorily part only of a house or other "building," if such party is willing and able to sell the whole thereof. The London County Council proposed to purchase compulsorily from the company certain land on each side of a bridge over their canal without purchasing the canal itself. The company contended that the canal was a "building" within the meaning of the foregoing clause, but the Court took the contrary view and decided in favour of the council.

Contract of Local Authority.

An important decision as to the validity of unsealed contracts by local authorities is that in *Hoare* v. *Kingsbury Urban District Council* (vol. xlii., p. 212). An arrangement was come to between the council and the plaintiff by which the latter undertook to throw a strip of his land into the adjoining road, and the council undertook to adopt the strip so thrown in and make up the road at their own expense. An agreement embodying these terms was drawn up, signed by the plaintiff, and approved at a meeting of the council, but the seal of the council was never affixed thereto. The plaintiff carried out his part of the agreement, and the council erected gas lamps on the strip, obtained sanction for a loan to make up the road, and advertised for tenders, but for some reason they proceeded no further. The plaintiff claimed specific performance of the agreement, but it was held that the agreement was a contract with the council as urban authority under sec. 174 of the Public Health Act, 1875, and was for more than £50 in value, and that therefore, not being under seal, it could not be enforced.

Damage by Flooding.

The case of *Massey Drainage Board* v. *Great Northern Railway Company* (vol. xli., p. 410) is of interest to all landowners, public or private. The railway company were the owners of a piece of land which was liable to be flooded at times. In order to protect it they enclosed it with an embankment, which had the desired effect. The flood water, however, thus cut off from the land flowed into a drain, burst the embankment, and flooded adjoining land belonging to the board. It was held that the company had done nothing more than was reasonably necessary for the protection of their land, and that they were not liable for the damage suffered by the drainage board.

Dangerous Structures.

The question raised in *London County Council* v. *Jones & Co.* (vol. xli., p. 802) was whether a house can be a "dangerous structure" within the meaning of the London Building Act, 1894, notwithstanding that it is uninhabited and incapable of causing danger to persons using the street. The Court came to the conclusion that if such a house is likely to cause danger to trespassers it is a dangerous structure within the Act.

Electric Lighting.

A point, not altogether novel, but of great importance to electric lighting authorities, was raised in *Attorney-General* v. *Sheffield Corporation*. Mr. Justice Eve (following *Attorney-General* v. *Leicester Corporation*, noted in vol. xxxviii., p. 90) held that the corporation had no power to carry on the business of electric light fitters, and granted an injunction to restrain them from so doing. It was intimated that the case would be carried to the House of Lords, so as to obtain a final adjudication on the questions of law involved, which affect so many persons and bodies corporate.

Highways.

Somewhat complicated questions as to the powers of a railway company to close a public highway were involved in *Great Central Railway Company* v. *Balby-with-Hexthorpe Urban District Council*; *Attorney-General* v. *Great Central Railway Company* (vol. xli., p. 506). The company, under statutory powers, closed a strip, A, of a certain highway. Subsequently they acquired an adjoining strip, B, but without power to extinguish public rights thereon. Later still they purchased a third strip, C (adjoining B), by agreement, under an Act which provided that public rights of way over land acquired compulsorily should be extinguished. It was alleged by the council that A had been rededicated to the public. This was denied by the company, who contended that public rights over C were extinguished, and that if the outer strips, A and C, were closed, the middle strip, B, must be closed also, there being no public right of access to it. It was held that the company had no power to rededicate A, but that C, having been purchased by agreement, and not compulsorily, the public rights over B and C still subsisted.

In connection with the subject of the adoption of *ratione tenuræ* roads the decision in *Re Hodgson's Settled Estates, Altamont* v. *Forsyth* (vol. xli., p. 536) is of importance. Mr. Justice Neville refused to sanction the payment by trustees to a district council of a lump sum in consideration of the council taking over a *ratione tenuræ* highway. His lordship agreed with Mr. Justice Warrington (in *Re Earl of Stamford and Warrington's Settled Estates* [noted in vol. xxxix., p. 623]) that sec. 148 of the Public Health Act, 1875, authorises local authorities to take over *ratione tenuræ* roads in consideration of a lump sum, but differed from him in thinking that (in the absence of express powers) trustees are not authorised to pay such a sum out of trust funds.

The next decision is of considerable interest as an illustration of what constitutes the dedication of a road to public use (*Tottenham Urban District Council* v. *Rowley*, vol. xli., p. 912). The defendant was the owner of a building estate on the south side of a public park belonging to the council. He appropriated a strip of his land next the park as a road, which was thrown open in 1908, when houses were built on the south side thereof. The southern portion only of the road was made up, but the road was used continuously by the public for traffic of every sort. The council having removed part of their fence next the road, in order to obtain access to the latter the defendant blocked up the opening, contending that there had been no dedication of the portion of the road

immediately adjoining the park. It was held by Mr. Justice Joyce that the defendant intended to dedicate the whole width of the road, and that the user by the public had been sufficient to complete such dedication. This decision was affirmed on appeal (vol. xlii., p. 830).

Municipal Tramways.

The decision of the Court of Appeal in *Eccles Corporation* v. *South Lancashire Tramways Company* (noted in vol. xxxvii., p. 244) was affirmed by the House of Lords (vol. xli., p. 662). The Eccles Corporation agreed to lease certain tramways in the borough of Eccles to the Salford Corporation, subject to a condition that the latter should not assign, sublet, or part with the benefit of the agreement or the lease without the consent of the Eccles Corporation. The Salford Corporation, without applying for such consent, granted a licence to the company to work part of the tramway. It was held that such licence was *ultra vires* in the absence of a licence from the Board of Trade.

Personal Injury.

In *Jackson* v. *London County Council and Chappell*, the defendant Chappell was employed by the council to repair the ceiling of a provided school, and tipped a barrowload of sand and lime in the playground. The head master directed its removal, and Chappell gave orders accordingly, but the orders were not carried out. A boy threw some of the stuff into the plaintiff's eye. The jury found that both the council and Chappell were guilty of negligence, and awarded the plaintiff £50 damages, for which judgment was entered. The defendants' appeal, on the ground that there was no evidence of negligence, was dismissed.

Rating.

An important point of rating law was decided in *Metropolitan Electric Tramways, Limited*, v. *Tottenham Urban District Council*. The question was whether a tramway line worked in connection with a light railway as an entire system was "land used as a railway constructed under the powers of any Act of Parliament," within the meaning of sec. 211 of the Public Health Act, 1875, so as to entitle the company to be assessed at one-fourth only of the annual value of the line. The Court answered the question in the affirmative.

Waterworks.

The liability of a water authority for damage due to the bursting of a main was the subject of a dispute in *Stewart* v. *Metropolitan Water Board* (vol. xli., p. 569). The board's water main in Essex-road, Islington, burst, and damaged the plaintiff's shop and stock in trade. The jury found that the burst was not occasioned by a pre-existing fracture, but by some other cause which the board could not have been reasonably expected to discover. Judgment was given for the board.

THE LEGISLATION OF 1912 IN RELATION TO MUNICIPAL ENGINEERING.

Only twenty public General Acts of Parliament received the Royal Assent during the year 1912, and as none are directly concerned with matters connected with municipal engineering, detailed reference to them is unnecessary. We can only hope that the exigencies of parliamentary and political matters will permit of a more fruitful crop of legislation, from the municipal engineer's point of view, during the present year.

Municipal Golf Courses.—The Parks Committee of Birmingham City Council are considering the establishment of a municipal golf course, the proposed site being at Castle Bromwich. Edinburgh (says the *Daily Mail*), with six public courses, claims to have been the pioneer of municipal golf. London has public courses at Chingford and at Hainault Forest; Nottingham has two courses, and Manchester has had one in Heaton Park, a great public open space, since 1911. Sunderland and Liverpool have similar schemes under consideration. Several sea-side resorts include municipal golf among their attractions. Brighton and Bournemouth are instances. Yarmouth has a scheme in hand, and Southport has considered a similar proposal.

SALARIES AT LLANELLY.

TEN SHILLINGS WEEKLY AFTER SEVEN YEARS.

A meeting of Llanelly Urban District Council was held recently to consider the suggested re-arrangement of the salaries of the deputy surveyor (Mr. J. H. Montgomery) and the junior assistant surveyor (Mr. Gough Thomas). A sub-committee which had had the matter before them had, it was reported, been unable to come to any definite decision.

It was stated by the chairman (Mr. H. D. Rees) that Mr. Gough Thomas was appointed on July 20, 1905, at a salary of £26 per annum, which was equivalent to 10s. per week, and had received no increase since. The sub-committee felt it was necessary to advance the salary of Mr. Thomas, and they felt similarly disposed to Mr. Montgomery, who was appointed in March, 1899. Mr. Montgomery had been in the council's service for twenty-four years, and only received £150 per annum at the present time.

Replying to Mr. W. H. Samuel, the deputy surveyor said that Mr. Thomas was twenty-four years of age.

Mr. D. James Davies: A young man twenty-four years of age getting 10s. a week!

Mr. J. Walter Thomas: Has he only been paid 10s. a week all this time?

Mr. D. Richards: We must remember that he has been taught his trade.

The Chairman: It is a very poor trade at £26 a year. He was articled to Mr. Watkeys for five years and after the experience he had gained during that period he was engaged by the council——

Mr. Davies: At the handsome salary of £26 a year (laughter).

Mr. J. L. Jones moved that the salary of Mr. Gough Thomas be increased to £78 per annum.

Mr. E. T. Jones: It appears altogether ridiculous that a professional gentleman after having served under a public authority for seven years should only be paid 10s. a week. In my capacity as chairman of the council and chairman of various committees I frequently came into contact with the officials, and I have some knowledge of the amount of work that has been done. To expect a young man to take levels, draw plans, and do clerical work for anything less than £78 per annum is unreasonable, and I can only attribute the fact that he has remained in our service to his having been paid privately by the surveyor. You cannot get an office boy or a lad in the tinworks for 10s. a week.

The Chairman: Does anybody second the resolution?

Mr. E. T. Jones: I will go further. We all recognise the services of Mr. Montgomery to the town in the past—his length of service, his Parliamentary experience, and the way in which he has carried out his duties. We have too high an appreciation of him to suggest anything less than £200, and an annual increment of £10 until £250 is reached, and at the end of that period he can put in a fresh application. It would be ungrateful on our part to offer him less, and I move a resolution accordingly.

On the chairman's suggestion Mr. Thomas' case was considered first, and the motion that he be paid £78 per annum was agreed to, with only one dissentient.

Mr. E. T. Jones' motion that Mr. Montgomery's salary be increased to £200, with annual increments of £10 up to £250, was then taken.

The chairman seconded the motion.

Mr. W. H. Samuel said he quite agreed with the resolution proposed. He had always been ashamed to think that they, as a public authority, paid a professional man less than tinplate manufacturers had to pay for first help in the cold-rolls department. He was in favour of paying their officials what he considered to be a fair rate of remuneration for their services. It was finally resolved that Mr. Montgomery's salary should be increased to £200, with two annual increments of £20 and one of £10. The chairman, addressing the deputy surveyor, said the fact that the motion had been passed unanimously showed their appreciation of his services.

Proposed New Road to West Hartlepool.—With regard to the proposed 30-ft. road to be made by the Tees Conservancy Commissioners from Port Clarence to West Hartlepool, a conference has taken place between representatives of the Middlesbrough, Stockton and West Hartlepool Corporations with the object of having the road widened to 50 ft. or 60 ft., and it has been decided that particulars of the cost should be obtained and laid before another meeting of the conference to be convened by the town clerk of West Hartlepool.

Works Projected by Local Authorities for 1913.

Important proposals in all departments of municipal activity will be found noted in the large number of interesting returns which, set out herewith, we have received for the eighteenth successive year from engineers to public bodies in all parts of the United Kingdom. In submitting this widely-appreciated feature of our Special Annual Issue we would take the opportunity of expressing grateful thanks to all who by their kindly co-operation have once again made possible its compilation. As is well known, the information presented is obtained entirely from official sources, and its reliability as a guide to the intentions of public authorities in the coming financial year is therefore amply guaranteed. Both in number and in the matter of expenditure the projects reported show an increase over the twelve months just ending. The important questions of road maintenance and housing are naturally claiming a larger share of attention than hitherto, and the outlay in these connections may be expected to constitute a record and provide an exceptional amount of work in all parts of the country.

Abergele and Pensarn (Mr. M. R. JONES, surveyor to the urban district council).—The council are now seriously considering the advisability of embarking upon a housing scheme for the poorer class. It is proposed to carry out some time during the year a complete scheme of surface-water drainage for the greater part of the district. Road widenings and improvements will shortly be carried out, also an extension of the sewerage system, and the resurfacing and tar-spraying of carriageways.

Aberystwyth (Mr. REES JONES, M.I.MUN.E., borough engineer and surveyor).—In the present Session of Parliament the corporation are promoting a Bill to authorise the laying down of a duplicate trunk water main from Plinlimon (16½ miles), and the carrying out of other works connected therewith, at an estimated cost of £28,240. The sanction of the Local Government Board to the erection of fifty-four workmen's houses has been obtained, and the contract for thirty of these has been signed at £5,000. The council have under consideration the advisability of extending and remodelling the sewerage system, and it is intended to carry out a portion of the work during the year. Private street improvement works are to be done, and additional public conveniences are to be provided. The council have also applied for a Provisional Order to extend their borough boundaries by taking in an area of nearly 4,000 acres.

Acton (Mr. FREDERICK SADLER, F.G.S., engineer and surveyor to the urban district council).—There are many indications that there will be considerable developments of this London suburb during the coming year. The extension of the Central London Railway to Ealing, which is in course of construction, crosses the district in cutting, and several new bridges will be erected and old ones widened. The Goldsmiths' Company are laying out a large estate within the district on garden city lines, and extensive building operations in that area are anticipated. The council have received the sanction of the Local Government Board to a large loan for resurfacing with tar-macadam many streets in the district. Contracts have been entered into for some of this work, and it is anticipated that a very large number of streets will be repaved with one or other of the newer methods of resurfacing during the year. Other public works projected are a new elementary school; administrative buildings at the isolation hospital; the laying out of a public playing field; the culverting with reinforced concrete pipes of the Bollo-lane watercourse; and a northern relief sewer, the last-named being estimated to cost £20,000. The council are also proceeding with a town-planning scheme for an area of about 1,000 acres in the northern part of the district. Of course, in addition to the above special works, there will be the ordinary routine works of private street improvements, extension of sewers, and so forth.

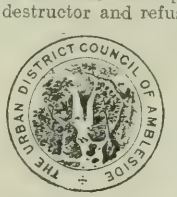
Aldershot (Mr. FRED. C. UREN, surveyor to the urban district council).—The projected works for 1913 comprise reconstruction of the main outfall sewer of the central district to 45 in. diam.; provision of surface-water outfall, 48 in. diam.; additions to the refuse destructor; new engine and pumps at the disposal works, at a total cost of £12,300; the construction of three public conveniences, two underground, and a number of private streets; and extension of tarmac roadways and those built up of bituminous material.

Alfreton (Mr. R. F. WARD, surveyor and water engineer to the urban district council).—During the year the council propose to lay a new 7-in. water main between Butterley and Lindway reservoirs, a distance of 3,100 yds. Alternative schemes of enlarging Butterley reservoir or of pumping from a disused lead mine at Ashover are under consideration. Pentrich-lane, Swanwick, will be widened at an estimated cost of £1,400, and a lesser improvement will be made at Newlands-road, Riddings. A ladies' lavatory will be provided, and filters will be made at Pye Bridge sewage disposal works.

Alsager (Mr. H. V. LYNAM, surveyor and inspector of nuisances to the urban district council).—Building operations in connection with the sewage disposal scheme will be commenced early in the new year. The experimental boring at the Oak farm has been entirely successful, and an abundant supply of water has been found. The council are pushing on with all speed the preparation of a complete water scheme for the district, and it is hoped that they may be able to apply for a loan within a few months. New sewers and extensions are to be made, and with the benefits of both a new sewage disposal and water scheme greater activity is anticipated in all trades throughout the year.

Alton (Mr. G. BERTRAM HARTFREE, F.S.I., M.INST.C.E., surveyor and water engineer to the urban district council).—Schemes of waterworks extensions, sewer construction and private street improvement are proposed.

Altrincham (Mr. HARRY E. BROWN, surveyor to the urban district council).—Further works of surface-water sewerage are anticipated, together with extensive additions to the sewage disposal works. It is hoped during the year to complete the housing scheme, which will comprise fifty-four cottages and twenty-eight cottage flats. The work of widening and remaking Ashley-road, at an estimated cost of £1,155 (towards which the Road Board has made a grant of £300) is in hand. A site has been purchased for the purposes of a destructor and refuse tip.



Ambleside, Westmorland (Mr. C. WATSON, surveyor and inspector to the urban district council).—Work in connection with the new sewage disposal scheme, it is hoped, will be commenced at an early date, and tenders are to be invited shortly. A new concrete storage sewer will be constructed at Waterhead. In order to try and meet the urgent need for workmen's dwellings, the council propose to erect eight cottages upon land belonging to them, and plans were prepared by the surveyor, but it has been decided to let the matter stand over for a while, as there is a possibility that some twenty cottages will be erected by private enterprise. A convenience for both sexes will probably be erected in Rothay Park, and the road leading to Stock Ghyll Park taken over as a public highway. Low Stock Bridge on the main road has been widened. The main roads will be tar-sprayed as in past years.

Ammanford (Mr. DAVID THOMAS, M.I.MUN.E., M.I.H., engineer and surveyor to the urban district council).—The following is a list of the works intended to be carried out this year: Private street works, completion of a retaining wall at a point on the river

Amman known as Graig Goch, and of the extensions to the water supply, and surface treatment for prevention of dust on the roads. In addition, the council intend to erect some public conveniences.

Arbroath (Mr. P. C. SMITH, burgh and water engineer).—In addition to the ordinary work of road and sewer maintenance, the following is contemplated: The construction of a screening chamber on the main outfall sewer; the reconstruction of the Sheriff Court-house; the erection of public swimming baths; the construction of a new street, and the widening of two other important streets. A proposal is also receiving consideration for the erection of foreshore protection walls at each end of the town. The old properties in the vicinity of the Abbey will also be cleared out and the ground laid out as an open space.

Ashborne (Mr. J. ABBOTT, engineer and surveyor to the urban district council).—The present year has brought about many developments in this town. The council have promoted a Bill in Parliament to acquire the whole undertaking of the Ashborne Gas Company, which has received the Royal Assent, and accordingly statutory powers have been obtained. It is anticipated that the undertaking will be transferred early next year. The question of providing an auxiliary water supply for the town, and supplying two villages and farms en route, has received consideration. It is proposed to construct a well and heading, and sink a borehole on land owned by Sir Peter Walker, Bart., a distance of 4 miles from the town, and to pump the water to a new reservoir to be constructed on the Derby-road, near Osmaston, at an altitude of 602 ft. above ordnance datum. From thence it will flow by gravitation to the present waterworks, and alternately to the town mains. The widening of Clifton-road sanctioned by the Road Board has been completed. Grants towards the cost of this work will be made by the board and the Derbyshire County Council. Street improvement schemes, road repairs and tar-spraying work have been carried out. Extensions have been made to the sewerage system, and new sewers have been laid in lieu of leaky sewers found in waterlogged ground. Additional new cattle pens have been provided, and the auction rings extended in the cattle market. Additions and alterations have been made to the hospital, including a nurses' sitting-room, three bed-rooms, bath and lavatory accommodation, extension of operating theatre, dinner lift, and a complete electrical installation of day and night bells. A very large condensed milk factory is in course of erection and nearing completion for the Nestle & Anglo-Swiss Condensed Milk Company, and when completed will find employment for 200 persons.

Barnard Castle (Mr. H. E. RAINE, A.R.SAN.I., surveyor to the urban district council).—The Local Government Board have under consideration an application to borrow money for the following purposes: Road improvements in Upper and Lower Galgate, and conveniences and a low-level sewer for Bridgegate. Other works to be carried out during the year include the removal of dwelling and warehouse property in Bridgegate for road-widening purposes, the making up of two private streets, back streets, and the erection of a building to house the fire engine and ambulance, together with the usual routine work of maintenance to roads, sewers, and paths in the picturesque and extensive woods adjacent to the town.

Barnes (Mr. G. BRUCE TOMES, ASSOC.M.INST.C.E., engineer and surveyor to the urban district council).—Several important schemes for the improvement of the district will be commenced. The High-street of Barnes and Sheen-lane, Mortlake (both county main roads) are to be widened, and, in addition, the carriageway of the latter is to be wood paved. The Malthouse area is to be dealt with under the provisions of the Housing of the Working Classes Act, involving the removal of a number of old cottages, and the erection of many new artisans' dwellings. The flood prevention works now in progress will be completed by the construction of a river wall about 730 yds. long, composed of solid concrete blocks with piers. The council have also approved a scheme for the erection of a tuberculosis sanatorium and dispensary, and a committee has been appointed to consider the provision of swimming baths for the district. Many new streets will be made up under the Private Street Works Act, and the town planning scheme will be proceeded with.

Barnsley (Mr. J. HENRY TAYLOR, M.INST.C.E., borough surveyor and waterworks manager).—The present year is likely to be rather an eventful one in the history of Barnsley. The town will become a county borough on April 1st, and that will involve considerable changes in the administration of the various departments of the corporation, entailing much work upon the principal officials. It is probable also that extensive street improvements will be carried out, and a site selected, at any rate, for a new town hall. The question of a new joint station for the town will also have to be faced, and, it is hoped, proceeded with during the current year, but this depends largely upon the railway companies themselves, who are very much averse to the expenditure of a large capital sum unless they can see a good return of interest on the same. The waterworks, sewage works, electricity works and public markets are now in a fairly complete state, and no change is likely to take place in them. The introduction of new industries is hopefully expected, the principal being a cotton spinning mill, which it is in contemplation to work, and the reopening of a colliery which is on the outskirts of the town. There are also indications that considerable building operations will be undertaken by a private concern within 2 or 3 miles of the borough, and this will probably affect business beneficially. The conversion of privies into water-closets is the chief sanitary improvement now being carried out. The infectious hospitals being in a complete and efficient state, capable of dealing with any ordinary outbreaks of infectious diseases, no further extension of them is probable. The extension of the public park will probably take place by the addition of 8¼ acres to the existing Locke Park. Altogether the current year shows signs of being a progressive one here so far as the public works and private enterprise are concerned.

Barnstaple (Mr. E. Y. SAUNDERS, M.R.SAN.I., borough surveyor).—During the year it is proposed to renew the defective wood-block paving in High-street at an estimated cost of £460. Tar-spraying some 7 miles of roads, chiefly main roads, will be carried out as last season. It is most probable that the Sticklepath district of the town will receive attention by the provision of storm-water sewers to abate the floodings complained of by residents. Shelters will be erected in the Rock Park, and various improvements in the parks generally. The usual small drainage extensions will be carried out in various parts of the borough.

Barrowford (Mr. G. W. HEWES, M.I.MUN. AND C.E., surveyor to the urban district council).—Alterations and additions to the sewage outfall works, involving provision of septic tanks, circular percolating filters and humus tanks, are expected to be carried out. Further private street improvement works are to be put in hand, also a main road improvement, and the erection of granite drinking trough and fountain. Further lengths of macadam roads are to be tar-sprayed.

Barrow-in-Furness (Mr. ARTHUR RACE, borough engineer and surveyor).—In addition to the usual making up of private streets under the statutory powers, and a continuation of the conversion of water-bound macadam roads to tar macadam, it is expected that a road improvement and widening in Salthouse-road will be carried out at an estimated cost of £2,000; also a similar improvement and widening in Fairfield-lane, at an estimated cost of £2,500. New elementary schools in the Hindpool district will be erected at a cost of £8,000; also new public fresh and salt water swimming baths, at an estimated cost of £16,600. Further progress with the laying out of the public park will be made by erecting new tennis and bowling pavilion, including refreshment room; also new entrance gates and shelter at an estimated cost of £1,500. Alterations and additions will be made to the police stations at a cost of

£2,500. Two new pavilions will be added to the Devonshire-road fever hospital, at an estimated cost of £6,200. The six houses and outbuildings in course of erection on the small holdings estate will be completed during the year at a cost of £2,450. It is expected that extensions will be made to Biggar Bank by the addition of about 15 acres of land, and that a road will be constructed in connection with the same, and a new pavilion, or extension of existing pavilion, dealt with. Schemes for providing houses for the working classes, amounting to £60,000, will be considered, and for the extension of the covered market, amounting to £1,500. The four town-planning schemes will, it is hoped, make further progress towards finality. The electrification of the sewage-pumping plant will receive further consideration, and schemes for new sewer outfalls will be prepared. A site for a sanatorium for consumptives will be purchased, and plans will be prepared for a sanatorium. Extensions to the electricity works, at a cost of £985, excluding plant, will be completed during the year. Extensions will be made to the corporation storeyard and depot in Ramsden-street, at a cost of £1,250.

Basingstoke (Mr. F. REGINALD PHIPPS, ASSOC.M.INST.C.E., F.S.I., borough surveyor and waterworks engineer).—The chief work outlined for the coming year is the establishment of an electrical undertaking, for which a provisional order is being obtained; a scheme has been prepared by the borough engineer and approved by the council, the estimated cost being £12,590. The storm-water drainage and channelling work, for which a loan has been sanctioned, will be commenced in the spring. The provision of a public abattoir is again engaging the attention of the council. A site has been obtained, and plans are being prepared, for a new fire station, and negotiations are proceeding between the borough and rural district councils for the services of the brigade in the country districts, and the provision of a motor engine. All the main roads and streets will again be tar-sprayed, and several lengths of tar macadam laid. The extension of the sewage farm is also under consideration. The new county asylum, estimated to cost £300,000, will be built adjoining the borough boundary, and the foundations and light railway have already been commenced.

Batley (Mr. OSCAR J. KIRBY, ASSOC.M. INST.C.E., borough engineer).—The principal works to be taken in hand by the corporation this year are the widening of Mayman-lane and Healey-lane, extensions to the council's schools at Healey, and the paving of Alexandra-road and Grange-road with granite. The estimated cost of these works is £9,361. Also further extensions to the sewage disposal works, which are estimated to cost £16,395.

Belfast (Mr. H. A. CUTLER, M.INST.C.E., city surveyor).—The chief works likely to be carried out this year are alterations to police courts and offices (£5,000), completion of new public abattoir and chill rooms (£45,000), clearance of old property, making of new streets and widening old ones (£150,000), and the erection of 252 houses on improvement scheme, the designs for which, submitted in competition, are now being examined (£25,000). Several underground conveniences are under consideration. Flood prevention works and sewage purification works, including a ferro-concrete outlet sewer, 1 mile long, on slob-lands, to replace the wooden chute constructed under Act of 1887 (£100,000), and district sewers (£30,000), are also proposed. There is also a Bill before Parliament for the reclamation of part of foreshore of Belfast Lough, which will embrace embankments about 3½ miles long (estimated to cost £100,000). The usual miscellaneous works in a large city will, of course, go on.

Belper (Mr. ROBERT C. CORDON, engineer and surveyor to the rural district council).—In addition to the maintenance of the 162 miles of highways, the improvement to various dangerous corners and widening of several lengths of roads will be carried out. The new sewerage scheme for the township of Crich will be commenced, the estimated cost being £10,250. Plans for a new bridge over the Derwent at Allestree Ford, with a span of 120 ft., will be prepared, other undertakings being sewerage and water supply works for part of the parish of Denby, water supply works for part of Mapperley parish, and the completion of a water supply scheme for the township of Duffield.

Beverley (Mr. E. PICKER, surveyor to the rural district Council).—The council are about to carry out a scheme of sewerage and sewage disposal for Brantingham and Elloughton-cum-Brough. The works consist of sewers, with the necessary manholes and the like, screening chamber, tank sewer, automatic tidal flap, and outfalls into the river Humber. The works have been designed by and will be carried out under the superintendence of Messrs. Fairbank & Son, M.INST.C.E., of Lendal, York.

Bexhill (Mr. GEO. BALL, ASSOC.M. INST.C.E., borough engineer and surveyor).—The corporation have in course of construction a scheme of storm-water sewers, with storm-water overflows, and enlargement of storage tanks at the sewage outfall, estimated to cost £4,300. These works will be completed about May 1st next. Contracts have been entered into for the construction of two hard tennis courts in connection with the extension of the Pleasure Gardens, now being laid out at an estimated cost of £1,110. Thirteen new groynes on the foreshore are in course of construction, and will be completed early in the new year, at an estimated cost of £1,950. An apron to the sea-wall will probably be taken in hand in the spring, at an estimated cost of £1,650, and sanction to the borrowing of this amount has been obtained. Iron fencing to complete the new sea wall and promenade will cost £250. Tenders are now being invited for the construction of a number of private streets, at an estimated cost of £2,877, and others are in contemplation, together with the improvement and widening of old highways. The council have under consideration the erection of a sub-fire station at Little Common, and the question of the erection of a new isolation hospital may come under consideration. The tar-spraying of the whole of the main roads and town area will again be carried out. The building trade is good; many large schools and residences are in course of erection, and building estates under development.

Bilston (Mr. VINCENT TURNER, ASSOC.M.INST.C.E., A.M.I.MECH.E., water engineer and surveyor to the urban district council).—During the past year the fire station and sanitary depot have been completed, and also a considerable length of pipe sewers. It is anticipated that the present year will see the completion of the sewerage extensions, the sanction for which has already been obtained from the Local Government Board. Other schemes under consideration are a public convenience, alterations at the Market Hall, including the provision of new shops, and the extension of the fever hospital. A much more extensive programme for tar-spraying has been approved, and an application has been made to the Road Board for assistance.

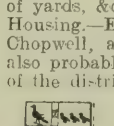
Birkenhead (Mr. CHAS. BROWNRIDGE, M.INST.C.E., borough engineer and surveyor).—The council have decided during the coming year to make application to the Local Government Board for inclusion within the borough of the outlying townships of Higher Bebington, Lower Bebington, Storeton, Prenton, Noctorum and Bidston, comprising an area of about 6,182½ acres. They have also agreed to purchase from Sir William Hesketh Lever, Bart., subject to the approval of the Local Government Board, the Leverhulme estate, which includes the whole of the Parish of Storeton and various outlying plots, and comprises an area of about 1,529 acres, and if the purchase is approved by the board parts of the land will be utilised for various municipal purposes, and a great part of the residue will be at once developed on modern town-planning lines. Tenders will shortly be invited for alterations at the abattoirs, the laying out, drainage and erection of conveniences and shelters on a large plot of land recently purchased for recreation purposes, and for the erection of public conveniences in various parts of the borough. It is also anticipated that the reconstruction of old and constructing of new intercepting and main outfall sewers as necessitated by the recent development and building up of certain parts of the borough will be undertaken during the course of the year.

Birmingham (Mr. HENRY E. STILGOE, M.INST.C.E., city engineer and surveyor). River and Sewerage Works.—A contract is in progress for the reconstruction of the roof of the Hockley Brook at Holborn Hill, where it crosses under land upon which is being built a new foundry for the Messrs. John Wright and Eagle Range Company, Limited. The roof, which replaces existing brick arches, is being constructed in concrete reinforced with girders and expanded steel. A contract will shortly be let for the reconstruction of the brook course in the Factory-road area, and is designed to stop flooding, which constantly occurs at this point. The question of doing away with the sewage farm at Acock's Green is under consideration, and schemes have been prepared with a view to finding the best means of conveying the sewage from Acock's Green to the farm at Cole Hall. Hall Green Sewerage—A 3 ft. 6 in. by 2 ft. 6 in. main sewer along valley of river Cole with branch sewers to drain Hall Green district (estimated cost £19,000); Woodthorpe-road, King's Heath—Extension of 18-in. and 9-in. sewage and storm-water sewers (estimated cost £1,127); Salford Bridge-road, Wheelwright-road, and Bromford-lane, Erdington—Sewage and storm water sewers, varying from 3 ft. to 9 in. diameter (estimated cost £4,795); Fentham-road Bridge—Reconstruction of sewer across bridge; 15-in. cast-iron pipes (estimated cost £75); Merretts Brook Sewer—Reconstruction of main valley sewer from Pershore-road to Bristol-road, including sewer through Messrs. Cadbury's works; Hay Mills Sewerage—A 24-in. main sewage sewer from Cole Valley, main 21-in. and 18-in. pipes along Deaking-row and Redhill-road, 12-in. and 9-in. sewage sewers and 30-in. and 24-in. surface-water sewer crossings under Warwick and Birmingham Canal (estimated cost £6,008); Tame Valley Sewerage—New main valley sewers to drain high and low level areas at Witton, Handsworth and Erdington; Roberts-road—Reconstruction of sewage and surface water sewers (estimated cost £930); Warwick-road, Acock's Green—Diversion of surface-water sewer and reconstructing existing sewer (estimated cost £370); Hagley-road—Reconstruction of sewage sewer (estimated cost £680); Shendley Fields—Extension of California sewer to Shendley Cottage Homes (estimated cost £1,000). Public Street Improvements.—Corner of Bull-street and Colmore-row; Wheelwright-road, Erdington; Bow-street; War-lane, Harborne; Grove-lane, Handsworth; May-lane, King's Heath; St. Margaret's-road; Forman's-road, bridge and street works; King's-road, bridge and street works; Stratford-road, river bridge; Aston Church-road, bridge and street works; Witton-road, bridge and street works. Private Street Works.—Robert-road, Small Heath; Robert's-road, Acock's Green; Livingstone-road, King's Heath; Vicarage-road, Handsworth; Springfield, Erdington; St. Edward's-road, Bournbrook; Common-lane, Washwood Heath New Streets.—Rose Hill-road, Handsworth; Golds Hill-gardens, Handsworth. Street Paving Works.—Wood: Lodge-road, Bennett's-hill (portion), Great Charles-street (portion), Hagley-road (sides of tramway); granite: Landor-street, Arden-road. Reconstruction of Streets.—Hamstead-road, Handsworth; Perrott-street, Handsworth; Lombard-street; Highgate-street. Buildings.—Police station, Digbeth; new offices, council house; alterations, Moseley-street police station; alterations, engineer's house, Windsor-street gas-works; new fire station, Aston; new weights and measures offices; new courts and offices; alterations to police stations at King's Heath and Selly Oak. Town Planning.—Quinton and Harborne scheme, East Birmingham scheme, North Yardley scheme, South Birmingham scheme. Tramways. Hand-sworth tramways, Hagley-road tramways.

Blackburn (Mr. W. STUBBS, ASSOC.M.INST.C.E., borough and water engineer).—The principal work in the engineer's department at present in progress is the construction of a reservoir to hold about 140,000,000 gallons. This is expected to be completed in about two years, at a cost of £65,000. Sanction to the preparation of a town-planning scheme for dealing with 887 acres has already been obtained, and the Local Government Board inquiry into the matter will shortly take place. The erection of large verandahs at the isolation hospital as a sanatorium for consumption is one of the minor matters which will receive attention during the coming year. Large underground conveniences for both sexes will also be constructed; and a recreation ground containing two 120-ft. diameter bowling greens and playgrounds for boys and girls will be laid out.

Blackpool (Mr. JOHN S. BRODIE, M.INST.C.E., borough engineer and surveyor).—The contract for the renovation of the Cocker-street Public Swimming and Marine Baths is now being vigorously carried on with a view to the baths being ready for reopening before next season commences. Four new public sanitary conveniences are being rapidly pushed forward, and when completed will be a useful addition to the existing accommodation for the crowds of visitors. Additional pumping plant and other provisions for dealing with storm water are being put down in connection with the sewerage of the low-lying districts of the borough. The council have under consideration a large new scheme, prepared by the borough surveyor, for continuing the sea-defence works from their present termination at South Shore to the southern boundary of the borough, a distance of 1¼ miles. The estimated cost is £50,000. A town-planning scheme is also embodied in the above for laying out the land between the proposed new promenade and the railway. The Marton tramway car shed is being doubled in length and capacity, and useful additions are being made to the Blundell-street car shed. One municipal bowling green has been laid down during the past year, and another will be laid down in readiness for next season. A large new higher elementary school is being erected, from the borough surveyor's plans, to accommodate about 1,450 scholars. About 1 mile of tramway track will be relaid. About 5 miles of private streets will be made and apportioned during the year, while about £2,000 will be spent on public street improvements.

Blaydon (Mr. GEORGE SYMON, M.R.SAN.I., M.I.MUN.E., engineer and surveyor to the urban district council).—The following is a list of the works at present in view for the year 1913: Roads.—In addition to the ordinary maintenance and repair of 9·2 miles of main and 37·5 miles of district roads, plus streets, &c., it is proposed to improve by penning and pitch grouting and otherwise part of the former, to make considerable improvements to the latter by forming, kerbing, cementing, and tar-paving footpaths at Winlaton, Rowlands Gill, Spen and Chopwell. Private Streets.—Completion of works in progress at Rowlands Gill; works sanctioned at Chopwell; works ordered at Blaydon, and probably others at Blaydon, Winlaton, Spen and Blackhall Mill, and possibly others at Rowlands Gill and at Chopwell. Sewerage.—Extending the system at Blaydon; relaying some sewers at Blaydon, Spen and Blackhall Mill. Sewage Disposal.—Completion of new works for Chopwell, &c., and commencement with others for Rowlands Gill or Barlow. Lighting.—Some minor improvements to street lighting at Blaydon, Stella and Winlaton. Public Conveniences.—The erection of conveniences at Blaydon, Winlaton, Chopwell, and Blackhall Mill. Scavenging.—Improvement to the system formerly in vogue at Blaydon, and possibly purchase of horses, carts, &c., for this purpose. Depots.—Reconstruction of buildings and formation of yards, &c., as depots at Winlaton and Chopwell. Housing.—Erection of houses already agreed to at Chopwell, and possibly extension of that scheme; also probable preparation of schemes for other parts of the district, possibly Spen.



Bognor (Mr. OSWALD A. BRIDGES, L.R.I.B.A., M.R.SAN.I., engineer and surveyor to the urban district council).—Owing to the ever-increasing popularity of this charming south-coast watering-place, much public work will have to be undertaken during the coming year, and Mr. Bridges is evidently the right man in the right place to undertake such work. Mr. Bridges has been in his present position as town surveyor for nearly seventeen years, and can therefore be relied upon to understand what is required to keep the place in the forefront as an up-to-date resort for both winter and summer visitors. The unrivalled sands are no doubt a great attraction and a big asset to the town. The sewerage outfall scheme, which will cost over £10,000, will be carried out during the spring. The eastern extension of the promenade will be completed before the summer season commences. Some flood-prevention works are to be carried out in York-road immediately to prevent flooding, which occurs in that locality during south-westerly gales, when the roads are flooded with sea water. Richmond-avenue (West), Goodman-drive and Greenlane will probably be made up under the Private

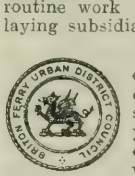
Street Works Act, 1892. Thirteen cottages out of a scheme of sixty-four are now being erected in Sheep-wash-lane under the Housing of the Working Classes Act. Extensive widening, kerbing and channelling is being carried out in Chichester-road, which also entails a new surface-water scheme for the whole of that portion of the town. The council have decided to make an open-air bathing station at the east end of the promenade, where a large bathing cabin will be erected. A scheme to widen the Marine Drive, opposite Lansdowne Mansions, at a cost of £6,000, which is under consideration, will mean another sea wall and promenade 35 ft. seawards, and a portion of the promenade will be thrown into the road to widen it.

Bolton (Mr. E. L. MORGAN, ASSOC.M. INST.C.E., borough engineer and surveyor).—Many important works have been carried out during the year, including the repair and maintenance of main roads and highways, involving an expenditure on this work alone of £13,000. Private street improvement works have involved an expenditure of £20,000. Many important sewer operations have been carried out in the various districts during the year. Several improvements have been carried out in various parts of the borough, including Junction-road, Deane, Crown-street, Markland-hill, Smith's-road, junction of Trinity-street and Bradshawgate, Gilnow-road and Park-road. For the tramways department the streets department have reconstructed a short length of line in Bridge-street, reconstructed the junction into Shiffnall-street car shed, and also constructed the junction into Carlton-street new repair car shed. In addition to this the streets department are responsible for the repair and maintenance of the permanent way. The new repair car shed, Carlton-street, which is now nearing completion, comprises the following departments: Wheel and truck, electrical equipment, body, paint, smithy, turning and fitting, armature, metal working and retyring, together with the necessary stores and offices. The various shops are fitted with up-to-date machinery, including drilling, slotting, shaping, grinding, mortising, sandpapering and metal-working machines, circular saw, hand and power feed planer, single and upright moulder, band saw and power hammer. A traverser has been laid down for bodily transferring cars from one shop to another. The shops are also provided with trolley tracks and overhead runways, a pneumatic dust-removing installation, and a hot-air heating and ventilating system. Dining, club and billiard rooms have been provided for the use of the staff. The opening ceremony is expected to take place at a very early date. The cost of this shed is about £20,000. The department contemplate carrying out many important works during the year, the principal of which are as follows: Reconstruction of tramways in the centre of the town; relaying of tramways in Fletcher-street between Bridgeman-street and Rishton-lane; further extensions at Hacken sewage works; concreting and paving of Deane Church-lane between Paris-street and Wigan-road; widening and reconstruction of Deane Church-lane bridge and approaches thereto; Captain's Clough-road improvement; raising of Blackburn-road, Astley Bridge; completion of Deansgate improvement; paving of Victoria-square and Newport-street with wood blocks; erection of new consumption pavilion and fever hospital, and extension to administrative block; erection of a new fish market and public swimming baths; laying out and completion of Great Lever Park, besides several other extensive street improvements in the centre of the town.

Boston, Lincs (Mr. G. E. CLARKE, ASSOC.M.INST.C.E., borough surveyor and engineer).—The coming year promises to be a busy one for the surveyor and his staff, as, in addition to a considerable amount of tar-macadam work, the Town Bridge is to be reconstructed, destructors are to be erected, and a new pumping station is to be put down to deal with the sewerage during high water when the main sewer is tide locked. New cottages are being erected on one of the council's farms, and considerable activity is being displayed by the council under the town-planning Acts, &c. New by-laws will come into operation during the year. In connection with the Harbour Trust, for which Mr. Clarke acts as harbour and dock engineer, new sidings are under construction and will be ready early in the year, which will greatly facilitate the coal shipments. Additional hydraulic machinery is being put down and the electric installation extended. The dredging is being pushed, and additional acetylene-lighted buoys are being laid down in the outer channels to burn 365 days. The river lights are being increased in number and power.

Bridlington (Mr. E. R. MATTHEWS, ASSOC.M.INST.C.E., F.G.S., borough engineer and surveyor).—The present year will be one of the busiest and most important in the history of the town. There will be no exceptionally large works in hand, but many smaller works will be carried out. Among these are the completion of the first twenty-five workmen's houses which the corporation are now erecting. It is expected that a further twenty-five will be built. Several important street widenings and improvements are to be carried out, including the widening of Garrison-street and Manor-street, also a street improvement in Brett-street, and possibly the widening of Cemetery-road. The formation of a wide boulevard in Cardigan-road is now being discussed by the council, and this improvement, to cost over £6,000, will probably be commenced. Other important schemes under consideration include the extension seawards of the Royal Princes Parade, and the building of a sea-wall on the south side of the town. The extension of the borough cemetery, which is now in hand, will be completed during the year, also two or three sewerage schemes for different parts of the borough. A number of private streets will be made up and taken over under the Private Street Works Act, and a large amount of tar spraying will be executed in the spring. The borough sanatorium is also to be extended during the year at an estimated cost of £1,500. It is hoped that the town planning scheme which is now being prepared will be adopted before the end of the year.

Brighouse (Mr. S. SPENCER HAYWOOD, borough engineer and surveyor).—Works projected at Brighouse are as follows: Completion of public baths, now in process of erection (£5,700); erection of public mortuary; completion of caretaker's house at the Rydings Park; extension of sewage works (estimated at £18,500); the preparation of schemes for new public abattoirs; laying out of new recreation grounds; widening of a county main road bridge; main road paving in granite setts on concrete; and the usual routine work of private street works, tar-spraying, laying subsidiary sewers, and so forth.



Briton Ferry (Mr. H. ALEX. CLARKE, engineer and surveyor to the urban district council).—The following are some of the works projected for the year 1913: Housing of the working classes.—The erection of sixty-two workmen's dwellings and the extension of roads, sewers and water mains in conection therewith. The total number of houses erected by the council will then be 113. Water supply extension.—The laying of about 2½ miles of water mains. Burial ground.—The council are negotiating for land for the extension of their cemetery. Public park.—Six acres of land have been presented to the town for a public park, the laying out of which will receive the council's consideration.

Bromley (Mr. STANLEY HAWKINGS, borough engineer).—The council are not contemplating any works on capital expenditure in the ensuing year.

Brumby and Frodingham (Mr. JOE GREEN, C.S.I., engineer and surveyor to the urban district council).—During the year a water-softening plant is to be installed and the water mains extended, a Venturi meter being provided. In the Highways Department it is contemplated to carry out a large amount of steam rolling and tar spraying. The council are also promoting a Bill in Parliament for the erection of new gasworks for the supply of their own and other districts.

Brynmawr (Mr. JOHN J. QUIRK, M.I.MUN. AND C.E., surveyor to the urban district council).—During the present year the council hope to proceed with the following works: New sewage disposal works and outfall sewer costing about £10,000; extensive improvements in connection with their reservoir and water supply; new sewers to outlying portions of the town; the reconstruction of several footpaths, and new council offices.

Buckinghamshire (Mr. R. J. THOMAS, M.INST.C.E., county surveyor).—It is intended to substitute bituminous-bound material for ordinary water consolidation on many of the trunk roads, and convert many miles of flint and gravel roads into basalt and other hard stone. An increased mileage will also be surface-tarred. Road improvements, comprising opening up of corners and widenings, will be carried out in various parts of the county. A 100-ft. span bridge in ferro-concrete will be erected at Wraysbury, and one or two smaller bridges elsewhere. Police buildings will be erected at Beaconsfield, Great Missenden, and Newport Pagnell.

Burnley (Mr. G. H. PICKLES, M.INST.C.E., borough engineer).—The following is a list of municipal works for 1913 in the borough engineer's department—viz.: Street widenings, street paving, housing scheme, tram shed extension, extension of ice works, bowling greens for recreation grounds, works in connection with baths, schools, and markets, additional offices for various municipal departments, municipal lodging-house, registrar's house at cemetery and extension of cemetery grounds.

Burry Port (Mr. A. J. OBORN, M.I.M. & C.E., surveyor to the urban district council).—Works projected here include a combined drainage and sewerage scheme for the whole district, a municipal abattoir, a municipal cemetery, alterations and additions to the public offices, an extension of water mains and the usual maintenance works.

Burton-upon-Trent (Mr. GEORGE T. LYNAM, M.INST.C.E., borough engineer and surveyor).—The widening of Burton Bridge in continuation of the widening carried out during the past year is under discussion. The wood paving of High-street is to be relaid, the old blocks being taken up, reduced 1 in. in depth, and re-laid upon 1 in. cement screed. A scheme is in preparation for installing the "Schulthess" patent system of lime slaking, and fixing, conveying and elevating machinery, so as to improve the method of liming the sewage. Electric power is to be introduced at the pumping station for driving the storm-water pumps, and for handling lime and slack. Station-street is to be further widened, involving the acquisition of property. It is proposed to establish a sanatorium at the borough hospital by the adaptation of the temporary scarlet fever pavilion. This will necessitate an extension of the administration block. It is also proposed to take about 3 acres of land for open-air treatment in isolated huts, and to establish a dispensary in the town. Considerable progress is being made in the extension of the supply of electric power to outlying districts on the overhead system, and the Gas Committee are seeking power to acquire the Tutbury gasworks and to extend the gas mains to Rollestone and Tutbury. Burton has been constituted a Quarter Sessions Borough, and some small internal alterations will consequently be required at the court house.

Bury (Mr. J. AINSWORTH SETTLE, ASSOC.M.INST.C.E., borough engineer and surveyor).—The work contemplated during 1913 includes repairs and improvements to baths, erection of new buildings at Town's Yard, extensions to sewers, the usual work in connection with maintenance of main roads and highways, and the execution of further lengths of granite paving on concrete. The average number of private street works will be carried out.

Buxton (Mr. F. LANGLEY, surveyor and water engineer to the urban district council).—Beyond the ordinary routine of highway maintenance, street widening, sewer extensions, tree planting, tar spraying and the usual work incidental to a health resort, the only special works will be the reconstruction of the natural baths and extensive repairs to the hot baths, the spa bathing establishments of the town, which are to be brought thoroughly up to date with all modern improvements for buildings of this character. It is hoped to complete the remedial works at Stanley Moor reservoir, which are now well in hand, also the erection of filter house at Lightfoot reservoir, for which tenders have already been accepted.

Calverley (Mr. WILLIAM WALKER, surveyor and waterworks manager to the urban district council).—About 300 yds. of Farsley-lane, being the only road giving direct communication between the urban districts of Farsley and Calverley, is to be widened and the levels adjusted. The necessary land has been given by the abutting owners, who are also contributing towards the cost of the wall. Kerbing, channelling and asphalting of the footpath is to be done coextensive with the widened portion. Most of the roads in the district will be tar sprayed if the weather permits. The council are in negotiation for 10 acres of land adjoining the 3 acres already purchased. The land is to be used for purposes of sewage disposal and refuse tip. Application is to be made to the West Riding County Council for permission to relay 200 yds. of footpath on the Shipley and Bramley main road. It is expected that the necessary consent will be readily given. All surface repairs to the road just mentioned are to be done with either tar macadam or granite grouted with "Tarvia" or similar binding material.

Cambridge (Mr. JULIAN JULIAN, B.E., borough surveyor).—An inquiry was held recently by the Local Government Board into the application of the town council for county borough powers, and the result is now being awaited. The inspector, on the same visit, sat as arbitrator between the county and borough councils with reference to the borough's claim for maintenance of main roads. A fair amount of work is in progress and projected for the ensuing year, included among which are additional settling tanks at the sewage farm, several sewer extensions, 2 miles of new 24-in. cast-iron rising main (in progress), two blocks of workmen's cottages, a new infants' school, reconstruction of the Market-hill and surrounding roads, cubicle blocks at the sanatorium, new footbridge over the Cam, the formation of allotments, two new recreation grounds, and other work in connection with the existing public parks.

Cannock (Mr. ROBT. BLANCHARD, engineer and surveyor to the urban district council).—In addition to the usual works of the district about 8 miles of main roads will be treated for the prevention of dust. Application has been made to the Road Board for contributions towards the cost of two important road widenings which will be carried out this year if a grant is made. Contract No. 1, part of a loan for the laying of 11 miles of kerbing and channelling on district roads, has been let, and further contracts will be entered into. Under the Private Street Works Act, 1892, several streets will be entirely constructed and made up. The extension of the sewage disposal works is expected to be commenced this spring, the estimated cost of the work being £10,442. The construction of further new sewers is also contemplated this year. The Education Committee have under consideration the erection of a new school at Hightown.

Carlisle (Mr. HENRY C. MARKS, M.INST.C.E., city surveyor and water engineer).—The boundaries of the city having been extended, the corporation intend to proceed with the sewering of a large portion of the added area. The Water Committee also contemplate laying about 15 miles of mains in their district. As the population of the city is now over 52,000, application to the Local Government Board is being made for county borough powers.

Carmarthenshire (Mr. R. W. JONES, M.I.MUN.E., county surveyor).—The chief works for the current year proposed to be undertaken by the county council are as follows: Road widening at Pwll, near Llanelly, including Talbot Bridge; road widening at Garnant, near Ammanford; the improving of road surfaces with tar-macadam, when 10 miles are included in the tenders accepted; repairs to various bridges, in addition to a large area of surface-tarring of roads, and the ordinary maintenance of the 309 miles of county main roads under direct labour.

Carshalton (Mr. WM. WILLIS GALE, ASSOC.M.INST.C.E., L.R.I.B.A., engineer and surveyor to the urban district council).—The year 1913 will see many important works carried out in this district, notably street widenings at Pound-street and West-street, and the widening of the bridge carrying the main Croydon and Epsom road of tramway over the London, Brighton and South-Coast Railway in Carshalton; and Woodstock-road and Dalmeny-road will be made up under the Private Street Works Act. A portion of the historical Carshalton Park, 19½ acres in extent, already provisionally purchased, will be thrown open as a public pleasure ground. It is hoped that the inquiry will be held to hear the petition of the district council to include in its area the parishes of Beddington and Wallington. The year will also see the public inquiry under the Town Planning Act, all the documents, maps Nos. 1, 2 and 3 having been prepared, and application made to the Local Government Board for permission to prepare a scheme.

Chatteris (Mr. SOLDEN HIPWELL, surveyor and water engineer to the urban district council).—During the year it is expected that a new steel and concrete footbridge will be erected over the Forty Foot river near Chatteris dock. It is proposed to resewer Bridge-street, and to put down new paving in two streets. Short lengths of extensions to water mains will be carried out, and the area for street lighting extended. Various lengths of roads will be taken over by the urban council.

Chelmsford (Mr. PERCIVAL T. HARRISON, ASSOC.M.INST.C.E., borough and water engineer).—The following works have been carried out or are in hand—viz., erection and completion of thirty-eight cottages, at a cost of about £6,000; trial borehole in connection with new water-supply scheme, which has resulted satisfactorily (£1,000); Grey Royal sett paving (£2,100); erection of new public convenience; new engine-house and suction-gas installation at main pumping station; extension of fire station; additions to market and repairs to bridges and wharfing in recreation ground. The council have adopted a stables scheme to cost £1,800, and application has been made for a loan. Some thousands of pounds have been expended during the last year on town improvements and new street, sewers and water mains, to keep pace with the rapid growth of the town owing to its industrial development. The council have decided to erect over 100 more cottages in connection with their housing scheme, and to further increase their waterworks by a second borehole and erection of new pumping station at Galleywood. Owing to its rapid growth the town is faced with the problem of a new sewerage system, and preliminary work in connection with same is already proceeding. The borough engineer has been instructed to report upon the cost of erecting new municipal offices with council chamber and committee room.

Cheltenham (Mr. J. S. PICKERING, M.INST.C.E., borough surveyor and water engineer).—A contract has been entered into with Messrs. A. Hill & Co., Kidderminster, for the completion of the sewage-purification works at Haydon, and the work will be commenced early in the new year. The works comprise the construction of circular precipitation tanks and eight percolation filters of 101 ft. diameter, the estimated cost of completing the works being about £24,000, which will make a total expenditure on the works of about £38,000. The reconstruction of sewers within the borough is being carried out district by district, and application is now to be made to the Local Government Board for a further loan of £5,464 in connection with this work. The work of converting the roads from the water-bound method to tar-macadam will be continued during the coming summer, and new foundations will be provided to some of the roads.

Chepping Wycombe (Mr. T. J. RUSHBROOK, borough surveyor).—During the coming year it is anticipated that a start will be made with the sewerage and outfall works (estimated cost £38,500), the Local Government inquiry for which has been recently held. Other public works under consideration include housing of working classes, refuse destructor, and town planning. Plans have been prepared for a new grammar school, the estimated cost being £17,000. This will probably be proceeded with forthwith. An additional elementary school is now nearing completion. It is hoped to further extend the use of tar-macadam in road reconstruction, and the usual quantity of tar-painting will be carried out.

Chiswick (Mr. EDWARD WILLIS, ASSOC.M.INST.C.E., F.S.I., A.M.I.MECH.E., engineer and surveyor to the urban district council).—The numerous improvement works sanctioned by Parliament in 1911 are being steadily proceeded with, and it is anticipated that further widenings, and purchase of properties to the extent of about £10,000 will be carried out during the coming year. A new secondary school site has been acquired, and the erection of a school for 200 girls will be shortly commenced. Further elementary school accommodation is also required, and extensive alterations to the existing schools or the provision of a new school will probably be put in hand before the end of the year. A new 60-ft. "avenue" highway with paved footways and grass margins will be commenced across the undeveloped land in Chiswick, and it is expected that this will become the main road into Surrey by a bridge over the river Thames in the future. Several new sewers will be required, and some private streets will probably be made up under the Private Street Works Act. Stamford Brook Common, which has hitherto been derelict, will be laid out as a public pleasure ground during the early part of the year, and it is hoped to provide for the playing of tennis, croquet, &c. A provisional order covering the acquisition of further properties is now before the Local Government Board. It is anticipated that certain further widenings will be carried out after the board's approval, but it is not quite definite whether the trolley-vehicle scheme, which has already received Parliament's sanction, will be carried out at present. It is possible that a new block may be added to the isolation hospital, and various alterations of an extensive character are to be carried out at the Holme Court Industrial School, necessitated by the widening of Twickenham-road.

Church (Mr. W. E. WOOD, M.INST.C.E., surveyor to the urban district council).—The council propose to carry out surface treatment of 7,000 super. yds. of granite-macadam road and tar spray. It is also proposed to build a new county council school. The contracts for new public conveniences have been let, and the work will shortly be commenced. The laying of the new gravitation sewer from Altham to the Church and Accrington sewerage works will also be commenced; the length is about 1 mile. This is a joint scheme with Altham and Church. New offices for the council are in course of erection, and will be opened in the spring.

Clydebank (Mr. G. Ross, burgh surveyor).—During the year the paving of Whitecrook-street with whinstone setts, and temporary repairs in macadam to Clyde-street, Elgin-street, Scott-street, and Douglas-street are to be undertaken. An overflow sewer is to be put into Livingstone-street and Victoria-street to relieve the pressure on the sewer in Kilbowie-road. It will also take the place of the present sewers in the streets mentioned, and will be constructed with a 15-in. pipe in Livingstone-street and a 24-in. pipe in Victoria-street. In all it will be 350 yds. long. The Dunbarton-road, from Caledonian Railway Bridge to Agamemnon-street, is to be widened for a length of 543 yds. to 60 ft., at an estimated cost of about £2,000, including land.

Colne (Mr. T. H. HARTLEY, borough surveyor).—During the year 1913 the town council propose to proceed with the following works—viz., Tramways Purchase.—The corporation are promoting a Bill in Parliament this Session to provide, among other things, for the purchase from the Colne and Trawden Light Railway Company of their tramway undertaking. Town Planning.—An area of 930 acres up to the westerly boundary of the borough has been selected as a town-planning area, and instructions have been given to the borough surveyor to prepare the statutory plans, and serve the usual notices upon the interested parties under the Act; this work will be proceeded with. Main Sewers and Sewage Disposal Works.—Further extensions are proposed on account of the active development of the

town, but the schemes are not yet completed. Private Street Improvement Works.—A large number of private streets are to be made up during the year, at a total cost of about £6,000. Main Roads Granite Paving.—It is proposed to pave a length of Keighley-road and Burnley-road with granite setts and flag the footpaths, and, including the surface-water drainage, &c., the cost will be about £14,000. Road Widenings.—Various widenings are proposed of existing highways, involving a cost of £950. Water-Carriage System.—Application has been made to the Local Government Board for sanction to a loan of £4,470 for the purpose of converting existing pail and tank closets to the water-carriage system, and it is proposed to proceed at an early date with the work. Tar-spraying and Tar-grouting.—It is proposed to continue this class of work during the year as the funds will permit.

Colwyn Bay (Mr. WILLIAM JONES, ASSOC.M.INST.C.E., surveyor and water engineer to the urban district council).—Steady development is still maintained in this popular and picturesque health resort. Plans for 127 new houses, having an average rental of from £30 to £35, were approved of by the council during the last twelve months. During the present year it is expected that the promenade extension at Rhos, for which a provisional order has been obtained, will be carried out at an estimated cost of £3,000. The surveyor has submitted a report, plans, &c., to the council for the provision of shelters and lavatories along the promenades, also for the erection of a chapel having a seating accommodation for about 150 persons at the Bron-y-nant cemetery. The council are continuing their policy of slowly widening and improving the Abergele main road, and have now practically completed the much-needed widening opposite the St. Paul's Church, but a great amount of work is still required to complete the scheme. Having been presented with a plot of land in the village of Old Colwyn, the local authority are considering the advisability of laying the same out as pleasure grounds. The questions of the provision of workmen's dwellings and refuse destructor are still under consideration, there being a slight divergency of opinion in regard to the sites.

Congleton (Mr. J. H. WALTERS, borough surveyor and water engineer).—Works in progress include the erection of a new town hall keeper's house and the widening of Cross-lane, estimated to cost £1,200. It is hoped that this improvement will be completed by the end of March. During the year 1912 the surveyor's department has been exceptionally busy in laying tar macadam on the main roads. Two new streets will be made up at an estimated cost of £600. The council hope to widen High-street shortly. Extensions to the waterworks pumping station, including the enlargement of the buildings and the installation of two Lancashire boilers, are in progress. The sanction of the Local Government Board to an expenditure of £1,100 has been received.

Conway (Mr. F. A. DELAMOTTE, ASSOC.M.INST.C.E., borough engineer and surveyor).—The year 1913 will see the completion of the gasworks extension contract, work in connection with which is now practically completed. Several streets will be made up under the Private Street Works Act. The Conway suspension bridge embankment retaining wall is in progress, by which the present embankment will be widened a matter of from 40 ft. to 60 ft., and ornamental grounds laid out thereon. The council have on hand the question of the development of the golf links for golf, and the erection of suitable residential bungalows in proximity, and the alteration of the guildhall to a more commodious law court and council chamber. Important experiments under the Board of Fisheries in respect of the cleansing of mussels and shellfish are being carried out.

Cornwall (Mr. ALBERT E. BROOKES, county surveyor).—In addition to the ordinary maintenance of the main roads, a very considerable expenditure will be incurred in providing foundations and strengthening road crusts on some of the through trunk roads of the county, part of which will be carried out under grants from the Road Board, and about £1,600 will be expended in removing or improving dangerous corners. At least two bridges will be entirely rebuilt, and others improved and strengthened.

Coventry (Mr. J. E. SWINDLEHURST, M.INST.C.E., city engineer and surveyor and water engineer).—The year 1913 promises to be one of considerable activity as regards work passing through the office of the city engineer and surveyor. In connection with the extension of the sewage farm, Baginton, the under-drainage has just been completed, as have also certain new tanks. Application has been made to the Local Government Board for sanction to a loan amounting to £35,000 in connection with the construction of bacteria beds at the sewage farm. Work is about to be commenced on the Earlsdon and Chapel Fields surface-water scheme, for which sanction has been received for a loan of £12,000. It is proposed to lay down a new arterial sewer to serve the Radford district, owing to the rapid development of this area. An area has been prescribed under the Town Planning Act, and most of the preliminary work in connection with this matter has been executed. The majority of the properties comprised in the Coventry Corporation Act, 1910 (Leicester-street Improvement), have been acquired, and the work of street widening will be shortly commenced. Extensions to the city hospital, consisting of new two-storey fever pavilion, and additions to the administration department, at a cost of about £12,000, are in hand, as is also the erection of a public mortuary on Pool Meadow, at a cost of about £3,000. A contract has been let for the extension of the market hall at a cost of £3,000. As a continuation of the scheme for the erection of municipal dwellings, thirty-two cottages are now being erected, and when finished a further forty-six will be proceeded with. Forty-eight cottages have already been erected on the Narrow-lane site, and when completed this site will contain 184 cottages. Twenty-two tenements on the dual flat arrangement have been erected in Short-street in connection with this housing scheme of the corporation. Three branch libraries are at present in course of construction—viz., one each at Earlsdon, Stoke and Foleshill, the building contract for these amounting to about £9,000. A scheme for the construction of an open-air swimming bath is under consideration, as is also an extension to the existing swimming baths, to provide two further large baths, together with an installation of a water-filtration plant. The work in connection with the provision of branch slipper baths at Primrose Hill is nearing completion. Several road improvements are contemplated in the new year or are at present in hand. These comprise the improvement of Swan-lane, Narrow-lane, and Earlsdon-avenue. It is likely that an extension of the city boundary will take place shortly, and the work devolving on the city engineer in this connection is being dealt with in a comprehensive manner. Tenders have been received for the provision of two motor fire appliances with a view to augmenting the present equipment of the brigade. Other schemes under consideration comprise the following: Erection of model lodging house; extension of Drinkwater-arcade; St. Mary's Hall renovation and repair; resewering of the city, and provision of means of sewerage for various areas which are developing on the outskirts of the city.

Cramlington (Mr. WILLIAM J. COULSON, engineer and surveyor to the urban district council).—During the year 1913 the council contemplate carrying out various works, of which the following are the most important—viz., a sewerage and sewage disposal scheme for the Shankhouse and East Hartford portions of the district; a sewerage scheme for the Klondyke area of the district; providing and laying out a recreation ground for Cramlington Village area; a highway improvement scheme; extension of water distribution mains; new lighting scheme (gas) for the whole of the council's area; making new tar-macadam footpaths, including kerbing with cement-concrete kerb.

Croydon (Mr. GEORGE F. CARTER, M.INST.C.E., borough engineer, surveyor and water engineer).—The erection of a new fire station at Thornton Heath and a Carnegie library adjoining will be commenced. Plans are about to be forwarded to the Local Government Board for a covered service reservoir to hold 10,000,000 gallons, a borehole, pumping plant and buildings at Waddon Well, and many miles of water main, the whole estimated to cost £90,000. A report has been submitted for further works of sewage treatment at the South Norwood

sewage farm, estimated to cost £20,000. The present open-air swimming bath at South Norwood will be extended and covered in. A provisional order for streets improvements will be placed before Parliament, and an application has also been made for extending the boundaries of the borough. An application has been made to the Local Government Board for widening West Croydon Bridge, at an estimated cost of £18,000, to further improve the main artery of the borough, and at the same time an inquiry will shortly be held with respect to the construction of a relief road within the borough between Thornton Heath and Purley.

Derby (Mr. JOHN WARD, M.INST.C.E., borough surveyor and waterworks engineer).—During the year it is expected that a sanatorium for phthisis cases will be erected from plans prepared by the borough surveyor. The resewerage of the Osmaston district will also be taken in hand. Various additions at the recreation grounds are being made, and public bowling greens with shelters will be laid out. The Omnibus Bill of the corporation will be laid before Parliament, and under it powers for extension of tramways, street widenings, and new streets are sought. Probably during the year further extensions will be made at the sewage disposal works. Designs for a new council school on the Osmaston estate are to be obtained, and other schools are being enlarged. Tar-spraying of all main roads that are macadamised will again be carried out, and the use of tar-macadam extended. Various private streets will be completed and taken over by the corporation, and extensions of sewers and water mains will also be carried out. It is expected that the important street improvement at the junction of Osmaston-road and London-road, which has been in hand for many years, will at last be completed.

Devonport (Mr. JOHN F. BURNS, borough surveyor).—The council are considering a scheme for the erection of new guildhall and municipal offices to cost £70,000. It is expected that architects will shortly be invited to submit designs. Mr. Ernest Newton, A.R.A., F.R.I.B.A., has been appointed assessor. Extensions to isolation hospital are to be carried out, consisting of new wards, laundry, and additions to administrative building, estimated to cost £5,000; also public street improvement works, estimated cost £10,000. The construction of retaining walls to the waterside depot is estimated to cost £3,788. Open-air swimming bath of reinforced concrete and new dressing boxes are being constructed at an estimated cost of £1,200.

Disley (Mr. C. S. RIGHTON, P.A.S.I., M.R.SAN.I., engineer and surveyor to the rural district council).—During the last few months the Disley village green has been reconstructed and lined with trees. It is again proposed to tar spray the whole of the main trunk road except such portions as are being relaid in tar macadam. Minor improvements are being carried out on the district roads. A contract has been entered into to sewer the Furness Vale portion of the district, and plans are being prepared for extensions to the sewage works, and for sewers for the Newtown portion, where a garden estate is being developed. Powers have been obtained by the adjoining local authority to supply the Disley portion (which is now the only closely inhabited part that is unserved) with gas, and it is intended to lay the mains early in the year. The Stockport Corporation (who are the water authority) have just completed a reinforced-concrete reservoir in the district for their area of supply.

Dorchester (Mr. H. D. STRANGE, M.I.MUN.E., borough and water engineer).—Works now under consideration or likely to be carried out by the town council during 1913 are as follows: Surface treatment of ordinary macadam roads by tar spraying, and the coating of one or more streets with bituminous-grouted or tar macadam; extensions of surface-water sewers; erection of additional plant, and the extension of irrigation area at the sewage works; erection of stables and corporation depot; private street works and the erection of a public convenience providing accommodation for both sexes.

Doncaster (Mr. F. OSCAR KIRBY, M.SC., ASSOC.M.INST.C.E., borough surveyor and water engineer).—During the ensuing year the refuse destructor at present in course of erection, to deal with 40 tons of refuse per diem, will be completed. The erection of a technical school to accommodate 300 students will also be proceeded with, as well as additions to the municipal offices. New public baths are also contemplated, and an extensive scheme of sewerage and sewage disposal for Doncaster and environs is under consideration. The erection of 124 cottages is in progress, and a tender for the erection of thirty cottage flats has recently been accepted in connection with the town council's rehousing scheme. The widening of St. Sepulchre-gate—a main thoroughfare—to 60 ft., will be further proceeded with, and compulsory powers are being sought under a Provisional Order to acquire land for this purpose. Other street improvements partly carried out will also be proceeded with. The extension of the Bentley tramway route will shortly be completed, and powers are at present being sought to extend the tramway system to Brodsworth and Warmsworth. Extensive works of street paving will be undertaken during the year, and considerable waterworks extensions will be necessary to cope with the large building developments in and around Doncaster. Alterations and additions to the race stands and enclosures are at present in progress, and will be completed by September. It is expected that a large amount of work will be undertaken during the year in connection with the promotion of a town planning scheme for Doncaster and district.

Doncaster (Mr. W. R. CRABTREE, ASSOC.M.INST.C.E., engineer and surveyor to the rural district council).—During the year just past, in addition to the usual work, the maintenance of the large mileage of roads and sewers, &c., the following work has been completed: Water Supplies: The capacity of the service reservoir at the Conisboro' waterworks increased from 250,000 gallons to 500,000 gallons, the work being carried out in reinforced concrete to the design of the surveyor. The contractors were the Combined Concrete Construction Company of Manchester. The surveyor has in hand the water supply of Adwick-le-Street parish, to provide for an ultimate population of 15,000. Street Improvements.—Edlington-lane, the main approach to the New Colliery Village of the Yorkshire Land Development Company, has been improved and widened from a narrow lane to a 42-ft. road, a length of 1,500 yds., at a cost of £3,500. The widening of Owston-road, Owston, the main approach to the New Colliery Village of the Bulcroft Colliery Company, is in hand, which also means the conversion of a narrow lane into a good road, the length being 960 yds. Station-road, Conisboro', has been also improved and widened for 500 yds., at a cost of £1,100. Sewage Disposal. Small sewage disposal works have been constructed at Braithwell, and the sewers extended in Cadeby. Main sewerage works are in progress in the parishes of Askern, Adwick-le-Street, Skellow, Owston, and Edlington, the engineers being Messrs. D. Balfour & Son, of Newcastle. Sewerage schemes are being projected in connection with Sutton and Norton parishes. The surveyor has in hand the main sewerage and sewage disposal of Rossington in connection with the New Model Village for the Rossington Colliery Company. On the main roads a good deal of tar-spraying has been done with good results, and several long stretches of road have been coated with tarred whinstone applied in one 4-in. coat, a certain proportion of small size being mixed with the larger. The roads so treated have stood the traffic remarkably well, and it is expected that this system will be extended in the coming year. Town Planning.—The council are joining with the urban district councils of Bolton-on-Dearne and Thurnscoe in a scheme of town planning, embracing the parishes of Adwick-on-Dearne, Barmborough, and a portion of Hickleton. A town planning scheme is also being prepared in conjunction with the borough of Doncaster and the urban district councils of Wheatley, Balby-with-Hexthorpe, and Bentley, which will probably embrace a large area around Doncaster. Town planning schemes are also projected in connection with Askern and district, and Carcroft and district. Buildings.—The opening out of the new collieries at Edlington, Bulcroft, Brodsworth, and Askern has caused a large increase of population. Building operations in the district have been brisk, the number of houses completed during the year being 460. It is expected that

the new collieries at Rossington and Barmborough will cause continued increase. Factories have been erected at Conisborough and Adwick-le-Street, and tar distillery works at Kirk Sandall. Public elementary schools have been erected by the West Riding County Council at Conisborough and Warmsworth, and others are in course of erection at Owston, Edlington, and Stainton. Street Lighting.—The street lighting of Adwick-le-Street, Skellow, and Owston has been extended, and electric lighting is in progress at Adwick-on-Dearne.

Dover (Mr. W. C. HAWKE, ASSOC.M. INST.C.E., borough engineer and surveyor and water engineer).—The corporation contemplate carrying out the following works during the ensuing year: Construction of a ferro-concrete viaduct in the pier district with electric tramway over same; demolition of old property; erecting workmen's cottages, and alteration to streets at a total cost of £108,000; tram siding at New Bridge; widening of Bridge-street; alterations at sea-front baths; additions to St. Martin's council schools; new kerbing and channelling at Eaglestone-road, and widening of Crabble-hill, and tar painting about 7 miles of roads.

Droitwich (Mr. HY. HULSE, M.I.MUN.E., borough engineer and surveyor). A scheme for the provision of twelve cottages has been adopted, and as soon as the approval of the Local Government Board is obtained the work of erection will be proceeded with. Another important scheme now under the consideration of the council is the improvement of High-street, which has suffered from floods due to subsidences caused by brine pumping. The scheme will probably entail considerable alterations to the street surface, also the construction of sewerage works. In addition to the tar-painting of about 5 miles of carriageways in the principal streets, it has been decided to tar-paint and gravel about 1 mile of footpaths in residential streets, all of which work will be done with refined tar from the council's gasworks. Some resurfacing of main roads with tar macadam may probably be done under arrangement with the county council.

Dunstable (Mr. JOHN STEWART, borough engineer and surveyor).—Since the borough boundary was extended some six years ago, the council have spent a considerable amount of time and money in improving the streets and laying new sewers in the added area, and in changing their outfall works from broad irrigation to sedimentation, detritus and dosing tanks, with filtration beds. A new lavatory for both sexes has recently been built near the centre of the borough. A storm-water scheme for the North Ward will be commenced early in 1913, and this will probably be the only work the council contemplate doing for the ensuing year.

Durham (Mr. JOHN T. PEGGE, city engineer).—During 1913 the council will consider all the schemes outlined in previous years, but "held up" for various reasons, together with the special repaving, probably with Durax, and tar-grouting the main and county roads, owing to the extraordinary development of motor traffic. Several small, but important, street improvements are in hand, and the first instalment of a system of workmen's dwellings has been inquired into by the Local Government Board.

Earby (Mr. J. E. ALDERSLEY, engineer and surveyor to the urban district council).—The coming year is likely to be a busy one. Alterations and extensions at the sewage disposal works are proposed, consisting of storm-water tanks, filters, and humus tanks, estimated to cost £3,500. The rebuilding of New-road Bridge is to be undertaken at a cost of £550, and several streets are to be made up under the 1892 Act. It is expected that the Colne and Broughton main road improvement and diversion scheme will be carried out at a cost of £4,550—to which the Road Board and county council are contributing.

Easingwold, Yorks (Mr. WM. SNOWDON, surveyor to the rural district council).—The rural district council have applied to the Local Government Board for a loan for the construction of a scheme of co-operative water supply for the high-level portion of their district. The water will be obtained from springs arising on the Wass banks, and the works include a covered service reservoir, and will provide supplies to the villages of Coxwold, Newburgh Priory, Oulston, Crayke, and Stillington, and an additional supply to the town of Easingwold. The council are also carrying out, in sections, schemes of sewerage and sewage disposal for the villages of Sutton-on-Forest, Huby, and Tollerton. The whole of the foregoing, both waterworks and sewerage works, have been designed, and will be superintended by Messrs. Fairbank & Son, M.INST.C.E., of Lendal, York.

East and West Molesey (Mr. JOHN STEVENSON, surveyor to the urban district council).—The widening and improving of a length of Hurst-road (leading to Hurst Park racecourse), where a dangerous piece of road and bend existed, is now in progress, and it is intended, in addition to the ordinary routine work, to proceed with the kerbing, channelling and paving of several footpaths, for which a loan has been granted.

Easthampstead (Mr. J. R. TREADWELL, M.I.MUN.E., district surveyor of highways to the rural district council).—In addition to the ordinary maintenance of the various roads, several miles have had the sides reconstructed and resurfaced, and more of this work will be done during the ensuing year. A considerable amount of drainage and kerbing will also be done. The roads are subject to heavy motor hauling on account of large brickworks situated in the district. As the subsoil is of clay, which is very near the surface, the difficulty experienced in their maintenance is obvious.

East Grinstead (Mr. W. E. WOOLLAM, engineer and surveyor to the urban district council).—The works projected for the coming year may include a refuse destructor, additions to sewage works, public conveniences, private street works, and extensions of sewers, widening of existing roads, fencing and laying out new cemetery, and additions to offices.

Eccles, Lancashire (Mr. THOMAS S. PICTON, M.INST.M. AND CO.E., borough engineer and surveyor).—It is proposed in the near future to apply to the Local Government Board for borrowing powers for the reconstruction of portions of the main sewers and the construction of a new outfall sewer with catchpit, provided with duplicate screens and elevators. The projected schemes include a 5 ft. by 3 ft. 4 in. egg-shaped brick outfall sewer through the sewage farm from Peel Green-road to the pump well (length 85 lin. yds.); and a 6 ft. 6 in. circular brick storm-water overflow sewer through the sewage farm, discharging into the Salt Eye Brook (length 1,164 lin. yds). The existing 3 ft. 3 in. circular sewers in Liverpool-road and Peel Green-road are to be replaced with egg-shaped brick sewers of new design, varying in size from 7 ft. 6 in. by 5 ft. to 4 ft. by 2 ft. 8 in., and having a total length of about 1,130 lin. yds. A new 18-in. pipe sewer, 465 yds. long, is to be laid in Regent-street, from the borough boundary to the market-place. In the Winton district a 5 ft. by 2 ft. 3 in. brick storm-water overflow sewer, 328 yds. long, is to be constructed through private land from the junction of Worsley-road and Parrin-lane to Worsley Brook. The total estimated cost of the above works is £56,554. Private street works are to be carried out at an estimated cost of about £13,500. At the Eccles Recreation Ground a new bowling green, 120 ft. by 120 ft., together with a bowl-house and pavilion, will be completed. Several schemes of road improvements are in contemplation. A new swimming bath will shortly be completed, and the extension to the hospital is hoped to be ready for opening in about six months. Sanction has been obtained for a loan of £600 for the revision of the 1-500 ordnance survey of the borough.

Exeter (Mr. THOMAS MOULDING, M.INST.C.E., city engineer and surveyor).—During 1913 the following works are to be considered or carried out by the Exeter council: Extensions and improvements at both sewage disposal works; new pumping plant at the waterworks; wood paving of several of the principal streets; and erection of houses for the working classes in connection with the street widenings and housing schemes in Paul-

street, Bartholomew-street, and Blackboy-road. The extension of the infectious diseases hospital will be carried out; tenders for same are to be considered at the next meeting.

Exmouth (Mr. SAMUEL HUTTON, engineer and surveyor to the urban district council).—Foremost among the new works is the new Marine-drive, 65 ft. wide and 1 mile long, the first contract for which has just been let. The total cost, including Lord Clinton's work, is about £20,000, the portion for which the council's engineer is responsible being £8,500. The widening of Salterton-road and Bradham-lane bridge are the more important of the road improvement works. About 1 mile of water mains, from 9 in. to 3 in. diam., will be laid during the year, and the council are also negotiating with the St. Thomas Rural Council to supply Lympstone with water. If this arrangement is carried out, there will be further expenditure on water mains to the extent of £1,700. Instructions have also been given to Mr. Hutton to prepare plans for a public abattoir. Improvements of pleasure grounds—*i.e.*, tennis courts, &c.—are in progress, and, with the routine work on 55 miles of roads and a large undertaking, the staff of the engineer's and surveyor's office anticipate a busy time during 1913.

Falmouth (Mr. JOHN S. WALTON, borough engineer and surveyor).—The contract for the erection of the main road retaining wall, including an important road improvement, at a cost of £1,445, will be completed early in the year, when the laying out of the new gardens at this place will be put in hand. The cost is estimated at £400. It is hoped that the year will see the erection of twenty-two workmen's dwellings, at a cost of about £5,000. Melville-road is to be widened at a cost of £200, and the Swanpool seawall reconstructed at a cost of £420. Other works anticipated are: Widening of Princes-street, by Old Town Prison, extension of sewers, and the general tar spraying of the highways.

Farnborough (Mr. J. E. HARGREAVES, surveyor to the urban district council).—The chief works projected during 1913 are the erection of a refuse destructor, depot and stables, additional tanks and machinery at sewage disposal works, and laying out two recreation grounds. Total estimated cost, £7,000.

Flaxton, Yorks (Mr. J. W. LUPTON, surveyor to the rural district council).—The council have under consideration a scheme for the sewerage and sewage disposal of Heworth Without, which has been prepared by Messrs. Fairbank & Son, MM.INST.C.E., of Lendal, York. The works include sewers, with the necessary manholes and the like; a pumping station, with electricity as the motive power; balancing and liquefying tanks; and a battery of primary and secondary bacterial filters.

Fleet, Hants (Mr. H. J. CHIVERS, M.I.M. & C.E., surveyor to the urban district council).—The most important works projected are (1) an entirely new sewerage scheme for the whole of the district, comprising 16 miles of sewers, air-compressing plant, ejectors, disposal works, &c., the engineer being Mr. T. J. Moss Flower, ASSOC.M.INST.C.E., of Westminster and Bristol, and (2) the purchase of the necessary land and the laying out of a cemetery for the district. In addition, further streets will be made up under the Private Street Works Act, paving, kerbing, &c., extended, and the tar spraying of several miles of roads and footpaths undertaken.

Friern Barnet, Middlesex (Mr. E. J. REYNOLDS, ASSOC.M.INST.C.E., engineer and surveyor to the urban district council).—Road widenings, improvements and other important works continue to keep the engineer and surveyor's department very busy. The entrance to the Friern-lane by the council offices has been widened from 35 ft. to a minimum of 50 ft. In one place the new width is 95 ft. Land is also being given up by the owners to widen the Friern-lane and other roads in the district to at least 50 ft., and agreements have been entered into to widen about 2,700 ft. in the Colney Hatch-lane, near the Hornsey boundary, from about 40 ft. to 50 ft., and the road will be properly kerbed and channelled at a cost of some £2,600. The work will shortly be carried out. In all cases, as usual, the necessary land has been given up free of cost to the council. The work of widening from 36 ft. to 50 ft. the Great Northern main line railway bridge, carrying the Friern Barnet-road, is proceeding, and will be completed in the present year. The estimated cost is £5,600. Work at the new Friary Park is being continued. In the past year conveniences and stores have been built, a new bowling green has been laid out with Cumberland turf, rockeries and ponds formed, and a children's gymnasium made. A proposal is before the council to lay out winter tennis courts. The council have purchased over 5¾ acres of land and cottages, and the land will be made into further allotments. Application has been made to the Local Government Board for sanction to borrow £3,750 to erect fifteen working-class cottages. Many private street works are in hand, and the engineer and surveyor has instructions to prepare plans and estimates for several other roads, &c. Among other matters receiving consideration are conveniences, depot and fire station, footpaths diversion, and the improvement of the lighting of the district. The proposed Northern Junction Railway Bill, now in Parliament, affects the southern part of Friern Barnet, and the council have the matter under consideration.

Flintshire (Mr. SAM. EVANS, county surveyor).—In addition to the ordinary work of maintaining about 200 miles of main roads, it is intended to reconstruct entirely a 6-mile length of heavily trafficked main road between Holywell and Northop, which carries traction engines and steam carts conveying lead and coal in connection with the lead mining industry on the Halkyn Mountain. It is intended also to carry out considerable works of footpath paving and surface-water drainage in places rapidly changing from a rural to urban character. The county surveyor has also in hand new schools at Gwespyr, Holywell, Mynydd Isa, Sealand, Rhuallt Gronant, and Queensferry, and a number of small holding homesteads and shippons, all of which it is hoped to complete within the next financial year.

Gillingham, Kent (Mr. JOHN L. REDFERN, borough engineer and surveyor).—In addition to the maintenance of about 50 miles of roads, which will probably all be tar painted, the council will widen the following: Barnsole-lane from 11 ft. to 40 ft., for a distance of more than half a mile, by agreement with owners; Hoath-lane, from 12 ft. to 40 ft., for a distance of a mile from Watling-street to Wigmore Garden Village. The council have recently acquired land in Toronto-road to enable three existing streets to be continued into it. The council have also acquired ten condemned tenements in Wood-street, with a view to demolition. They have also acquired an estate known as "Woodlands," on the east of the town in the direction of the town's development, comprising a house with grounds, cottage, farm buildings, and 13 acres of land containing some very fine elm trees. They intend to preserve the amenities of that neighbourhood, and to widen when necessary Woodlands-lane from 16 ft. to 40 ft. for a distance of 1,000 ft. The surplus land will be utilised as the council may decide. A new sludge press is to be provided at the outfall works to meet the growing needs of the town. The new pier has now received the approval of the authorities, and will probably be started in the ensuing year. Plans for a swimming bath are in course of preparation. A storm relief sewer will be laid through the dockyard; the sewering of Barnsole-lane, at a cost of £2,345, will be carried out. Brompton infants' school will be remodelled if satisfactory arrangements can be made with the War Department, but, failing this, a new infants' school will be built. Two nurses' rooms will be added to the small-pox hospital. A town planning scheme is being prepared which will comprise a large area of undeveloped land adjoining the developed part of the town. Paving of back alleys under the Public Health Act will be continued. Already 12 miles have been completed and taken over. A small public convenience is to be built in Sawyers-alley.

Gloucester (Mr. RICHARD READ, ASSOC.M.INST.C.E., city surveyor).—The construction of the new outfall sewer, including a syphon under the eastern branch of the river Severn, for which tenders are now being considered, is expected to be carried out. Progress is also to be made with the testing of the new borehole for an additional water supply at Ketford. The new fire

station is now in the hands of the contractors, and will probably be ready about March. The widening of Westgate-street is proceeding, and several new roads are in course of construction. The question of public bowling greens in the park is under consideration.

Codalming (Mr. J. H. NORRIS, borough surveyor and waterworks engineer).—The work in this borough during 1913 will chiefly be connected with highways. The wood paving of the main streets is at last settled to begin directly after Easter, and following that, further portions of the Portsmouth main road will be reconstructed and surfaced with some asphalt material. A cloister in memory of Jack Phillips, the wireless operator on the "Titanic," will be proceeded with during the year.

Gosport and Alverstoke (Mr. HERBERT FROST, engineer and surveyor to the urban district council).—In addition to the general work contemplated during the current year, such as the making up of private streets, paving, improvement of roads, tar-spraying, &c., the more important proposals of this council are the development of a large area under a town-planning scheme; sewage outfall, by carrying the 36-in. cast-iron main and buoy 230 yds. further into the deeper waters of the Solent; the compounding of the existing air compressors for actuating the sewage ejectors to give greater efficiency; the provision of a fan for destructors; the introduction of superheaters to two Galloway boilers; and substitution of a 6-in. steel main for the 7-in. cast-iron one existing; the possible introduction of slab-making plant; new shelter for recreation grounds, and a ladies' chalet; considerable sanitary improvements, and an improvement of the ferry landing in ferro-concrete.

Great Torrington (Mr. W. C. MEDLAND, borough surveyor).—The council have entered into a small contract (of about £100) with Messrs. R. Eastmond & Son to remove about 700 ft. of their old 4-in. cast-iron water main, and lay in its place new 5-in. British Mannesmann tubes in about 30-ft. lengths, with the different accessories.

Grimsby (Mr. H. GILBERT WHYATT, ASSOC.M.INST.C.E., borough engineer and surveyor).—During the past twelve months no very extensive works have been carried out, but the following have been completed successfully: The additional police-cell accommodation at the town hall, for which sanction from the Local Government Board had been obtained, at an estimated cost of £2,550, has been completed, the actual cost being £2,192. Opportunity has been taken to convert four of the old cells into muniment rooms and safes, and this work is now in hand. The extension of the new cemetery, at an estimated cost of £9,300, and the ventilation of the sewers of the southern district of the town, at an estimated cost of £852, are now approaching completion; and the sanction of the Local Government Board has been received for the ventilation of the sewers of the western district, at an estimated cost of £850. Tenders are now being obtained for this work, and it will probably be commenced in February. Sanction has been received for the construction of a new sewer in Welholme-avenue, across the line of an old river-bed which is now filled with peat. The sewer will be constructed on piles. The estimated cost is £1,560, and the work will be commenced in the spring. An inquiry has been held by the Local Government Board into an application for the culverting of some fresh-water streams in the Clee district at an estimated cost of £5,900, and, if sanction is obtained, the work will be carried out during the ensuing summer. Schemes are now being prepared for the construction of new sewers and flood relief culverts, the estimate being £18,000. Public conveniences for both sexes are to be constructed adjoining the Freemen's market, a dwelling-house having been leased for the purpose. The estimated cost of conversion is £480. The Watch Committee have decided to build stables for the police horses (three stalls at present), and the Highways Committee have instructed the borough engineer to prepare a complete report on the team labour question as to whether the corporation should erect stables and purchase horses, adopt mechanical traction, or continue with hired team labour as at present. Committees are now considering schemes for a foot subway under the railway at Wellowgate, the widening and boulevardisation of Weelsby-road, the erection of swimming baths, and also the erection of porter's lodge and reception office at the sanatorium. With regard to street paving, the conversion of the streets from ordinary macadam to tarred macadam has been suspended for a time, it having been found that in certain streets the traffic is too heavy for this class of paving, and after the Roads Congress in June (at which a delegation from the Highways Committee will attend) the corporation will be asked to decide whether wood paving or granite paving shall be adopted. The town council have decided to erect a new school in Victoria-street, and tenders have been obtained, the one recommended for adoption amounting to £13,333. During the past year the Great Central Railway Company have obtained Parliamentary powers for the construction of a large extension to their fish dock at Grimsby, and it is anticipated that this work will be commenced in the early spring.

Guildford (Mr. C. G. MASON, ASSOC.M.INST.C.E., borough engineer and surveyor).—During the year several public street improvements are contemplated, the chief of which is the widening of the High-street at the top of the town, at a cost of just over £11,000. A new ferro-concrete bridge over the river Wey will shortly be completed, which should lead to considerable building developments in the northern part of the borough. A large estate is proposed to be laid out on the hills, which will afford splendid views of the surrounding country. Certain extensions to the surface-water drainage of the borough will shortly be carried out, and the usual number of private street works undertaken. New percolating beds at the sewage works are to be laid down, and further subsoil drainage of the areas over which the sewage effluents are irrigated must soon be undertaken. An additional source of water supply is to be sought for, and a 24-in. borehole will be sunk into the chalk for this purpose, entailing the installation of further machinery at the waterworks. Additions and extensions to the fire station have been sanctioned by the Local Government Board, and these works will be put in hand shortly.

Guildford (Mr. J. ANSTEE, surveyor and engineer to the rural district council).—During the coming year it is proposed to carry out extensive road improvements and bridge works. Several narrow roads are to be considerably widened and dangerous corners removed. Four new bridges will be constructed between Send and Woking in substitution of existing wooden structures. The largest span is over the river Wey, and the structure will be of ferro-concrete. The others, spanning the River Wey Navigation Canal, and two tributaries of the Wey, will be of steel girder type. Further extensive dust prevention experiments will be carried out with various bituminous and other binders on numerous sections of the 200 miles of highways which traverse the district.

Guisborough, Yorks (Mr. R. H. KILBURN, surveyor to the rural district council).—The council have under consideration a scheme for the abandonment of their existing sewage farm, and the substitution thereof of a bacterial installation for the treatment of the sewage. They have consulted Messrs. Fairbank & Son, M.INST.C.E., of Lendal Chambers, York, who have prepared and laid before them a scheme. The works proposed consist of the adaptation of the existing settling tanks, and the provision of a battery of four primary and secondary filters, each 66 ft. in diameter, together with the necessary humus pits, outfall drains, and the like.

Halesowen (Mr. GEORGE H. DALLOW, engineer and surveyor to the rural district council).—During the year quite a number of small improvements, such as road widenings, metalling, kerbing and channelling roads, and small sewer extensions will be carried out, and several open spaces are to be laid out in parts of the district that are urban in character. There will be, of course, the usual maintenance of the public highways, and in addition a considerable amount of

tar-spraying will be done as in the past year. A fairly large area of the public footpaths will be tar paved, an improvement that has been greatly needed in this district. There promises to be quite a number of new streets constructed and laid out on private estates on town-planning lines. The Town Planning Act, 1909, has been adopted in this district, the result of which will be the active preparation of a town-planning scheme to cover about 620 acres. It is quite possible that the street lamps which are now illuminated by gas will be electrified throughout the greater part of the district, and a length of tramways will probably be commenced shortly. There is likely to be a number of private street works put in hand during the year.

Halifax (Mr. JAMES LORD, M.INST.C.E., A.M.I.E.E., borough engineer and surveyor).—Highways.—The paving of several lengths of main roads with granite setts will be proceeded with, and borrowing powers of £11,500 are now being applied for. Main Sewerage.—The relaying of the main outfall sewer in the bed of the Hebble Brook (48 in. diameter) has been commenced, and it is expected to complete this during the ensuing year (cost £24,000). Work is about to be commenced on the last section of Northowram sewerage in Kell-lane, Hough, Towngate and Upper-lane respectively, and a scheme will probably be considered for the Ovenden district. Sewage Disposal.—All outstanding contracts have now been completed, and the question of storm-water treatment will be considered, as also will the question of further treatment of the pressed sludge to facilitate disposal and for saleable purposes. Experiments in precipitation are proceeding with a view of adopting a most efficient system. Schemes for the disposal of sewage at Mixenden and Bradshaw respectively will be proceeded with; the necessary land has been acquired, and the sanction of the Local Government Board for the necessary borrowing powers is awaited. Tramways.—The doubling of the track on the Skircoat-green route, and several other tramways will be carried out. Town Planning.—Permission has been obtained to prepare town planning schemes for two areas in Warley and Ovenden respectively, and the work is now in hand. Application is also being made to the Local Government Board for permission to prepare a scheme for a third area of 655 acres in the Bradshaw district. Parliamentary Bill.—A Bill is being promoted for additional tramways and street widenings this session.

Harrogate (Mr. C. E. RIVERS, ASSOC.M.INST.C.E., borough engineer and surveyor).—The principal works to be taken in hand or completed during the year consist of alterations and remodelling of portions of the Victoria baths, alterations and extensions to the gentlemen's section of the Starbeck baths, the redecoration of the main hall and several departments of the Royal baths, a new annexe to the Royal pump-room, and a new entrance scheme to the Valley Gardens, all of which are expected to be finished before the commencement of the Harrogate season. Considerable progress has been made with the first section of the cemetery scheme, and it is anticipated that this should be completed in the early spring. Private street improvement works will proceed as usual; about fourteen streets are to be commenced shortly, and plans are to be prepared for a further eighteen. The corporation have under consideration the duplicating of about ½ mile of cast-iron syphons on the main south outfall sewer, a new surface-water drainage scheme for the Silverfields district, and the relaying of several old sewers. Schemes are also projected for the erection of a shelter, conveniences, and a caretaker's house on Harlow Moor, and shelters in the Valley Gardens. The Corporation are about to purchase the Harlow Car estate, which is situated just outside the borough, and which consists of several valuable sulphur springs, a suite of baths, hotel, cottages, &c., and about 58 acres of land. The corporation will then own the whole of the mineral springs in the district. The erection of a new elementary school for 675 scholars will be proceeded with during the year. The corporation have under their consideration the provision of a municipal golf course.

Hartlepool (Mr. PERCY HORSLEY, borough engineer and surveyor).—The following is a list of the works projected: The laying out of a small public park, with shelter; completion of new cemetery, and the erection of chapels and lodge; new elementary school for 756 scholars; extension of headland protection and promenade; improvement of the south cliff and the construction of a lower promenade; footbridge over the Slakes; and the clearing of an insanitary area and the erection of workmen's dwellings.

Haslingden (Mr. J. SINGLETON GREEN, borough engineer and surveyor).—During the year it is expected that a new council school will be erected at a cost of £19,000. The plans have been prepared by the borough surveyor, and the accommodation is for 1,200 scholars. Several important main drainage schemes will be carried out. About 2 miles of the Ewood Bridge main road will be relaid with macadam, and the channels and kerbs on either side will also be relaid. The borough surveyor has prepared plans showing the development of an estate of 14 acres purchased by the corporation. Several new roads have been cut through this estate, connecting Helmshore-road with Manchester-road, and a number of lots will be offered for sale by public auction at an early date. Public improvements, including the widening of Stonefold-road and at the bottom of Warner-street, will be completed this year. A number of private street improvement works will be carried out, also a length of main road paving with granite setts on a concrete foundation.

Hebden Bridge (Mr. T. WADDINGHAM, surveyor and water engineer to the urban district council).—A further length of macadamised roadway on the Todmorden, Halifax and Burnley main road will be taken up early in the year, and granite sett-paving laid on a concrete foundation, at an estimated cost of about £1,000. A new road-retaining wall will be built on this main road at the side of the Rochdale Canal, for a distance of about 110 yds. It is expected that two widenings of the same main road will be carried out at an estimated cost of £4,500. These include the demolition of buildings and the widening of one bridge over the river Hebden, and the building of a new steel girder bridge to replace a stone-arched bridge over the Colden Water. The council have at present under consideration an extensive road widening scheme at Hollins-place, on the Lees and Hebden Bridge main road. This will entail the purchase of houses and shops, pulling these down, building a large retaining wall to support land and roads at a higher level, and paving the added portion of the roadway. Several streets in the town will be repaved with Lancashire setts, and many private streets will be made up, principally with sett-paving. A new iron footbridge will be constructed over the river Calder at Fountain-street. The tar-spraying of roads will be continued, as it has proved such a great success. An additional filter-bed will be constructed at the Hollin Hall water filtration works. New 6-in. water mains will be laid in two portions of the town. Plans of new stables for the council's horses have been sent to the Local Government Board, and the building will be commenced immediately the board's consent is received; 720 yds. of new 6-in. sewer will be laid to drain property at Wood Top. A new 9-in. sewer, 750 yds. in length, will be laid in Wandsworth-lane to take the sewage from the adjoining portion of the Mytholmroyd Urban District Council's area into the Hebden Bridge sewerage system. The sewage from a large adjoining portion of the Todmorden Rural District Council's area will be connected up to this council's system. Enlargement of the filtration accommodation at the sewage disposal works is contemplated. Surface and spring water will be disconnected from the sewers in several districts, and new sewers laid for this water, thus relieving the pumping at the sewage disposal works. The question of providing additional public conveniences is now under consideration. The Lancashire and Yorkshire Railway Company propose to widen the Station-road Bridge where it crosses the Rochdale Canal, and the council have offered to con-

tribute towards the cost of the work and to maintain the road surface.

Hereford (Mr. JOHN PARKER, ASSOC.M.INST.C.E., city surveyor and engineer).—The corporation have now under consideration the substitution of electricity for steam at their waterworks pumping station. This will entail the installation of two electrically driven centrifugal pumps, each having a capacity of 60,000 gallons per hour against a head of 120 ft., and a high-pressure centrifugal pump of 20,000 gallons capacity per hour against a head of 140 ft. The existing triple-expansion set and boiler will remain as a stand-by plant. New sand filters having been recently constructed, the work of cleaning out and repairing the old beds will shortly be commenced. The council purchased in September last the pleasure grounds known as Dinedor (Roman) Camp, containing 20 acres, which includes several acres of woodland. This is 598 ft. above sea level, commanding extensive views of the Welsh hills, the river Wye and surrounding counties, and has in the past been a favourite resort for Hereford people. The Local Government Board has sanctioned a loan for the purchase and improvements. A new sewer is being laid to the Westfields district at a cost of £600, which will also make provision for the sewering of the city and county asylum. Application has been made for a loan of £7,100 for extensions and alterations of the present boys' and girls' departments at Lord Scudamore's school, recently purchased by the council for use as junior and girls' departments. The board has already granted £3,750 for the conversion and extension of the infants' school into a boys' school, this work being now in progress.

Herefordshire (Mr. G. H. JACK, F.G.S., M.S.A., chief surveyor of main roads, bridges and buildings).—The county council will next year carry out the first instalment of a scheme for strengthening the foundations of certain main roads. The first section comprises about 15 miles of road (£38,000). The work will include the drainage of waterlogged stretches and the strengthening of many bridges and culverts. A new secondary school, to accommodate 226 girls, will be established at Hereford. An infants' school is to be built at Ledbury. Alterations and additions are to be carried out to many of the council schools. A committee is considering the question of establishing a domestic economy school in connection with the county training college.

Hertford (Mr. J. H. JEVONS, ASSOC.M.INST.C.E., borough and waterworks engineer and surveyor).—The only work outside the ordinary routine work in contemplation is the probable extension of the sewage disposal works, for which Mr. Jevons is the engineer, and Mr. George Medley Taylor the consulting engineer.

Heywood (Mr. JAS. B. NUTTALL, borough surveyor).—The Heywood Corporation have in hand the erection of a new council school in Hornby-street for 750 scholars; the completion of a granite-paving scheme of £4,000, and the commencement of a new one of £6,000; road improvements on the Bury and Rochdale main roads and Heap Brow; the completion of the Hopwood Recreation Ground; alterations at the Queen's Park; in addition to which the usual amount of private street works, sewerage works, road maintenance, scavenging, &c., will be undertaken. Improvements will no doubt be called for at the sewage works, gasworks and electricity works to meet increasing demands.

Hinckley (Mr. E. H. CRUMP, ASSOC.M.INST.C.E., surveyor and water manager to the urban district council).—The new main outfall sewer, consisting of cast-iron pipes and concrete tubes, will be started early in the year, at an estimated cost of £6,000. It is anticipated also that the housing scheme, consisting of the erection of eighteen workmen's dwellings, the laying out of a recreation ground and new road, will also be commenced, at an estimated cost of £4,500. This scheme is now awaiting the sanction of the Local Government Board. The work in connection with the provision of new pumps at the waterworks pumping station will also be put in hand, at a cost of £2,000, the contract having been settled. The ordinary routine work will include further underdrainage at the sewage disposal works, where possibly an experimental biological filter-bed will be installed. The tarring of the roads of the town will be further continued.

Hindley (Mr. OSWALD P. ABBOTT, surveyor to the urban district council).—A number of private streets are expected to be constructed during the year, and the conversion of grit paving to granite paving on parts of the main roads will be continued. Extensions to the sewage works and a new pumping station are to be considered. A new elementary school for the Platt Bridge district is to be built by the council, and the erection of a manual training department and cookery and laundry centre has been practically decided upon. The council purpose distributing electricity in a portion of the district under their Electric Lighting Order.

Honiton (Mr. A. TILLOTSON, A.R.SAN.I., M.I.MUN.E., surveyor, sanitary inspector and waterworks manager).—The town council are endeavouring to acquire lands for proposed new sewage disposal works and irrigation purposes in accordance with the requirements of the Local Government Board. The proposed sewage disposal scheme includes the replacement of the old sewer in bed of the river Gissage by a cast-iron pipe sewer. The council also have the question of the erection of workmen's dwellings under consideration, and have discussed and inspected several sites in connection with the project. Tar-spraying on an increased scale is to be done on the main London to Exeter Road, the whole length of which in this district is being now made up with granite in place of local flint.

Horbury (Mr. W. SUGARS, M.I.M. & C.E., M.R.SAN.I., engineer and surveyor to the urban district council).—In addition to the ordinary repairs and maintenance of roads, several important road widenings and improvements are contemplated, also the probability of further extensions to the sewage works to cope with the increased trade effluent. There is also a proposal for the erection of workmen's dwellings under the Housing of the Working Classes Act, and the erection of an annexe to the town hall to be used as a public hall. The rearranging of the lighting of the district and other works of a minor character are also under contemplation.

Hornsea (Mr. W. E. WARBURTON, M.S.I., surveyor to the urban district council).—The council have applied to the Local Government Board for sanction to a loan for the erection of a floral hall to seat 800 persons, and an amphitheatre to seat 1,200, in the Promenade Gardens. It is intended to relay several lengths of 15-in. sewers, and to make two streets under the Private Street Works Act. A building estate is being developed and rapidly taken up, and this will entail a further extension of sewage and water mains.

Horsham (Mr. R. RENWICK, surveyor and water engineer to the urban district council).—In connection with the surveyor's department, no new works of any importance are in contemplation for the year.

Hove (Mr. H. H. SCOTT, ASSOC.M.INST.C.E., borough surveyor).—Parliamentary powers have been obtained to instal a system of railless trolley 'buses throughout the borough. The town council have decided to promote a Bill in the coming Session of Parliament to purchase the Hove Electric Lighting Company's undertaking.

Hoyland Nether (Mr. FREDERIC J. THACKRAY, engineer and surveyor to the urban district council).—The present year promises to be a very busy one, the council having under consideration the advisability of making application to the Local Government Board for a loan for the carrying out of the following works: Open-air swimming bath; extensions to

the sewage disposal works, consisting of humus tanks and sludge lagoons; conversion of privies; private street works; road widening and improvements; the relaying and construction of several sewers; the enlargement of the motor-house at the stores yard; and the construction of covered sheds. The council (having obtained a Provisional Order for the lighting of the township by electricity) will in all probability consider the question of a combined destructor and generating station, the disposal of house refuse having become somewhat acute, owing to the few suitable tips available. A housing scheme has for some time received the attention of the council, and will no doubt be again considered during the year.

Huddersfield (Mr. K. F. CAMPBELL, M.INST.C.E., M.I.E.E., borough engineer and architect to the Education Committee).—The County Borough of Huddersfield, in the matter of public works, have had an exceedingly busy time during the past twelve months. They have in contemplation the following important works during the next twelve months—viz., The completion of a new method of sludge disposal dealing with 350 tons of wet sludge per day. The scheme involves a material departure from any of the methods hitherto introduced in dealing with this difficult problem. It is expected that the plant will be put into operation early in the new year, and if the results are as anticipated, a most valuable asset to the new sewerage scheme, which has now been in operation for three years, will be established. The corporation are also considering the question of erecting baths and wash-houses on an extensive scale; the erection of a free library, art gallery and museum, as well as additions to three of the public schools. A Bill in Parliament is being promoted for the extension of the tramways system, involving an expenditure of £150,000, including street widenings and improvements, and other important works. The tramways department have erected a new car shed with accommodation for eighty-five cars, together with workshops, stores, and other offices complete. Competitive designs have been obtained for the laying out of four sections of the borough. These designs have been submitted to Mr. H. Percy Boulnois, M.INST.C.E., London, for his report and award on the merits of each scheme sent in. The corporation contemplate the erection of workmen's dwellings involving a large expenditure, and some of the houses are now in course of erection. An additional scheme is now being prepared. Generally speaking, the cost of public works still to be carried out by the corporation during the next twelve months will not be less than £200,000. The whole of these works will be designed by the borough engineer, and carried out under his superintendence with the assistance of his professional staff.

Hull (Mr. A. E. White, M.INST.C.E., city engineer).—No considerable new highways or widenings are likely to take place. A widening of the Hessle-road from Pickering Park to Pickering-road has been commenced, and preliminary enquiries are being made with regard to an extension of Chanterlands-avenue under the Hull and Barnsley Railway towards the Cottingham-road, but this latter is not likely to take practical form at an early date. A number of existing streets are likely to be paved with wood, granite or asphalt. The corporation have put in hand the blacksmiths' shops and two of the blocks of stables and cartsheds referred to in last year's forecast, and have recently purchased a site for the third district, and stables and cartsheds on this site will probably be erected during the year. Besides the infectious diseases hospital mentioned last year, it is proposed to provide accommodation for tuberculous patients. A tramway extension on Spring Bank West is now in hand, and it will be followed by extensions already authorised on Hessle-road, Cottingham-road and Beverley-road, and a loop through Brook-street and Jameson-street. A contract has been let for extensive stores, workrooms, &c., at the tramway power station, and a site has been purchased for car-repairing workshops adjoining the Liverpool-street depot. A large extension of the electricity works is in hand. It is expected that the teachers' training college will be completed during the year, and further elementary schools are contemplated. The second section of the new Guildhall has been brought into use, and the old Guildhall pulled down, and the building of the third and final section commenced.

Hyde (Mr. JAMES DIGGLE, ASSOC. M.INST.C.E., borough and water engineer).—There are a considerable number of new streets to form under the Private Street Works Act, 1892, and the extension of the town hall by the addition of a new public hall, police and coroner's courts, offices and cells is now proceeding. The amount of the contract is £14,000. It is expected that the contract will also shortly be let and the work commenced for the extension of the baths.

Ilford (Mr. H. SHAW, M.INST.C.E., engineer and surveyor to the urban district council).—The council anticipate commencing during the forthcoming year an extension of main sewer in the rural part of the district, new public baths, town hall extensions, dust destructor buildings, necessary roads and plant, large extensions to Valentines Park and Goodmayes Recreation Ground, a number of private street works, and the second portion of the Cranbrook-road improvement.

Ilkeston (Mr. HENRY J. KILFORD, M.R.SAN.I., borough surveyor).—The extraordinary work anticipated for the coming year is briefly as follows: The laying of new sewers—viz., 12,300 yds. of 9-in. to 18-in. stoneware pipes, 2,230 yds. 24-in. to 27-in. concrete tubes, 1,560 yds. 12-in. to 30-in. cast-iron pipes, together with manholes, ventilating shafts, and automatic flushing apparatus, and alterations and additions to existing pumping plant for three small outfall works, at an estimated cost of £30,000. Public street works will include the widening of Heanor-road from Bath-street to the Great Northern Railway station to 60 ft. wide, and also Burn-street to 30 ft. wide, at an estimated cost of £1,443; the widening and improvement of High-street, and construction of a new street therefrom to Cantelupe-road, and the remaking and improvement of Lower Granby-street and East-street. Private street works will include Green's-lane, Whitworth-road, Westwick-street, Nesfield-road, and five short avenues off Stanton-road, the cost being estimated at £1,575. Roads and streets around the site of the new Ilkeston county secondary schools are estimated to cost £2,500. Other works include the completion of the secondary schools, the completion of the new bridge over the Erewash Canal at Gallows Inn on the main road to Nottingham, and a new footbridge over the river Erewash, town hall extensions for additional office accommodation, a new gas holder and tank 113 ft. diameter, extensions to water mains, and a ferro-concrete water tower 70 ft. high.

Isle of Wight (Mr. LESLIE A. COZENS, surveyor of highways to the rural district council).—The past year here has been an extremely active one, some eight road improvements of widenings of narrow roads and corners having been completed, one embracing the removal of three cottages at a dangerous corner. Many important road widenings are also scheduled for carrying out during the present year. Two miles of highways have been reconstructed under a grant from the Road Board, and it is anticipated that further works of this nature will be carried out this year. The council anticipate carrying out a considerable amount of tar-spraying, about 25 miles of main roads having been sprayed during the past year. Two short lengths of sea wall have been erected, and repairs completed to others. Some of the roads along the coasts have been causing anxiety, especially the popular road from Ventnor along the undercliff to Blackgang, and the main roads at Yarmouth and at Mavestand, owing to the encroachment of the sea and the unsatisfactory nature of the subsoil of these roads. The council are, however, endeavouring to take steps to minimise the damage being done.

Jarrow-on-Tyne (Mr. J. SCOTT WEIR, ASSOC.M.INST.C.E., borough engineer and surveyor).—In addition to the usual work of maintaining, scavenging and lighting of the roads, and the repairing and flushing of the sewers, further new sewer and surface water drainage is contemplated to prevent flooding in certain parts of the borough. Extensive road improvements are under consideration in different parts of the borough, in-

cluding, in one case, the construction of new railway bridges, &c. The estimated cost of the above improvement will be about £35,000. The construction of an East-end park is in hand, including tar-macadam paths, bandstand, promenade and conveniences. The construction of a public sanitary convenience in the centre of the town is in hand, and the council have under consideration the question of the extension of the borough boundaries to include adjoining areas. The reconstruction of main roads with tar macadam and whin-sett paving is progressing; also the laying of new wide channels in other main roads, while many private streets will be laid with tar macadam. The alteration to the machinery in the laundry at the public baths into electric-power driven will probably be undertaken this year. The erection of large gates, working automatically from watchman's cabin on one of the main thoroughfares, will be put in hand this year, including the necessary alterations to the levels of the approaches.

Kendal (Mr. F. W. Oxberry, borough engineer and surveyor).—During 1912 a considerable length of Rocmac and tarred macadam have been laid, and several gravelled footpaths tar-paved. Two important street widenings have been effected—viz., Queen's-road and Stricklandgate the corporation having received a grant from the Road Board for the latter improvement. An oak bandstand, with stone base and oak shingle roof, has been erected in the Abbot Hall grounds. Application has just been made to the Local Government Board for sanction to extend the sewage works, at a cost of £10,000. The scheme includes the provision of automatic screening apparatus, storm-water tanks, additional percolating filters, humus tanks, sludge beds and pumping machinery. This scheme, together with the housing of the working classes, the extension of the borough boundary, and the still further improvement of the roads and footpaths, are the chief matters which will receive the attention of the surveyor's department during the present year.

Kesteven, Lincs (Mr. W. B. Purser, assoc.m.inst.c.e., county surveyor).—It is intended chiefly to deal with ordinary maintenance on the main roads, and a few improvements by widening narrow places and opening out dangerous corners. The county surveyor is also experimenting with improved construction, and has adopted various special binders in lieu of the old water-bound system. It is probable that from 70 to 80 miles of main road will be surface treated.

Kettering (Mr. Thos. Reader Smith, assoc.m.inst.c.e., surveyor to the urban district council). Although the works mentioned in last year's return have not yet all been carried out, there is every probability of their being executed during the next twelve months. These comprise the provision of public baths, for which it is proposed to carry out alterations on an existing bath site which contains a large open-air bath 240 ft. in length and 45 ft. in width. It is proposed to construct a tepid swimming bath at one end, the dimensions to be 75 ft. in length by 35 ft. in width, together with slipper baths, Russian vapour baths, plunge baths, and a liberal provision of sprays. The other end of the bath, which is somewhat out of repair, would be reconstructed so as to form a good open-air bath to be about 130 ft. long, together with dressing boxes and sheds. The question of underground conveniences has been before the town for a long time, and it is now definitely decided to construct a block in the public market place. These will comprise conveniences for both men and women, and some other lavatory accommodation. Another piece of work which it has also been definitely decided to carry out in the near future is the construction of a public destructor and cleansing station. This will comprise the usual buildings and apparatus for a steam disinfector, together with offices for public distribution of disinfectants and a cleansing station (particularly for use in connection with the council's schools) which will include waiting-room, nurses' room and the necessary baths.

Kettering (Mr. W. Hadley Darby, m.i.mun.e., surveyor to the rural district council).—In addition to the ordinary maintenance of 110 miles of roads and bridges, the following works, it is hoped, will be carried out: Improvements to dangerous corners at Pytchley, Stanion and Thorpe Malsor; new surface-water drain at Rushton; new tar-paved footpaths at Broughton, Burton Latimer, Geddington and Rushton. The tar-macadam laid down during the past year has given satisfaction, and it is proposed to extend its use to a greater extent during the coming year. The scheme for the widening of Church-street, Burton Latimer, it is hoped, will be put in hand, and negotiations are now in progress with the landowners for the acquisition of the necessary land. The estimated cost is £320, towards which the Road Board have agreed to contribute £100.

Kiveton Park (Mr. Frank Hewitt, engineer and surveyor to the rural district council).—The whole of the house connections to the new sewerage systems in Wales and Dinnington being just completed, drawings are now in hand for a new sewer at Dinnington, and other new sewers will be dealt with during 1913. The laying of storm overflow sewers at Kiveton Park and Wales is at present proceeding. In connection with the improvement of Laughton-road, Dinnington, surface-water sewers of stoneware pipes and steel-ribbed concrete tubes are to be laid. The surveyor's estimate amounts to nearly £1,000. Sewage Purification.—Dinnington sewage works are to be more than doubled in size, and the preparation by the surveyor of drawings for screening chambers, enlargement of pumping wells, alterations to pumping plant, additional septic tanks, storm tanks, filter-beds, sludge beds, &c., will be commenced immediately. In consequence of complaints by the Rivers Board, the surveyor reported fully upon the Wales sewage works, and has since received instructions to prepare a scheme involving screening chambers, alterations to pumping arrangements, humus pits, sludge beds, &c. Several minor improvements will be carried out during the year at Wales Bar, Woodsetts, and other outfall works. Roads.—Detailed drawings and estimates prepared by the surveyor for widening, paving, &c., Laughton-road and Outgang-lane, Dinnington, were sent to the Local Government Board at the end of last year. The work will cost about £5,000, exclusive of surface-water sewers. The widening of several other roads will be dealt with during the year. During the summer months considerable tar-spraying work, on district roads by the council's own men, on main roads by contract, will be done, and a good deal of tar-grouting and other modern methods of road making carried out. Private Streets.—A number of private streets in Kiveton Park, Anston, Harthill and Dinnington require making up, and probably the work—including the provision of surface-water sewers—will come on before the end of 1913. Bridges.—Now that the work of widening Monks Bridge is finished, the surveyor has been instructed to prepare drawings for widening Hard-lane Bridge. The reconstruction of Turner Wood Bridge in steel will be carried out shortly, the plans having already been approved. Refuse Destructor.—The enlargement of the engine-house being now practically completed, other smaller works for improving the working of the destructor and sewage pumping machinery are proceeding. Council Buildings.—The surveyor's plans for alterations and additions to the council offices and the provision of cart sheds, &c., are at present in the hands of the Local Government Board, and the work will be put in hand as soon as the sanction is received. Water Supply.—The Local Government Board inquiry was held in December into the scheme, prepared by the surveyor, for Thorpe Salvin, and it is hoped that the work will be completed during the summer. The water supply of Woodsetts is now under consideration. Several new water mains are at present in course of construction, and other extensions will be dealt with during the year.

Knaresborough (Mr. Robert E. Wilson, m.i.mun.e., surveyor to the urban district council).—In addition to the ordinary routine work the council intend doing another portion of High-street with Tarvia-bound macadam and repairs to main road with Tarvia binding. A new length of 9-in. sewer is to be laid in Stockwell-lane, and storm overflows fixed on surface drains at New Scriven. A portion of the underdrains at the sewage farm are to be relaid on concrete. The widening of a portion of Stockwell-road to 40 ft. is to be carried out this year.

Leatherhead (Mr. Sidney R. Drake, engineer and surveyor to the urban district council).—The council have purchased a strip of land for rounding off the Swan Corner, and it is expected that the work will

be completed by May next. The council have also purchased about 4½ acres of land in the upper part of the town for the purposes of a recreation ground, at a cost of £1,050, and will at once proceed to fence in, erect a pavilion, &c., and lay out the ground, at an estimated cost of £450. Certain private street improvement works are contemplated during the coming year. The roads in the district will be again surface-tarred, and part of the footpaths of Church-street and Bridge-street will be relaid with artificial stone.

Leeds (Mr. W. T. LANCASHIRE, M.INST.C.E., city engineer and surveyor).—The extension of the city boundaries, which took effect from November 9th last, will cause additional work, including the preparation of schemes for various improvements in the newly added areas, and will promote the consideration of town-planning schemes to co-ordinate development in the added areas with that within the city as before constituted. Two or three areas of considerable extent are receiving attention with a view to application for permission to prepare town-planning schemes. In connection with the remodelling of a portion of the centre of the city, one street is now being made 75 ft. wide, and work in other streets will be carried out during the ensuing year. Parliamentary powers are being sought for the construction of an entirely new street, 60 ft. wide, in connection with the extension of the infirmary, which will relieve, to a large extent, the congestion in another thoroughfare leading to the north-west suburbs. Other improvements are being proceeded with under old powers, and Parliamentary powers are being sought for widenings to enable tramway tracks to be laid. Application will be before Parliament in the coming Session for various tramway and trackless-trolley car extensions. In addition to the ordinary work of maintenance and repair of sewers, additional storm-water sewers are about to be constructed to relieve flooded districts. Other extensive sewerage works are in contemplation as the result of the recent enlargement of the city boundaries. Good progress is being made by the sewerage engineer (Mr. G. A. Hart) with the new sewage disposal works at Thorpe Stapleton, and it is expected that tenders will be invited shortly for the new high-level intercepting sewer. An arrangement has been come to between the Improvements Committee and the Tramways Committee to hand over the greater portion of the land purchased by the former committee in the centre of the city in connection with an improvement scheme (containing about 8 acres) for a central tramway depot, works and yard.

Leek (Mr. W. E. BEACHAM, M.R.SAN.I., surveyor and waterworks engineer to the urban district council).—During the past year the principal works carried out have been extensions to the gasworks, the erection of new gas offices, and extension to coal store. For the current year works of main sewerage are contemplated. Plans are already prepared for a new main outfall sewer for the western district, coupling up with that of the northern district at Pile Bridge. A new convenience is being erected at the junction of Mill-street and West-street. Plans for alterations to the existing baths, and the erection of new public baths, have been before the council, but are deferred for the present in favour of some slight repairs to the existing swimming tanks. A housing scheme, involving the erection of forty-two workmen's cottages, is before the council, and is likely to be proceeded with. Works of street improvement are contemplated in Ashborne-road, Buxton-road and Abbots-lane, and development plans for 12 acres of land between Ashborne-road and Buxton-road, and 15 acres on the Belle Vue estate, are being considered. A new council school will be erected during the year on a site off the Ashborne-road. Generally, the year promises to be up to the average in municipal progress.

Leicester (Mr. E. GEORGE MAWBEY, M.INST.C.E., borough engineer and surveyor).—The principal works contemplated during the coming year or now in hand comprise storm-water sewage disposal scheme and augmentation of the sewage pumping plant, at an estimated cost of about £120,000; electric tramway extensions and street improvements in connection therewith, at an estimated cost of £149,000; extension of tramway car sheds, at an estimated cost of £5,800 (in hand); public hall, with accommodation for over 3,000, at an estimated cost of £17,000, now in course of erection; and improvement of a further section of the Willow Brook, to cost £5,000.

Leigh-on-Sea (Mr. JOHN W. LIVERSEDGE, ASSOC.M.INST.C.E., engineer and surveyor to the urban district council).—The rapid development of this district as a residential area still continues, necessitating the execution of a number of public and private improvement works. Two important matters likely to affect the district are the absorption of the London, Tilbury and Southend Railway by the Midland Railway Company, and the probability in the near future of the line from London to Southend (which passes through the district) being electrified. Already electrification has taken place as far as Barking, which is the present terminus of the District Railway electrical system. Continuation to Southend would represent a further extension of 28 miles. The Southend Corporation is seeking county borough powers, and a Bill is being promoted in Parliament to include the district of Leigh-on-Sea within the county borough area. During the past year the new public offices and fire station have been completed, giving more commodious accommodation for the council and staff. The engineer to the council was architect for the buildings. The works in hand and contemplation include the completion of the Broadway improvement scheme, for which a Provisional Order has been obtained: Rectory-grove improvement (widening from 36 ft. to 50 ft.); sewerage works main outfall sewer extensions; gasworks extensions and additions; and various private street improvement works, including the making up of private streets on the system adopted by the council of concrete foundations and tar-macadam surfacing.

Leith (Mr. J. R. FINDLAY, burgh surveyor).—The present year is likely to be a quiet one in regard to the carrying out of municipal works. The only work of any magnitude in contemplation is the paving of Seafield-road with granite setts, at an estimated cost of £5,000. Apart from municipal work, however, there are large schemes in hand, for which Parliamentary authority is being asked during the coming Session. These embrace two new railways, partly within the burgh, and a large extension of the harbour and docks, which will ultimately cost about £500,000.

Lichfield (Mr. W. B. CHANCELLOR, city engineer and surveyor).—The following work will probably be executed during the ensuing year—viz., Erection of refuse destructor and tar-macadam installation; various road improvements; the laying down of considerable lengths of kerbing and channelling; the tar-macadamising of the footways on the outskirts of the city, and tar-spraying several miles of roadway.

Lincoln (Mr. R. A. MACBRAIR, M.INST.C.E., city engineer and surveyor).—The following, very briefly stated, are a few items which it is proposed to carry out: The construction of revolving sprinklers or tank accommodation at the sewage farm; the laying out of a pleasure ground, and the removal of stables in Westgate; the installation of a refuse destructor at the sewage pumping station; the extension of the electricity works; the possible provision of another bathing place on the river Witham; a shelter at the tramway terminus, and extensive repairs and laying down of wood block paving.

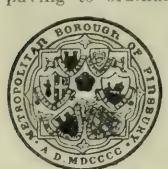
Littleborough (Mr. GEO. H. WILD, surveyor to the urban district council).—Apart from the ordinary work in the surveyor's department, important street improvements will be carried out by the conversion of granite macadam to granite sett paving. The sewage works extensions will also be completed.

Liversedge (Mr. A. ROTHERA, M.INST.M.C.E., engineer and surveyor to the urban district council).—During the coming year some important work is proposed by the council. The chief item will be the extension to the lower sewage works, where the council have acquired about 18 acres of land adjacent to the existing works for constructing additions to existing tanks and four new tanks, bringing the total tank capacity

to 935,394 gallons, against a dry-weather flow of 1,132,385 gallons. The filtrate will be afterwards dealt with in existing contact beds and on eight proposed rectangular percolating filters, varying in size from 360 ft. by 30 ft. to 225 ft. by 30 ft., the distribution being done by travelling distributors fed from a brick channel supported on arches and piers. The total capacity of contact beds and filters will be 17,755 cub. yds. The filtrate will afterwards be dealt with on land and humus tanks before passing to river Spen. The estimate for this work is £17,150. Other work proposed is the widening of Bradford-road between Leeds-road and Littletown, the making up of various private streets, as well as the laying out of Healds Hall estate, which has been presented to the districts of Hecknondwike and Liversedge for a public park and museum, and will be worked by a joint committee of the two councils. A large amount of tar-painting of main roads will be done, as well as the reconstruction of some of the main roads with either Tarmac or by the tar-grouting system. Surface-water drainage along various roads will also be carried out during the ensuing year.

London, Bermondsey (Mr. R. J. ANGEL, M.INST.C.E., A.R.I.B.A., borough engineer and surveyor).—The work proposed during the ensuing year will include a new underground convenience, an extension to the Rotherhithe Town Hall and to the electric lighting plant, and the repaving of several roads.

London, Deptford (Mr. J. SUTCLIFFE, ASSOC.M.INST.C.E., borough surveyor).—The erection of a central library at the corner of Lewisham High-road corner of Rokeby-road has just been commenced. A site has been obtained for the erection of public baths and wash-houses, and also a branch library in Evelyn-street. The laying out of the roads and paths and the drainage of the subsoil water of an extension to Brockley cemetery will be commenced early in the year. In connection with the usual work of maintenance of the roads of the borough, the council have decided to tar-spray certain roads, and also to use a bitumen matrix in the resurfacing of one or two roads. The borough council have been compelled to undertake the entire reconstruction of one street owing to subsidence of the abutting property, and in this connection it has been decided to convert the old tarred macadam paving to ordinary waterbound granite macadam.



London, Finsbury (Mr. P. G. KILLICK, borough surveyor).—Several large factories are about to be erected in the borough, including a telephone exchange in Lever-street, and the streets surrounding the latter are to be widened by agreement with the Post Office authorities. A considerable area of wood paving will have to be renewed, and probably a few macadam streets will be paved with some more durable material. A portion of sewers will be reconstructed. The council is supporting a Bill promoted by the London County Council for extending the tramways from the present terminus in Farringdon-road by Charles-street to a point in Farringdon-street near to Ludgate-circus.

London, Paddington (Mr. E. B. B. NEWTON, M.INST.C.E., borough surveyor).—The council's works for the ensuing year are not yet decided upon, but it is probable that they will include steps in connection with the erection of a new footbridge and new wood and other paving works. Further steps will be taken, no doubt, with regard to the erection of new public baths and wash-houses.

London, Woolwich (Mr. J. RUSH DIXON, M.INST.C.E., borough engineer and surveyor).—Further extensive road widening and paving works in connection with the London County Council's electrical tramway extension on the conduit system through to Woolwich will be proceeded with. The underground convenience for women, now proceeding in Beresford-square, and the overground sanitary conveniences and shelters for both sexes at North Woolwich and Abbey Wood will be completed. The council will have under consideration important schemes of flood prevention in Woolwich and Plumstead districts. In addition to the usual work of resurfacing and maintaining the large mileage of roads and sewers, several trial sections of paving materials will be laid in Footscray-road, New Eltham, adjoining the Road Board trials on the borough boundary. In addition to the usual private street works, there will no doubt be some further development of the several building estates in the borough.

London, Holborn (Mr. E. F. SPURRELL, borough surveyor). It has not yet been decided what works to carry out this year, but they will probably include the repaving of certain roads, and the reconstruction of certain sewers.

Lowestoft (Mr. G. H. HAMBY, ASSOC.M.INST.C.E., borough engineer).—In addition to ordinary routine work plans are under consideration for a new concert pavilion, to seat 1,200, in the popular Sparrow's Nest Park. Schemes are also contemplated for a lodge and extensive additional ward accommodation at the isolation hospital, and further public lavatory additions are receiving attention. The southern ejector station is being altered with a view to its modernisation. Several private streets are to be made up, and the work of relaying and repaving the tram track will be proceeded with. An additional timber revetment is projected on the south beach, and a busy year is anticipated in renewing groynes.

Luton (Mr. J. W. TOMLINSON, ASSOC.M.INST.C.E., borough engineer).—It is anticipated that the new public baths, which are being erected at a cost of £15,000, will be completed and opened early in the summer. The deep-level sewer now being laid for the Kimpton-road district will be completed in the early part of the year. Work will be proceeded with on the new main surface-water drainage system, including about 1 mile of 4-ft. diameter intercepting sewer, together with long lengths of branch sewers, and it is hoped to complete this within the year. A new foul-water intercepting sewer will be laid, dealing with the Dunstable-road district of the town. A new ward at the infectious diseases hospital is well in hand, and will be completed early in the year. It is anticipated that progress will be made with the town-planning scheme, sanction having been received from the Local Government Board to prepare a scheme for some 4,300 acres. Application has been made to the Local Government Board for the borough to be constituted a county borough. A scheme for an extension of the refuse destructor will be put in hand. Several extensions of school premises will be completed. One new school for 300 scholars will be completed, and another for a like number put in hand.

Lyme Regis (Mr. FREDERICK H. MCDONNELL, borough engineer).—The Bridge-street improvement will be started shortly. This includes the demolition of the property on the seaside, and unfortunately includes the old fossil shop, so that the bridge and road may be widened. At present it is only 7 ft. 8 in. wide in parts. It is proposed to have a stone breaker and a steam wagon of some sort for hauling the road metal, and to use more granite in lieu of flints for the ordinary maintenance of roads. The corporation have purchased the Cliff land adjoining the parade for laying out as a pleasure garden, with sanitary conveniences for both sexes, and shelters between. The roofing will form an upper promenade. More workmen's cottages are being erected, and there will be several small sewer and water main extensions.

Maidstone (Mr. T. F. BUNTING, borough surveyor).—During the ensuing year it is proposed to build an additional elementary school, and the restoration of the old Archbishop's Palace is to be further proceeded with. There is a proposal coming before the corporation for a system of motor 'buses for the northern part of the borough, the rest of the town being served by a system of electric trams. There will be the usual routine work, and a few road improvements, and the renewal of short lengths of sewers.

Maldon (Mr. T. R. SWALES, M.INST.C.E.I., borough engineer and surveyor).—In addition to the usual work of maintaining the roads of the borough, a further extension of surface treatment for prevention of dust is proposed, and the work of making up several streets under the Private Street Works Act, 1892, will be carried out. Extensions to the waterworks are in progress, and an extension of the main sewerage system will probably be put in hand. The council have adopted the borough surveyor's scheme for the erection of thirty-two artisans' dwellings, which work is to be put forward at once.

Manchester (Mr. T. DE COURCY MEADE, M.INST.C.E., city surveyor).—There are few special works in course of construction in the city, with the exception of the main drainage works, which are of considerable extent.

Mansfield (Mr. THOS. P. COLLINGE ASSOC.M.INST.C.E., borough engineer and surveyor).—The projected work during the ensuing year includes the erection of new council schools at Moor-lane, Chesterfield-road, Rainworth, and extensions to Broomhill schools. The new schools at Pleasley Hill will also be completed. A scheme for dealing with the Rainworth sewage has been adopted, and will shortly be put in hand. A new 18-in. sewer, for a length of 550 yds., will be laid in Nottingham-road. The new slipper baths at Pleasley Hill, cattle market extensions, and Southwell-road and Big Barn-lane main sewering will also be completed. A number of street improvements under the Provisional Order sanctioned last year will be carried out, and an area of upwards of 3,000 acres of land in the borough has been scheduled for town-planning purposes, and the administration of the scheme is being proceeded with. Considerable extensions at the infectious diseases hospital are to be carried out at an early date. Good progress is being made with the new railway from Clipstone to Kirkby. During the year 393 new houses have been certified for occupation. The estimated population of the borough is 40,000.

Margam, Port Talbot (Mr. JOHN COX, surveyor and waterworks engineer to the urban district council).—The works projected are: Erection of gasworks and extensions of lighting systems; new connecting roads to the Avan Valley; erection of Carnegie library, to cost £2,500 (plans approved); new public cemetery and chapels, area 7 acres, estimated cost £5,000; erection of stables, stores and fire brigade station; progression of sea outfall sewer, jointly with Glyncorrw Urban District Council; provision of working-class dwellings; extensions and improvements of water supply, including increased storage. Considerable activity is taking place in commercial circles here, and vast works are being promoted which will have the effect of greatly extending the town.

Margate (Mr. ERNEST A. BORG, borough engineer, surveyor and water engineer).—Works now in progress at Margate include an 8-cell refuse destructor, to cost £13,500, including land; a new bathing pavilion, shelter, and public lavatories at Westbrook Promenade (£5,500); a new footbridge over Hodges' Gapway (£1,200); an extension to the Fort Pavilion and Winter Gardens, by covering over the open arena and entrance steps, &c.; slipper baths and houses for the working classes; a fire station; bowling pavilions; secondary school; and cooking and manual training centre are also under consideration. Two sets of motors and rotary pumps are now being fixed at the King-street pumping station, to cope with the heavy pumping work in storm time. Other works approved by the town council are a new pumping plant, to deal with 3,500,000 gallons in twenty-four hours, for Wingham Waterworks (£17,000), including engine-house, well, &c.; and a new reservoir to hold 2,000,000 gallons (£12,000). A memorial has also been laid before the Local Government Board for powers to extend the boundary borough to Kingsgate on the east and Westgate-on-Sea on the west.

Marsden (Mr. FRED. GREENWOOD, M.I.MUN.E., engineer and surveyor to the urban district council).—In addition to the usual work of maintaining the main and other roads, tar-spraying, tar-macadamising, and water-binding, it is expected that the following works will be carried out—viz.: Widening the roadway in Peel-street East; building a motor ambulance shed; building a road roller shed; sewer extensions; laying surface-water drains with flushing chambers; and extension of sewage outfall works (estimated cost £7,000).

Market Harborough (Mr. HERBERT G. COALES, ASSOC.M.INST.C.E., F.S.I., engineer and surveyor to the urban district council).—Extensions to the fire station, with ambulance store and cottages for the fire brigade engineer and driver are to be built. Otherwise no other public work is projected at present. All the projected work set out in last year's note has been carried out.

Matlock (Mr. JOSEPH TURNER, surveyor and waterworks engineer to the urban district council).—The council have under consideration the further development of their pleasure grounds, including the providing of additional tennis courts, bowling green, croquet lawns, shelters, &c. It has also been decided that a loan should be taken up for the erection of a concert hall or pavilion, and the surveyor has been instructed to prepare plans. Alterations to premises occupied by the Liberal Club at the town hall are to be carried out, including the provision of an additional billiard-room. Sanction to a loan of £45,000 for a main sewerage scheme has been granted, contracts let, and the work is being proceeded with. The securing of open spaces and other minor improvements are to be carried out.

Meriden (Mr. THOMAS HENRY NEGUS, surveyor to the rural district council).—The amalgamated rural districts of Meriden and Castle Bromwich, which include twenty-two parishes, now comprise an area of 55,815 acres, or nearly 90 square miles. Its population in 1911 was 15,389, and its rateable value £145,655. Various schemes of sewerage, sewer extensions and water supply are under consideration. Application for a loan of £1,700 for sewerage and sewage disposal for the village of Fillongley has recently been made.

Merthyr Tydfil (Mr. A. J. MARSHALL, borough engineer and surveyor).—In addition to the usual work of maintaining the large mileage of roads and sewers, further extensions are certain to be undertaken to connect up the large number of houses which are either in course of erection or contemplated within the corporation's area. It is intended during the forthcoming year to lay down a 30-in. diameter trunk sewer between Troedyrhiw and Quaker's Yard, the length being 4½ miles, and the estimated expenditure £24,000; also a relief sewer, varying in diameter between 12 in. and 24 in., to prevent the flooding of the lower parts of the borough. This sewer will be about 1 mile in length, and will involve an expenditure of £1,100. Several street, bridge, and main road widening schemes are under consideration, and the relaying of the tramway track through the centre of the town is probable. River defence walls to protect the corporation sewage farm lands will be commenced in the near future, and several private streets will be made up under the Act of 1892. Three public parks and recreation grounds are to be laid out this year, for which loans have already been obtained.

Middlesbrough (Mr. S. F. BURGESS, M.INST.C.E., F.R.SAN.I., L.R.I.B.A., borough engineer and surveyor).—During the ensuing year a number of schemes for the sanitary and general improvement of the borough are under contemplation. An extensive main drainage and sewerage scheme has been approved by the town council, and application has been made to the Local Government Board for sanction to borrow the requisite amount and an inquiry will be held shortly. The total cost of the scheme is estimated at £60,000. Only a portion of the scheme, to cost £33,850, is to be carried out in the first instance, and the remainder will be put in hand after the first section has been completed. A scheme for the erection of a dock and shed for the refuse barge has also been approved by the town council. Estimated cost of constructional work, £3,500. A scheme for the erection of a divisional police station, to cost about £3,000, has been submitted to the Watch Committee. Work in connection with the foundations for the statue to be erected as a memorial to the late Sir

Samuel Sadler, and alteration to the public walks in Victoria Park (where the statue is to be erected) will be carried out. Estimated cost, £250. In addition the statue is to cost £2,000. Road improvements and street paving, to the extent of about £15,000, will also be put in hand. The corporation have under consideration the extension of the borough boundaries to include a considerable district north, south, east and west of the existing borough. A town-planning scheme is also well in hand. The scheme embodies the laying out of the remaining unbuilt-up portion of the borough, including some acreage beyond. A total area of 1,000 acres is under review. The installation of water-closets in lieu of privies has been extensively carried out during the past year, and in the ensuing twelve months will be continued, so that in a few years' time it is hoped that the water-carriage system will be practically the system in the borough. About £20,000 will be spent during the year. Internal alterations of the municipal buildings, to adapt the same for use by the various departments by reason of the removal of the Free Library and News Room to the new Carnegie Library, will also be put in hand. About half this work has already been carried out. An extensive scheme is being prepared under the Housing and Town Planning Act, 1909, for improvement of the various properties on the north side of the river. An extension of the Industrial School gymnasium, at a cost of £200, will be carried out.

Middleton (Mr. W. Welburn, borough surveyor).—The following works will be carried out -viz., Private street works (£4,944), and new street for which Parliamentary powers have been obtained (£3,330); plans are being prepared for new streets for opening out two large districts. New baths are under consideration, and the question of a new town hall is being considered. The borough surveyor has been instructed to report on the question of mapping out the whole of the outside areas unbuilt upon for the purpose of a town-planning scheme.

Montrose (Mr. S. L. Christie, burgh surveyor).—The works projected in Montrose during 1913 include the following: Erection of a shelter at beach in concrete with flat roof, at a cost of £1,000; improvement of promenade and bathing facilities; erection of a turbine and pumps at Kinnaber waterworks, estimated to cost £2,000; deviation of Kinnaber Lade to suit new position of turbine, and extension of bridge over said Lade, estimated to cost £800; the probable causewaying of Northesk-road, at a cost of £3,000; the laying of a new sewer to beach, at a cost of £200, and the treatment of road surfaces with tar brushing, and the alteration and extension of slaughterhouse, at a cost of £2,000.

Morpeth (Mr. J. Davison, borough surveyor). The second housing scheme carried out by the town council under the Act of 1890, comprising thirty-three cottages, will be completed during the early months of the year. A considerable amount of work in connection with the making up of private streets will also be undertaken at an early date. Allotment gardens will be laid out by the corporation, and there will be extensive repairs to streets and footways during the year. Extensions to water mains will be carried out. It is expected that application will be made for an extension of the borough boundaries in a short time.

Motherwell (Mr. Wm. Ross, burgh engineer and surveyor and master of works). Contracts have been fixed for a large extension to the slaughter-house, and work will be commenced thereon shortly. It is anticipated that during the year the proposed sewage purification works for the western district of the burgh will be proceeded with, beside several extensions and renewals of sewers. The fencing, planting and laying out of three of the public parks have been commenced, and will be carried out steadily through the ensuing year. A town planning scheme has been drafted for the Hamilton-road district of the burgh in conjunction with the Middle Ward district of the County of Lanark adjoining, and has been approved of by the two councils. A motion has been before the town council to erect new swimming ponds and baths, and if agreed to will probably be carried out during the year. Several street improvements are also contemplated, and these may be completed during the coming season.

Neath (Mr. D. M. Jenkins, assoc.m. inst.c.e., borough engineer).—Works in progress include the draining, laying out and planting of new Mount Pleasant recreation ground, and the formation of paths, the laying out of bowling green and enclosure for children's games, and the erection of pavilions, shelters and lavatories in connection with same; the construction of two additional sets of septic tanks, filters, and storage tanks, in connection with Llantwit sewage purification works; erection of store and workshop for water department, and building for domestic subjects centre at Gnoll council school. Works to be proceeded with this year: Erection of ninety-three workmen's dwellings on a site of 5 acres, to let at rentals of from 4s. 6d. to 5s. 3d. per week; auxiliary works of water supply in connection with the Ystradfellte waterworks of the Neath Rural District Council; new block of buildings and general additions to Gnoll council schools; various extensions of water and electricity distributing mains; sundry private street works and road improvements. A Town-Planning Committee has been appointed by the corporation, and the preliminary steps are being taken to initiate a town-planning scheme for the borough.

Newport, Mon. (Mr. H. Tremelling, assoc.m.inst.c.e., borough and water engineer).—The works projected for the current year include: Underground and other conveniences (£3,000); purchase and laying out of new recreation grounds (£2,600); reconstruction of central depot, Friars-street (£3,000); new surface reservoir, Beechwood Park, and the widening and improvement of Chepstow-road. A large number of streets will also be dealt with under the Private Street Works Act. Subject to a grant being obtained from the Road Board, various road widenings and surface improvements will also be dealt with.

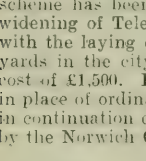
Newton-in-Makerfield (Mr. Arthur Bowes, assoc.m.inst.c.e., engineer and surveyor to the urban district council).—Application has been made to the Local Government Board for permission to carry out a scheme of sewage treatment, estimated by the engineer to cost £11,000. A fever hospital, containing twenty beds, has just been completed at a cost of £5,000, and during the year the laying out of the surrounding grounds and the erection of subsidiary buildings will be proceeded with. Public baths will receive consideration, none yet existing in the district. Plans are in hand for about thirty streets to be made up. A town-planning scheme, comprising the whole of the district unbuilt upon, is in hand, and the first conference of interested parties has been held. The council is also considering the advisability of acquiring a large area of land for laying out as model building sites.

Norfolk (Mr. T. H. B. Heslop, m.inst.c.e., county surveyor). The principal work for the year will consist in restoring the damage caused by the unprecedented flood of August 26th last. This will include reconstructing forty-one bridges and culverts, and repairing sixty-four bridges and culverts. The larger bridges will be in steel with brick and concrete abutments. Thirteen of the smaller bridges and one of 40 ft. span will be constructed in ferro-concrete. Several miles of main roads damaged by flood will also be remade. It is also proposed to reconstruct about 24 miles of roads in various parts of the county by the aid of grants from the Road Board. Cottages for police constables are to be erected, and a new police station is in course of erection. Cottages are also to be erected for attendants at the county asylum.

Northampton (Mr. Alfred Fidler, m.inst.c.e., borough engineer and surveyor).—Works in connection with the Bridge-street improvement will be put in hand. The Far Cotton tramways, which passes through this street, will be constructed for a distance of 1¼ miles; also the doubling of the Kingsthorpe section for about the same distance. The laying out of the Far Cotton and Kingsthorpe recreation ground will be proceeded

with, and the erection of fifty workmen's dwellings, which will form part of a comprehensive scheme for the erection of houses of this class in different parts of the town. It is also intended to erect district baths and wash-houses and swimming baths. An extensive housing and town-planning scheme is now being prepared. The erection of a new fire staion is under consideration. In addition to the above it is expected that some important road improvements will be carried out.

Norwich (Mr. ARTHUR E. COLLINS, M.INST.C.E., city engineer).—The following are the principal municipal works which, it is expected, will be commenced, proceeded with, or completed during the ensuing twelve months: Adaptations of the existing municipal offices, and extensive additions thereto, to enable centralisation to be effected of the staffs of the various departments of the corporation. The estimated cost of the scheme sanctioned by the city council is £12,800. Following upon the flooding, in August, of a considerable portion of the city adjacent to the river Wensum, a Flood Prevention and Housing Committee has been appointed to inquire into housing conditions and consider measures for flood prevention. Steps are being taken to effect considerable widenings and improvements of the river through the city, for which purpose a commencement has been made in acquiring properties adjoining the river. Extensions of the male and female sides of the city asylum are to be carried out, and the transfer of the wholesale fish-market from a site in the centre of the city to one near the principal railway station is to be effected. The estimated cost of this transfer, for buildings only, is £2,000. Erection at the sewage farm of a block of cottages for the workmen employed thereat (estimated cost £1,200). Erection of foreman's dwelling and coal store at the main sewage pumping station at Trowse (estimated cost £1,300). Construction of a roof over part of the yard at corporation depot (£1,000). Construction of a shelter, with lavatory accommodation, at the city cemetery (£300). Provision of public conveniences in streets at Sewell Park, &c. Continuation of the laying out of Wensum Park. Various street widenings. For the improvement of the sewerage of a district in the north-eastern portion of the city, a scheme costing £1,200 will be carried out; in addition, £2,200 will be expended upon adaptations of the existing sewerage of streets prior to proceeding with private street works therein. An automatic electrically driven additional air compressor in connection with the Shone installation, and new river sluices are to be installed at New Mills power station at a cost approaching £1,000. Negotiations are in progress for the leasing from the Ecclesiastical Commissioners of Kett's Cave, near Household Heath, which is associated with Kett's Rebellion. It is proposed to maintain this cave as a place of interest, and to lay out the remainder of the site as a children's playground. For the purpose of commercially dealing with the sludge from the sewage farm, works have been erected there by the Norwich Natural Manure Company, licensees of the Electro Metals, Limited, 9½ Union-court, Old Broad-street, London. It is expected that their operations, involving the use of Ekenberg's wet carbonising process, will be commenced early in the year. In anticipation of the demands of unemployed labour, a scheme has been prepared for the completion of the widening of Telegraph-lane, and works in connection with the laying out as public gardens of two churchyards in the city will also be available, at a further cost of £1,500. Large areas of bituminous macadam, in place of ordinary macadam, are expected to be laid in continuation of the policy in this direction adopted by the Norwich Corporation.



Notts (Mr. E. P. HOOLEY, M.INST.C.E., county surveyor).—There are no very special works anticipated in Notts other than necessary to meet the needs of a greatly growing county. It is hoped that the Road Board will agree to the completion of the Fosseway, which will mean the construction of over 12 miles of the surface in Tarmac. At least 16 miles of main road are annually reconstructed into Tarmac roads in Notts, and this will be continued in 1913. Ten new public schools are to be commenced, some of which will be completed. A widening of a bridge at Edwinstowe is to be carried out.

Nuneaton (Mr. F. C. COOK, ASSOC.M.INST.C.E., borough surveyor and water engineer). The work contemplated during the forthcoming year comprises the following. Completion of water-pumping station at Griff, including the erection and equipment of the engine-house, installation of mechanical filters, and the laying of about 2,300 yds. of pumping main; an important widening in the market-place in conjunction with the erection of a new post-office; the erection of new slipper baths, and extensions of electricity generating station for the electricity department. The corporation have also under consideration the question of instituting a service of motor 'buses.

Ossett (Mr. H. HOLMES, M.INST.C.E.I., borough surveyor and water engineer).—From the number of projected works for the coming year, it is evident the borough surveyor's department will be extremely busy. An extension of the sewage disposal works is being prepared, which will include four 100 ft. percolating filters, settling tanks, and concrete carriers, and the laying out of land for filtration. The surveyor has also received instructions to prepare a surface-water drainage scheme for the whole borough. The relaying of the main outfall sewer, 2 ft. 9 in. in diameter, storm-water tanks, sludge mains, engine-house, &c., are being carried out departmentally, and the following works are to be taken in hand during the year—viz., Gawthorpe sewerage and surface-water scheme; underground conveniences in the market-place; erection of stores, workshops, fire station, and storekeeper's house; the purchase of a motor fire engine; Pildacre-hill sewerage scheme, and water mains extensions. A number of private streets are also scheduled to be made up and sewered; as many as sixty private streets in the borough require making up. It is proposed to revise the by-laws. During the past year a considerable amount of Tarmac has been laid, and tar-spraying done on the main road and district roads, and this will in all probability be continued this year.

Oundle, Northants (Mr. G. BELSON CHILVERS, M.I.MUN.E., M.R.SAN.I., engineer and surveyor to the urban district council).—The agreement between the urban district council and the rural district council for the enlargement of the isolation hospital of the latter authority, at a cost of £1,000, has been sealed, the cost of the work being borne by the urban district council, and when completed the hospital will be under the joint control of the two authorities. The work will undoubtedly be carried out during the year. The architect for the building is Mr. Traylen, of Stamford. The widening and repairing of the North Bridge by the county council, at a cost of nearly £9,000, is in progress, and will probably be completed by the end of the year. Other work includes the installation of a water-level indicator by the postal authorities. The county council have acquired a site for the erection of an elementary school. About 20,000 sq. yds. of surface tarring will be carried out, and 1,000 lin. yds. of main road will be recoated and bound with Tarvia binder, in addition to ordinary repairs to district roads. The conversion and adaptation of existing premises (which the council propose renting) for the purpose of depot and stables is another matter which will receive attention. During the past year the council took on lease a small field for use as a recreation ground, and will probably this year erect swings, &c., for the amusement of children. A public convenience has been talked about, but there is a difficulty in agreeing upon a site which will be in a central position.

Oxford (Mr W. H. WHITE, M.INST.C.E., city engineer).—It is expected that during the current year the electrification and extension of the tramways, which have been long delayed, will take place. It is proposed that petrol electric cars shall run on the central portions of the system: that on the outer parts the ordinary overhead electric traction shall be installed; and that on certain routes there shall be a service of motor-omnibuses. An extensive street improvement is being planned, involving the widening of more than half the length of one of the four main thoroughfares. There will be extensions of the storm-water drainage within the city. Several new streets are contemplated, and extensions of the water-supply and sewerage in certain outside parishes. The question of town planning will also engage the attention of the council.

Pembrokeshire (MR. A. H. THOMAS, A.R.I.B.A., county surveyor).—In addition to the general routine of work in connection with the upkeep of the county buildings and bridges, and the maintenance of the main roads, the coming year's work will be considerably increased by reason of the diversion of Dinas Hill, Fishguard, ballasting of the Haverfordwest St. David's-road, and the improvements of bad corners on the main roads. The hill which is to be diverted may safely be described as one of the worst on any main road in the kingdom, its average gradient being 1 in 6¼, with 1 in 5 at the hairpin bend. The Road Board has granted for this work a loan free of interest, repayable by ten annual instalments; grants have also been made by the board towards the ballasting work and the improvement of the corners. The Public Works Committee are about to build a new police station and sergeant's residence at Pembroke, carry out additions to the police station at Milford Haven, and to erect an office for the deputy chief constable at the constabulary headquarters.

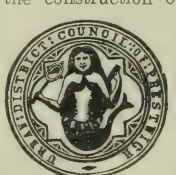
Peterborough (Mr. J. W. WALSHAW, city surveyor).—The undermentioned works are expected to be carried out in this borough during the year 1913—viz.: The Great Northern Railway Company are promoting a Bill under which they will stop up and close a considerable area of public highways within the borough. In connection with this scheme the town council are asking the company to lay out a new street, 50 ft. in width, between Cowgate and Priestgate, and to widen St. Leonard's-street to a width of 50 ft. Drainage.—With a view to preventing the flooding of cellars in the centre of the town during heavy rain storms, about £500 will be expended upon new surface-water drains. Roadways.—Provided the weather be suitable, about 6 miles of public highways will be tarred or treated with suitable material, and granited. Footpaths.—It is proposed to lay out a sum of about £800 in concrete and asphalt footpaths. Baths.—The town council have under consideration the construction of baths; they are obtaining information from other towns upon the steps which have been taken by them in this matter. Recreation Ground.—A new recreation ground, 5 acres in extent, is being laid out at West Town; a public bowling green is being formed therein. Cemetery.—Steps are being taken with respect to the formation of a new cemetery, and a site for same of about 30 acres in extent is being negotiated for.

Poole (Mr. SAMUEL J. NEWMAN, F.R.I.B.A., borough surveyor). — Work anticipated for the coming year comprises the carrying out of wood-block paving to the High-street and Longfleet, the reconstruction of the footways, and improvements to the storm-water sewering. The sewering of the Hamworthy district, it is hoped, will be in hand. The provision of new systems of storm-water sewers to portions of Parkstone and Poole has to be carried out. A large number of streets are scheduled to be made up this year under the Private Street Works Act. The new infants' school at Courthill is nearly completed, and plans are prepared for the extension of the Branksome Heath girls' school. New wood-block floors are to be put in the Poole secondary school. It appears likely that extensions of this school will be necessary in the near future. The public conveniences in Poole Park are in course of reconstruction, and tenders are being obtained for conveniences to be erected in other places in the borough. Plans are also being prepared for laying out Alexandra Park. Some of the unemployed are engaged in preliminary work for the widening and improvement of the Sandbanks-road. A new disinfecting block constructed at the Alderney Hospital is nearly completed. Five acres have been acquired for the extension of the Poole cemetery, and plans for laying this out are under consideration. It is also proposed to acquire land for extending the Branksome cemetery. The present rateable value of the borough is £190,589.

Portsmouth (Mr. ARTHUR W. WARD, ASSOC.M.INST.C.E., borough engineer and surveyor).—In connection with the treatment of tuberculosis, the corporation have found that the Tuberculin Dispensary needs to be on a larger scale than at present, and the erection of a much more pretentious dispensary is being considered. The open-air swimming pond has met with such unqualified success that a further range of dressing boxes will be taken in hand shortly. It is expected that the extensive storm-water scheme for the eastern part of the town will be completed during the coming year. The tenders have been received for the erection of a much-needed range of stores (Hennebique ferro-concrete) at the Camber Quay, which will be shortly commenced. A start has already been made with the construction of an esplanade for pedestrians on the harbour side between Whale Island Bridge and the new swimming pond. The question of the provision of an art gallery is still claiming the attention of the local authorities, and serious consideration is being given to the extension of the infectious diseases hospital.

Prescot (Mr. R. NORRIS, A.R.SAN.I., surveyor and inspector of nuisances to the urban district council). — The council are negotiating for the purchase of a field, 5¾ acres in area, adjoining their sewage works, for the purpose of disposing of the town's refuse, and for providing and making a road to the sewage works. An application has been made to the county council for extending the district to take in a portion of the township of Whiston, in the district of the Whiston Rural District Council. A number of back passages are to be paved. About 300 lin. yds. of main roads have been reconstructed during the past year, and it is most likely that further reconstruction will follow on during the coming year.

Preston (Mr. THOMAS COOKSON, ASSOC.M.INST.C.E., borough engineer and surveyor).—The new works and schemes to be considered in 1913 are: The erection of new baths (£16,000), markets and offices (£3,000), tramway shelters (£260), new sewers, streets improvement (£4,500), new station on the London and North-Western Railway main line, adjoining the cattle market, auction market, and horse repository; town planning scheme for the north-east portion of the borough. An Omnibus Bill is to be promoted next session for the extension of borough, new main roads, improvement of bridges, streets improvement, and the construction of Deepdale Bridge (£5,000).



Prestwich (Mr. SYDNEY H. MORGAN, ASSOC.M.INST.C.E., engineer and surveyor to the urban district council).—Town planning will form a prominent feature of the municipal work in 1913. The preliminary steps have all been taken and application formally made to the Local Government Board for permission to prepare a scheme. An inquiry is expected early in the year, and after this the work of preparing the town plan will be taken actively in hand. Already a conference has taken place between the Town Planning Committees of the Manchester Corporation and the Prestwich Council with a view to correspondence in the schemes of both authorities, and certain matters have been referred to the city surveyor and the surveyor to the district council to arrange and report. A scheme for the improvement of Bury Old-road will be taken in hand. The scheme includes the reconstruction of the surface with granite setts on concrete, a system of surface-water drainage, and widening. The scheme is estimated to cost about £14,043. Early in the year extensions to the town's yard and stables will be carried out. Additions to the present stables will be built to provide five additional stables and a loose box. A new office with weighbridge and entrance gates, 87 yds. of open shedding and boundary walls are included in the contract. Eight streets have been made up under the Private Street Works Act, 1892, with carriageways of tarred macadam or grit setts, at a cost of £3,947. In eight streets improvement work, involving an expenditure of £3,360, is in progress, and it is anticipated that during 1913 many more will be done. The surveyor has received instructions to rearrange the ward boundaries so as to obtain more equal representation, and this will be probably carried into effect during the year. The council are considering the advisability of applying for a charter of incorporation as a municipal borough, either alone or in conjunction with adjoining districts not already incorporated, and it is possible

that some steps in this direction will be taken during the year.

Ramsbottom (Mr. THOS. H. BELL, surveyor to the urban district council). From a municipal point of view, the year is to be an important one. Parliamentary powers were obtained in 1912 for the inauguration of a system of railless traction, which is to extend through the urban district area for a distance of 3½ miles, at an estimated cost approximating £11,000. The supply of electricity is to be taken from the cables of the Lancashire Electric Power Company, and the buildings for the tramways car shed, depot, and housing the electrical rotaries, are to be erected to the design and under the personal supervision of the surveyor. Most of the contracts in connection with the scheme are already let, and the work is to be proceeded with at once. Another progressive venture which is to be carried out during the early months of the year is the installation of a refuse destructor and steam disinfector. A two-cell plant is to be put down at a cost of £4,300, and the contract has been placed in the hands of Messrs. Dawson & Manfield, of Manchester, whose tender was accepted after careful consideration. Works now in progress include sewerage contracts of £7,000 for dealing with the sewage from the districts of Brooksbottoms and Lower Summerseat, and new filters, humus tanks, and additional plant on the sewage works; also an important main road widening in the centre of the town, which will be completed at a cost of £373. Schemes of a minor character which are to be completed during the year are as follows: The sewering of portions of the district at Edenfield, Holcombe Old-road, and Dearden Clough Valley, at an estimated cost of £1,280, recently sanctioned by the Local Government Board; main road ordinary maintenance, £1,400; special main road improvements, £1,250; district road maintenance and improvements, £850; and secondary road improvements, £300. It is pleasing to note that there is a decided stimulus in respect to the erection of new property in the council's area, and as a new weaving mill, to provide for 800 looms, is to be built this spring, a further incentive to development will be given.

Ramsgate (Mr. T. G. TAYLOR, borough engineer). Appended is a list of the works likely to be executed in this borough for 1913: The erection of shelters on the East and West Cliffs; extension of the promenades on both sides of the town (the works at the East Cliff have already been commenced); the erection of a shelter on the extension at the East Cliff; and a considerable area of wood paving repairs.

Rawtenstall (Mr. JAMES JOHNSON, borough engineer and surveyor). In addition to the usual works of maintaining the large mileage of roads and sewers, further new sewer and surface-water drainage work will probably be taken in hand, and several road improvements carried out. Private street improvements, estimated to cost £6,000, will be carried out under sec. 150 of the Public Health Act, 1875. It is expected that the housing scheme for the working classes, comprising forty cottages and the necessary roads and sewers, will be commenced and completed. Alterations and extensions to the central fire station, to accommodate a motor ambulance car and motor fire engine, as well as a large recreation room for firemen, are in hand. The Health Committee have decided to construct public conveniences for both sexes at Waterfoot, and it is probable that these will be erected during the year. The question of damage to highways by heavy motor traffic will engage the attention of the council, and further works of house drainage will be completed.

Redcar (Mr. J. HOWCROFT, engineer and surveyor to the urban district council).—The following works are likely to be carried out during 1913—viz: Extension of waterworks, public urinals and lavatories, and private improvements works.

Redditch (Mr. A. J. DICKINSON, ASSOC.M.INST.E.E., engineer and surveyor to the urban district council).—A considerable length of improved road surfacing will be laid during the year, and about 6 miles of roads will be tar-sprayed. Sixty acres of land recently purchased by the council will be laid out with new street, building sites, recreation ground and allotment gardens. The work of renewing certain old sewers will be completed by the end of March.

Richmond, Yorks (Mr. H. W. MARSDEN, M.I.MUN.E., borough surveyor).—During the past year an extensive amount of work has been carried out under the Housing Act. Old sewers have been taken up and relaid, and the drainage generally is being improved. The corporation are considering the question of erecting workmen's dwellings. It has also been decided to reconstruct a portion of the retaining wall of the footpath around the ancient Castle, which has been stated to be one of the finest specimens of such structures in the country. H.M. Office of Works are carrying out very extensive works with a view to the preservation of the walls and laying bare the foundations of buildings within the walls. The Keep remains in almost as good state of preservation as when it was built 1,000 years ago. One of the finest views in the North can be obtained from the Castle Walk.

Ripon (Mr. A. BARLOW, ASSOC.M. INST.C.E., city engineer and surveyor).—It is proposed to have a museum in High-street, Agnesgate, adjoining the cathedral grounds, in an historical house which has been presented to the city. Among other works two street improvements are suggested, in addition to extensions to the corporation depot and tar-macadam plant, the under-draining four of the filter-beds at the Fishergreen sewage farm and provision of storm-water overflows. Tar-macadam roads and tar painting will be extended and continued.

Rochdale (Mr. S. S. PLATT, M.INST.C.E., F.R.SAN.I., borough surveyor).—In addition to a large amount of private street works, in some of which it is intended to introduce tar-macadam, the work will consist of the first instalment (now approaching completion) of extensions of the main sewage disposal works (£31,500), including electrical pumping plant, percolating filters, storm-water tanks, &c.; the final stage of a small town planning scheme, to be followed by one over a more extended area (about 1,600 acres) on the westerly side of the borough; a further extension of the covering of the River Roch in connection with the contemplated erection of a new General Post Office in the centre of the town; several important road widenings and improvements, some of which will form the subject of an application to the Road Board for grant towards the cost to meet the requirements of increasing motor traffic; and extensions of main sewerage work towards the outskirts of the borough.

Rotherham (Mr. ERNEST B. MARTIN, ASSOC.M.INST.C.E., borough and waterworks engineer).—During the year it is expected that the following works will be undertaken: New reservoir, capacity 3,000,000 gallons; new pipe line to convey the Derwent water to Rotherham; water tower and small electric pumping station; extension to tramways and car sheds; extension to destructor; extension to sewage works; new police station; completion of river wall for the reclaiming of lands; underground pumping station for lifting sewage; roof for covering outside market; various street improvements; and completion of small-pox hospital.

Rushden (Mr. W. B. MADIN, M.R.SAN.I., engineer and surveyor to the urban district council).—The coming year will be a busy one for those engaged in the surveyor's department at Rushden. It is hoped the contract for the new sewage disposal works will be let at an early date. These works comprise detritus and screening tanks, upward-flow sedimentation tanks, eight percolating filters 88 ft. diameter, humus tanks, and the laying out of 7 acres of land, building manager's house, and incidental works. Work has also been commenced upon the laying out of the new recreation ground, 15½ acres in extent, recently acquired by the council for £2 000. With the laying out of this ground it is probable the council will seriously consider the widening of Washbrook-road and bridge, which forms the boundary on one side of the ground. The council have also under consideration the question of further private street works, and the erection of workmen's dwellings is to receive consideration at an early date.

In continuation of the policy adopted for several years past, considerable lengths of road will be resurfaced with bituminous-bound granite, and surface tarring will be carried out. Plans were recently passed by the council for an electric generating station for the Rushden and District Electric Supply Company, who have recently obtained a Provisional Order to supply electric light and power in the district. It is possible the council may consider various improvement schemes when the annual estimates are prepared.

Ryton (Mr. JOHN P. DALTON, engineer and surveyor to the urban district council).—The council intend to proceed with the construction of a number of new streets, the laying of tar-grout on the main road, the cementing and asphalting of various public footways, the erection of public urinals, sewer extensions, &c. The questions of recreation grounds, allotments, automatic lighting, &c., will also receive consideration.

St. Andrews (Mr. WM. WATSON, burgh and water engineer).—In addition to the various works of maintenance and repair of the main and secondary roads by the usual methods, it is anticipated that all main roads will be treated with surface tar-spraying, and, where extensive resurfacing is required, that the metal will be tar-grouted. The new reservoir at Cameron, with a storage capacity of 200,000,000 gallons, will be opened during the year. Parliamentary sanction is meantime being asked for (1) extension of the burgh boundaries to take in about 400 additional acres of land, and (2) power to acquire or lease land for the construction of an additional or fourth golf course of 18 holes, and this work, it is anticipated, will be carried out at an early date. Consideration is also being given to the following schemes—viz., an extension of the reclamation wall at the Bruce Embankment, the laying down of a public bowling green and lawn tennis courts. It is anticipated that a considerable alteration will be made at the harbour, including the erection of new gates, sluices, groynes, &c.

St. Austell (Mr. E. D. GROVES, M.INST.M. AND C.E., engineer and surveyor to the urban district council).—The work of street improvements and road widening will be continued. The Bodmin-road and Tregonissey-road widenings, which include new footpaths, have been completed at a cost of £1,000. The East Hill main road widening and new footpaths will be done shortly, and the council are at present in negotiation with the owners for a further strip of land on this road with a view to the completion of the widening to the town. The Duke-street improvement scheme has been approved by the owners and the council, and the first portion of this work will be started forthwith. The improvement includes the demolition of old property, setting down a new frontage line, and construction of new footways, thus converting the present narrow winding street into a straight road, 30 ft. wide. The compensation to be paid by the council for the first portion of land given up is £340, and the total cost of the whole improvement will be about £1,200. The council are at present engaged in obtaining a site for artisans' dwellings, and it is hoped that a scheme will be completed soon. The western main drainage scheme has been carried out during the year by the surveyor's department, at a saving of £100 on the estimated cost. A scheme for the extension of the urban boundaries is being prepared.

St. Ives (Mr. SIDNEY PALMER, M.INST.M. AND CO.E., P.A.S.I., borough surveyor, waterworks manager and sanitary inspector).—The council have one or two small works in hand for 1913 as under: Culverting portion of the Stennack River, estimated cost £360; road widenings (several), and sewering Bulbens-lane. There is some talk of extending the West Pier, at a cost of £10,000, and several shelters will probably be erected before the spring.

Salford (Mr. J. CORBETT, borough engineer).—In addition to the usual highway sewerage and private street works, the works in connection with the first section of the Pendleton relief sewer will be completed; also the reconstruction and extension of main sewers at Irlams-o'-th'-Height and Eccles New-road. At the sewage works additional tanks will be provided for dealing with the manufacturers' trade wastes. The extensive alterations to the present town hall are in hand, as well as the buildings for slab-making plant at the Agecroft destructor. Provision has been made for laying out the Highfield reservoir site as a recreation ground, and the acquiring of an area of about 45 acres for the purpose of additional playing fields and recreation ground is under consideration.

Scarborough (Mr. HARRY W. SMITH, ASSOC.M.INST.C.E., borough engineer and surveyor).—A Provisional Order has been filed by which it is proposed to extend the borough boundary to the north, taking in a small part of the area under the jurisdiction of the Scalby Urban District Council. The beach bungalows on both the North and South Bays have proved to be so popular with the visitors and residents that the corporation are extending the promenade in the North Bay, and erecting an additional seventeen bungalows and a large open shelter. In the South Bay, in the newly acquired South Cliff gardens, thirteen additional bungalows, conveniences, floral shelter, beach and bathing shelter and café are to be erected, while the development of the gardens with winding walks and planting is to be proceeded with. The drainage of the southern portion of the grounds is being proceeded with preparatory to the further development of this section.

Seaham Harbour (Mr. FRANCIS E. BOAZ, M.I.MUN.E., surveyor and inspector to the urban district council).—The work for the current year will be of an extensive nature, consequent on the exceptional growth of the district, and will include the erection of forty-five houses for the working classes, being the first section of a scheme to cost £15,000. The whole of the main sewers are proposed to be diverted to the south part of the district, and a scheme for this purpose is now being prepared by the surveyor. The council purpose taking over the whole of the plant for street lighting, and a scheme is now being prepared by the surveyor for an extended and improved system. The council are negotiating with the North-Eastern Railway Company as to the details for a large subway at the Princess-road crossing, and intend carrying out an extensive improvement at the Dene-road bank in connection therewith. An improvement is to be made to the Lord-street subway by the council. Further highway improvements include Green-street and Ropery-walk, and private street works, estimated to cost about £14,000, are to be completed during the year. The present system of ashpit scavenging is to be reorganised, and a public urinal is to be completed at a cost of £144.

Sedbergh (Mr. E. PARK, M.INST.MUN.E., surveyor to the rural district council).—During the year it is proposed to widen and improve the road near the Sedbergh union workhouse, and the bridge at Hawes Junction, while the Sedbergh and Hawes main road is to be reconstructed. In the public health department it is proposed to provide a water supply for the town of Dent, and to sewer the hamlet of Millthrop.

Selby (Mr. BRUCE MCGREGOR GRAY, ASSOC.M.INST.C.E., engineer and surveyor to the urban district council).—The year 1913 will be a busy one for the council's officials. Twenty-three workmen's houses are in course of erection, and eighty-five more are to be built during the year by the council, which will necessitate the formation of two new streets. It is hoped that private enterprise will erect most of the other houses required in the town, it being estimated that 300 houses could be let at the present time without any difficulty. The extension of the baths as an assembly hall will be completed. The 4 acres of land recently purchased will be laid out as an addition to the present park. The council are also purchasing about 125 acres of land adjoining the waterworks at Brayton as a protection to their water supply, and also for future extensions of the waterworks. It is expected that several other villages in the Selby rural district will obtain their water supply from Selby, three villages having been connected during 1912. Other works contemplated include extensions of sewerage, water mains, &c., and a proposed road and bridge from Flexley-road to Gowthorpe.

Sheringham (Mr. F. HALL SMITH, M.INST.M. AND CO.E., P.A.S.I., M.R.SAN.I., engineer and surveyor to the urban district council.—The council have just received sanc-

tion for a loan of £1,500 for the following works - viz., Retaining wall and promenade in cliffs, 11 ft. above existing promenade, and shelter in centre of the same, at the Sheringham end of town; shelter on septic tank; extension of promenade and retaining wall at Beeston end of town; and surface-water sewer, 9-in. and 12-in. pipes, 400 lin. yds., in Beeston-road. Application has been made for a loan of £150 for the improvement of the street lighting.

Sheffield (Mr. C. F. WIKE, M.INST.C.E., city engineer and surveyor). In addition to the usual routine work of the department, including sewage treatment, a portion of the scheme for the disposal of the Sheffield sewage (estimate, £270,000) is in progress, and the expenditure on this work during the year will probably amount to about £15,000. Various important street improvements are to be taken in hand, at a probable estimated cost of £50,000, together with numerous smaller improvements and a number of tramway extensions, powers for which were included in the Sheffield Corporation Bill, 1912. The council have decided to adopt a scheme for widening two important thoroughfares, and providing a large open square at the very busy junction of these streets. This entails the purchase of a large area of land and property, the surplus from which will be utilised for erecting new markets. The total cost of the scheme (exclusive of buildings) will be upwards of £250,000. In connection with the scheme a portion of the river Sheaf is to be covered over, which work will probably be taken in hand during the coming year. A considerable amount of work is in progress in connection with town planning, and will be proceeded with during the year. The total area of the town-planning schemes at present in hand is about 6,000 acres. It is proposed to put in hand the widening and improvement of several bridges over the river Don, at a probable cost of £5,000 to £6,000. Public conveniences are to be erected in various parts of the city, at an estimated cost of £3,000. A scheme is at present under consideration for the erection of an abattoir. A site has been selected, and negotiations are in hand with the railway companies as to the provision of siding accommodation. In addition to the ordinary work in connection with parks and recreation grounds, portions of two new parks and a bowling green are to be laid out; also a new cemetery with an area of about 60 acres. It has been decided to purchase about 10 acres of land for further allotments, which will shortly be laid out for that purpose.

Sheffield (Mr. W. J. HADFIELD, surveyor of highways and deputy city engineer).—The principal works likely to be taken in hand during the coming financial year by the highway department are as follows: Highways.—A sum of £24,000 will be spent on paving loan account, partly in replacing obsolete forms of paving with surfaces more suited to the requirements of modern traffic, and £55,000 is to be expended on the maintenance and upkeep of the adopted streets within the city. Private Street Works.—£35,000 worth of work will be carried out under this head, and, in accordance with the custom now adopted by the corporation, it will be done under the sanction of the Local Government Board. Sewers. The work of converting rubble and other insanitary sewers is to be pushed rapidly forward, and a sum of £25,000 has been authorised on capital account for this important section of the department's work. A sum of about £11,000 has been allowed on revenue account to cover the cost of sewer maintenance. Tramways.—The expenditure upon tramway renewals and repairs will probably reach £40,000, several extensions and doublings being included in this figure. Main Roads. Of the amount of £11,000 lent to the corporation by the Road Board for the tar-macadamising of main roads, about £7,000 has already been spent, and it is proposed to complete this work during the coming financial year. The ordinary upkeep will entail an expenditure of about £7,000. In addition to the foregoing, a large amount of private recoverable work, consisting of drainage, &c., is continually being carried out by the department, amounting to about £18,000 per annum.

Shoeburyness (Mr. F. FEATHER, engineer and surveyor to the urban district council).—The council has just received sanction to borrow £750 for public convenience on the sea front, £250 for shelters, £100 for seats, £500 for making up promenade to Southend-on-Sea boundary, £300 for extension of water main to sea front, and £2,000 for extension of gasworks. Owing to the extensive building operations, numerous streets are to be made up under the Private Street Works Act, 1892, plans of which are now before the Local Government Board. The council have under consideration the question of widening Ness-road to the coastguard station to 50 ft., at a cost of £7,000. The work during the early part of 1913 will be new street works in connection with the promenade and road, 100 ft. wide, in the older portion of Shoeburyness, near to the School of Gunnery. This work is now being carried out departmentally. The council are now considering the question of borrowing £2,000 for workmen's dwellings.

Skegness (Mr. R. H. JENKINS, engineer and surveyor to the urban district council). This popular seaside resort, with its air which is so bracing, is continuing to develop at a rapid rate. An estate of 50 acres (including the park) in all probability is about to be developed. The Great Northern Railway Company have purchased 26 acres of land adjoining the present station for extensions, and the new line is nearing completion. Ten private streets are about to be made up at a cost of £4,000, and several road improvements are to be carried out. Surface-tarring is proposed to be extended. The Esplanade is about to be extended, and the council are considering the necessity of making up the whole of the front under the Private Street Works Act. Sewerage extension works are to be executed to deal efficiently with the North Shore estate, including the installation of Shone's ejectors. The sewage pumping plant is also to be augmented at the pumping station, and the surface-water sewers will probably be considerably extended. The filter beds at the sewage farm are to be cleaned, and other works are projected for dealing with the increasing flow. The council are considering the advisability of purchasing the Pleasure Gardens from Earl Scarborough.

Skelton and Brotton (Mr. R. S. MOON, surveyor to the urban district council). In addition to the usual work of maintaining a large mileage of roads and sewers, several road widening schemes will be completed. A joint disposal scheme in conjunction with the Loftus Urban District Council for new parts of the district will be carried out.

Somerset (Mr. H. T. CHAPMAN, county surveyor).—In addition to the ordinary maintenance of 953 miles of main roads and 493 county bridges, several works of a special nature are projected, including the surface-tarring of about 80 miles of roads; the improvement of the surfaces of lengths of the main trunk roads by the laying of Tarmac on the Bath and Bristol road, and the substitution of water-bound granite surface tarred for limestone and flint on the Bristol and Weston-super-Mare road, the Bristol and Bridgwater road, and the London and Exeter road; the improvement by widenings, diversions and new bridges of the Taunton and Minehead road, and the Dulverton to Minehead road; a diversion about half a mile in length, estimated to cost £3,000, at Puxton, on the Bristol and Weston-super-Mare road, and an improvement in line and gradient, estimated to cost £2,500, including the rebuilding of Yenston Bridge, on the Wincanton and Stalbridge road. Widening corners and opening out the view at dangerous cross roads will be dealt with as opportunity occurs during the year, and probably five county bridges will be rebuilt.

Southampton (Mr. J. A. CROWTHER, ASSOC.M.INST.C.E., borough engineer and surveyor and architect to the Education Committee).—The following is a brief description of the work in hand and contemplated: Private Streets.—There are at present plans, estimates, &c., being prepared for thirty streets. Contracts have recently been let for making up a good many private streets. This work is now proceeding. Schools.—One elementary school for 1,200 scholars is now in course of erection; the first half is now in use, and the remainder will be finished at as early a date as possible. A tender for another elementary school for 1,230 scholars was accepted by the council at a recent meeting, and the work of erection will be commenced at once. Plans for enlarging one of the smaller schools are now in progress and before the Board of Education, and this work will no doubt be proceeded with as soon as the sane-

tion has been received. Tramway Depot.—One of the tramway depots is being extended in order to cope with the natural growth of the tramway system. Asphalt Macadamising.—The corporation are coating a large area of carriageways with asphalt-macadam, and it is expected this type of road coating will be largely substituted for flint and gravel and ordinary water-bound macadam in the coming year. Sewage Disposal.—The council have under consideration the question of the reconstruction of the sewage disposal works at one of the sub-districts, having a present population of 5,000 people, with a prospective population of three times that number. Cemetery.—The whole of the work at the new cemetery, which has an area of 50 acres, having been completed, chapels, lodge, and other necessary buildings and boundary wall erected, and subsoil drains laid, the cemetery is now ready for use. Baths.—Recently fourteen slipper baths were added to the western shore baths, and the council are now considering the question of erecting several baths, each consisting of twelve or fourteen slipper baths, in several of the suburbs. Refuse Destructors.—The council have under consideration schemes for erecting refuse destructors at two suburban depots. These will consist of three or four cells each. Boilers will be provided for raising sewage. Isolation Hospital.—Plans are being prepared for adding twelve bedrooms to the administration block at this hospital, this accommodation being necessary owing to the recent additions to the pavilions. Tuberculosis Dispensary.—A large residence has been purchased and fitted up for use as a tuberculosis dispensary. Fire Station.—Plans have been prepared, and are now before the Local Government Board, for a small fire station in the suburbs, the cost being £1,000 (exclusive of land). Convenience.—The sanction of the Local Government Board has been received to the borrowing of £1,150 for a small underground convenience, and the construction of this will be proceeded with at once. Free Library.—The Free Library Committee have had under consideration the erection of a branch free library, and as soon as a site has been obtained the plans will be proceeded with. Buildings.—Last year plans for 400 houses, shops and complete buildings were submitted to, and approved by, the council. At present everything points to an exceptionally busy year in the building trades. The corporation have leased 11 acres of land which they have recently reclaimed for use.

Southend-on-Sea (Mr. Ernest J. Elford, M.Inst.C.E., borough engineer and surveyor).—The new main sewerage and sewage disposal works, estimated to cost £160,000, are nearing completion; approximately £115,000 has already been expended. Practically the whole of the deep-level sewers are completed. The percolating filters, covering 3 acres in area, will be finished early in the year, and the erection of the pumping station and machinery is being proceeded with. A refuse destructor, costing £11,000, is under construction and will be completed during the year. A Parliamentary Bill, seeking county borough powers and the extension of the present borough boundaries by the inclusion of the Urban District of Leigh-on-Sea and part of the parish of Eastwood, is being promoted. An administrative block at the borough sanatorium, costing approximately £5,000, will be completed in a few months. A swimming bath, costing £8,000, is in course of construction, and it is hoped will be finished by the summer. A further extension of the Western Esplanade will probably be proceeded with, the estimated cost of the whole extension being £52,000. A reinforced-concrete loading pier, estimated to cost £11,000, is under construction, and will be finished during the year. The new tramway boulevard scheme at the eastern end of the borough is well in hand, and will probably be completed during the present year. The total estimated cost is £45,000. A lodge and refreshment room at Southchurch Park, costing £1,000, will be completed early in the year. The corporation have recently obtained, under a Provisional Order, powers for the construction of a pier at Westcliff, and for improvement works on the existing Promenade Pier. It is probable that the latter (estimated to cost £24,000) may be commenced during the current year. Private street works will proceed as usual, and the expenditure for this purpose will probably be £30,000. It is anticipated that a considerable length of public road will be resurfaced with tar-macadam or tar-dressed.

Southport (Mr. A. E. Jackson, Assoc.M.Inst.C.E., borough engineer and surveyor).—The extension of South Marine Gardens, and laying out of New Fairground, to cost £10,000, is in hand. Other works contemplated are alterations to town hall; new fire station and science and art schools; Birkdale town-planning scheme, 2,848 acres; Hesketh estate town-planning scheme, 387 acres; Ainsdale-Birkdale sewerage scheme, £60,000; and resurfacing and tar-spraying of roads. A Bill has been deposited in Parliament for power to make numerous street improvements, dredging and improving sea channels, and running trolley vehicles and motor-omnibuses.

South Shields (Mr. Leslie Rose-veare, Assoc.M.Inst.C.E., borough engineer and surveyor).—In addition to the usual routine work the following works are projected for 1913: Roads.—Repaving several streets with granite setts on concrete, a contract for a portion of which, at £2,690, has just been let. The partial diversion of portions of West Holborn due to the construction of a new dock. It is proposed to proceed with schemes to divert a length of the main road to Newcastle 470 yds. long, and the construction of a short cut on the Jarrow road, including the erection of a new bridge over the river Don. Sewerage Works.—A scheme for the drainage of the foreshore properties, including about 1,330 yds. of sewers and an ejector station, is to be carried out. About 235 yds. of 3-ft. brick culvert is proposed to be laid in the centre of the town, together with various extensions of pipe sewers in other parts of the borough. Parks, &c.—A new bowling green is in hand, a bowl house, costing £250, is to be erected in the West Park, and about 337 yds. of railing erected in the South Marine Park. The extension of the Harton cemetery, comprising 19 acres, is to be enclosed with a railing 1,200 yds. in length. The development of the foreshore is to be proceeded with, the work including two groynes, and a lavatory and shelter, costing £1,517, is to be erected. General.—Schemes for a dispensary have been adopted, and plans have to be prepared for a proposed tuberculosis hospital. A complete installation of new lavatories for the Cone-street schools is about to be advertised. Plans for the erection of a new wharf and transit shed, together with a dock for refuse hopper, are in course of preparation. Buildings in course of erection in the borough include two large picture halls, seating 2,240 and 1,170 persons respectively, also a Roman Catholic school.

Southwold (Mr. James S. Hurst, borough surveyor).—Works contemplated here during the year include the erection of additional groyne at the north end of the Shire Cliff protection works, the laying out of the greens on sea front, treating of the chief roads in the borough with tar, the carrying out of a scheme of housing for the working classes, the provision of additional allotments, and the usual works of street improvements, sewerage, and so forth.

Stoke-upon-Trent (Mr. A. Burton, Assoc.M.Inst.G.E., F.S.I., borough surveyor).—After an exceedingly busy year, the work of bringing into working order the administration of the federated area is almost an accomplished fact. Nevertheless, this year promises to bring forward an abnormal amount of work. In addition to the ordinary maintenance of over 150 miles of roads, several important street improvements and road paving works are to be carried out, and the council intend to make up a large number of private streets under the Private Street Works Act, 1892. Application has been made to the Local Government Board for a loan of £11,000 for the provision of a large scheme of surface-water drainage in the Burslem district, and various works of sewer construction and reconstruction will be carried out. A comprehensive scheme of main road widenings has been considered, and many improvement lines have been adopted by the council in connection therewith. Sanction has been obtained from the Local Government Board to the preparation of a plan, under the Housing and Town Planning Act, 1909, for an area in Burslem, and application will be made shortly for another large area in the county borough. The extensions of the Stoke Town Hall are completed, and the following works are nearing completion: New central power house at Hanley; new technical

college; Longton Town Hall remodelling; extensions to electricity works, Burslem and Stoke; Tontine-square conveniences; and Tunstall Market roof recovering. The following buildings are contemplated: New fire stations at Stoke and Hanley; new police stations at Fenton and Burslem; public dispensary, under the Insurance Act.

Stafford (Mr. WM. PLANT, ASSOC.M. INST.C.E., borough engineer and surveyor). A scheme is now in course of preparation for the provision of sixty working-class dwellings, the erection of which will commence at an early date. The corporation are laying out two building estates to accommodate 750 houses. The borough isolation hospital will be considerably enlarged during the year to provide accommodation for patients from the rural district. The new Carnegie Free Library, now in course of erection, will be completed during the year. A scheme has been prepared for a new road from the Lamascotes across the valley of the river Sowe to Lichfield-road, and an application is now before the Local Government Board for sanction to a loan of £10,000 to carry out the work. An entirely new code of building by-laws will come into operation during the year.

Staffordshire (Mr. JAMES MONCUR, ASSOC.M.INST.C.E., county surveyor).—The schemes for the work out of the ordinary for the ensuing year have not yet been considered.

Stretford (Mr. ERNEST WORRALL, F.S.I., surveyor to the urban district council).—The extension of the Technical Institute is nearing completion and will shortly be opened; and the extension of the town hall and new adjacent baths will be finished during the year. Tenders are invited for the erection of a new concrete and masonry bridge and approaches, 50 ft. wide, over the Bridgwater Canal on the Chester (main) road, and the scheme is expected to be completed during the year. Another (the seventh) new elementary school is to be erected. Private street works, to the value of some £13,000, are scheduled, besides public street repaving to the amount of about £7,000. These are to be done in granited rock asphalt. The widening of Edge-lane—a thoroughfare to Chorlton—from 10 yds. to 18 yds., co-extensive with Longford Park to the district boundary, is also to be carried out. The development of this new park of 70 acres has made good progress, and will be continued. A length of road widening is proposed in Derbyshire-lane, also several minor street widening improvements. An extension of the main drainage system due to the growth of population is proposed, besides contingent extension works at the sewage farm. Smaller items of improvement and growing maintenance will add to a busy year's work.

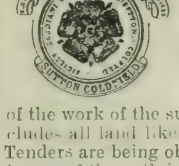
Stroud (Mr. G. P. MILNES, ASSOC.M.INST.C.E., engineer to the urban district council). Loans having been sanctioned by the Local Government Board, it is proposed during the year to undertake the entire remodelling of the sewage disposal works, including an effluent drain about ¾ mile long, and the erection of a refuse destructor. The contract for the latter work has been let to Messrs. Manlove, Alliott & Co., of Nottingham. On behalf of the Joint Burial Committee Mr. Milnes has prepared drawings and estimates for the extension of the cemetery at Stroud. This matter is now before the Local Government Board, and it is hoped that the work will be proceeded with during the year.

Sudbury, Suffolk (Mr. W. IRONSIDE TAIT, A.M.INST.C.E., P.A.S.I., borough and waterworks engineer).—No works of importance are contemplated during 1913. The council have completed the erection of an isolation hospital of twelve beds during 1912, and brought up the main roads to the requirements of the West Suffolk County Council, who have adopted about 5 miles of roads. The question of providing a new pumping plant at the waterworks is at present engaging the attention of the council, and steps may possibly be taken during the year to put down new engines and pumps, together with the erection of a standpost to increase the pressure in the borough.

Sunbury-on-Thames (Mr. HAROLD F. COALES, ASSOC.M.INST.C.E., engineer and surveyor to the urban district council).—Application has been made to the Local Government Board for sanction to a loan of £2,500 for sewerage purposes. It is proposed to instal a new ejector station on Sunbury Common, consisting of two 500-gallon "Shone" ejectors, and to increase the engine power at the sewage works by replacing a 12½ b.h.p. oil engine with a 40 b.h.p. gas engine working on suction gas, and driving a new air compressor. The Metropolitan Water Board have deposited a Bill in Parliament for power to construct a new conduit, filter-beds, railway and incidental works which affect the district to a considerable extent; power will also be given to the council under the Bill to acquire land and execute road widenings at Charlton, where a new reservoir of the board is to be commenced this year. In view of the increasing traffic through the district, the principal roads will again be tar painted, and several dangerous corners rounded and improved. Negotiations are in progress for widening and making up Laytons-lane under the Private Street Works Act. Better bathing accommodation at the council's bathing-place will be carried out in the spring.

Sunderland (Mr. J. W. MONCUR, M.INST.C.E., F.I.S.E., borough engineer and surveyor).—This corporation are contemplating, during the present year, the following works—viz., golf course at Roker, open-air salt-water plunge and swimming baths at Roker, floral hall at Roker, extension of boys' industrial school, and the provision of a new day training college. The Highways Committee have carried out during the past year many improvements in street widening, and substituting wood paving for macadam in the main streets in the borough.

Surrey (Mr. ALFRED DRYLAND, M.INST.C.E., county surveyor).—The principal works to be carried out in 1913 include the widening of Kingston Bridge, the completion of a ferro-concrete bridge of 70 ft. span over the Wey at Guildford, and schemes are under consideration for widening Windows and Cobham Bridges on the Portsmouth Road. It is hoped to make further progress with the conversion of the surface of the principal traffic arteries to bituminous macadam.



Sutton Coldfield (Mr. W. A. H. CLARRY, ASSOC.M.INST.C.E., borough surveyor and engineer).—Having received the permission of the Local Government Board to prepare a scheme for town planning an area of 6,400 acres of the borough, the preparation of the necessary plans and documents will form an important part of the work of the surveyor's department. The area includes all land likely to be developed for many years. Tenders are being obtained for an electricity sub-station in one of the outlying districts. At least one elementary school will need enlarging, and a refuse destructor built to obviate the objectionable tipping on land, while a movement is being made to build a public free library in the centre of the town. Many widenings are arranged, and will be made as soon as possible, and the ordinary work of sewering, road construction and building development of the borough will be continued.

Sutton-in-Ashfield (Mr. WALTER BURN, ASSOC.M.INST.C.E., engineer and surveyor to the urban district council).—The concrete tube sewer contemplated for this year has not been carried out, but it is hoped to do so during the coming year. It is intended to apply for a loan to carry out a number of private street improvement works. It is proposed to build a new fire station, also a public convenience. Several widenings and improvements are to be carried out, the most important of which is in Low-street, for which a Local Government Board inquiry has just been held for the borrowing of £600 for the purchase of the necessary land. It is proposed to make the storm-water beds at the sewage disposal works into tanks, and lay a duplicate storm-water sewer, and also carry out levelling work at the farm. It is intended to lay a considerable amount of tar-macadam and carry out tar spraying.

Sutton, Surrey (Mr. WM. HEDLEY GRIEVES, surveyor to the urban district council).—During the past year the policy of improving the main and secondary roads has been followed; 10,00 sq. yds. of wood paving in the High-street, and 6,000 yds. of Mexphalte on the London-Brighton main road have been laid. Again, nearly 20 miles of roads were tar-sprayed during the summer months, and will be continued next summer. A town-planning scheme is in course of preparation: a new 100-ft. sprinkler is being constructed at the sewage disposal works, and will be completed next year; the council have just purchased grounds which will be laid out as a public park; 3 acres of land will be conveyed to the county council for the purpose of erecting a secondary school for boys; a secondary school for girls is also under consideration, and an option for the purchase of the land has already been secured by the county council. One hundred acres of land on the Rose Hill estate is being developed on garden suburb lines, and when completed will make an addition of over 800 houses to the district. Advantage is being taken of this opportunity of widening the main road for a length of about ½ mile to a width of 60 ft., and the work of widening will be commenced shortly. The Sutton to Wimbledon railway is likely to become an accomplished fact. The company are seeking powers for extending their line, and it is believed the work will be commenced within six months. This will make a new route, via Wimbledon, to London, and will open out a good deal of building land The railway company are proposing to reconstruct the bridge carrying the road over the Epsom Downs line.

Swindon (Mr. H. J. HAMP, ASSOC.M. INST.C.E., borough surveyor).—During the year it is expected that the extensions to the sewage disposal works will be commenced, at a cost of £24,000. The works comprise conversion of contact beds into percolating filters, with travelling distributors, for primary treatment of the effluent, and 2 acres of percolating beds with fixed spray jets for secondary treatment; also the provision of a pumping station. Plans are being prepared for widening and improving Coate-road, at an estimated cost of £3,500. The work of laying out the new cemetery site is well in hand. The land drains are being laid and the roads and fences are being proceeded with; the chapel and lodge will probably be erected during the summer. Public conveniences are to be erected at the Whale Bridge and the County Ground. Fifty private back roads and several streets are to be made up during the year.

Swinton (Mr. HORACE BIRKS, engineer and surveyor to the urban district council).—In the coming year new waterworks will be completed. In 1911 Parliamentary powers were obtained for borrowing £10,000 for the works. A well has been sunk which yields 20,000 gallons per hour. Tenders for plant, including softening plant and filters, have been let. Other works consist of enclosing and laying out a recreation ground and making up several private streets, also minor improvements to existing roads and footpaths.

Taunton (Mr. DAVID EDWARDS, ASSOC.M.INST.C.E., borough engineer and surveyor).—It is expected to commence a scheme for the erection of workmen's dwellings in Stringlane, at a cost of £158 per house, inclusive, to be let at a rent of 4s. per week. Twelve of the houses will shortly be let by contract. The council will also commence the work of scavenging by direct labour, a subject which has been under consideration for some years. The borough surveyor's estimate for the work shows a saving of £200 per annum on the present contracts. The construction of an overflow weir 200 ft. long will be carried out on the river Tone in substitution of the present penstocks. Various road improvements, sewerage extensions, and private street improvements are contemplated, and, with the usual routine work, it is expected there will be a busy year.

Tenterden (Mr. W. L. C. TURNER, borough surveyor). A scheme for resewering the town, and outfall works in connection therewith, has been prepared, and, subject to Local Government Board sanction, will be proceeded with. The tar-painting of road surface is to be increased, and a portion will be made up with tar-macadam. The other work will be of the usual routine character.

Tenby (Mr. B. MORLEY, M.R.SAN.I., borough surveyor, water and harbour engineer).—In addition to the ordinary works of maintenance throughout the borough, the council will further consider the scheme presented for the reconstruction and extension of the western outfall sewer as well as the reconstruction of the low-level sewers. Granite macadam will again be substituted for limestone on some of the main thoroughfares, and surface tar-spraying will be extended practically to all the main roads in the borough. The erection of shelters and sanitary conveniences for both sexes will also receive attention, plans of which have already been prepared by the borough surveyor, as well as the scavenging and disposal of refuse. Various works will be carried out on the Royal Victoria Pier, and a housing scheme will probably be prepared during the ensuing year.

Tetbury, Glos. (Mr. T. V. H. DAVISON, surveyor and water engineer to the urban district council).—The District Council of Tetbury, Glos., have under consideration the question of improving the water supply of the borough. The question is whether a new borehole, 14 in. in diameter, should be sunk at the present works to a depth of 400 ft. in the inferior oolite, or an open well with galliers be sunk in the great oolite, or a new site be obtained to the west of the town for sinking the new well. The council are also considering the question of reforming and improving several of the streets in the town, as they are considered too high in the centre under the altered conditions of tar spraying of the surface. It is suggested that the streets should be picked up, a large amount of materials removed, and a new surface formed with tarred stone. The improvements at the sewage disposal works are now nearly completed, and the works are giving great satisfaction. They are situated close to the town, and surrounded by popular walks, and near the main road to Malmesbury and Cottage Hospital. No nuisance is experienced, either in the matter of offensive emanations or of pollution by the effluent to the lake in a private park.

Thornton-le-Fylde (Mr. H. FENTON, surveyor and inspector of nuisances to the urban district council).—It is expected that during the year many improvements to the Cleveleys portion of the district will be carried out, including the paving of a section of the promenade and provision of much needed public shelters and sanitary conveniences. In addition to the tar spraying and resurfacing of the principal roads, several widenings will be completed. General extensions will be made at the gasworks to cope with the rapid growth of the district. Every preparation is being made for the adoption of a scheme of town planning for the district, the physical features of which are very favourable to extensive developments as a residential locality.

Tintwistle (Mr. S. E. KETTLEWELL, surveyor to the rural district council).—The rural district council received sanction last June to a loan being raised to carry out a scheme for sewerage and sewage disposal works, prepared by the council's engineers, Messrs. Brady & Partington, A.MM.I.C.E., of Chapel-en-le-Frith and Stockport. The Mersey and Irwell Joint Committee has for some time been urging the council to provide some efficient means of improving the sanitary conditions of the district, as the old soughs and drains, which received all the sewage matter of the village, discharged into the river Etherow and caused pollution. The contract has been let to Messrs. Daniel Eadie & Co., Limited, Stockport, and the work is well advanced.

Todmorden (Mr. J. A. HEAP, borough surveyor and waterworks engineer).—In addition to the usual work of maintaining the large mileage of main roads, highways and sewers, the following works are projected by this authority for the present year: Widening of Burnley-road, paving a portion of Burnley-road with granite setts, private street improvement works on the Roomfield estate and at Cornholme, storm-water tanks at the sewage disposal works, sewerage of several districts, completion of Castle Hill council school, and shelters and bowling greens at Centre Vale Park.

Tonbridge (Mr. W. LAURENCE BRADLEY, engineer and surveyor to the urban district council).—The principal work for the ensuing year will be the completion of the isolation hospital, widening of the Great Bridge, the probable widening of a portion of the High-street, an extension at the electric light works, the completion of the county school for girls, Sussex-road elementary school, an extension to the cemetery, in addition to a certain amount of sewerage and private street works.

Tonbridge (Mr. FRANK HARRIS, engineer and surveyor to the rural district council). — The council have under consideration the erection of workmen's dwellings over practically the whole of the district, together with the closing of several insanitary areas, the making up of Hilden Park-street, in the parish of Hildenborough, the widening and improvement of roads and dangerous corners, sewer extensions in several parts of the district, an extended use of tarred rag macadam, the purchase of plant for the treating of road surfaces on the principle adopted by the county surveyor, and the tar-painting of about 250,000 super. yds. of road surface. The redrainage of the union workhouse will also be carried out.

Torquay (Mr. H. A. GARRETT, ASSOC.M.INST.C.E., M.S.I., borough engineer, surveyor and harbour engineer). —The works projected for 1913 include the construction of a large underground public convenience for ladies and gentlemen, at Castle-circus, at an estimated cost of £2,000; a further extension of the bathing platform at Torre Abbey Sands (£500); the construction of a swimming bath (£7,000); the conversion of the existing bath saloons into up-to-date medical baths (£8,000); the erection of a shelter at Corbyns Head (£400); a covered fish market on the fish quay (£350); a tramway passenger shelter and waiting-room, Torbay-road (£350); road widening works, Torre Station roads scheme (estimates in course of preparation, probable cost, with compensation for land, £3,500); redecking part of Princess Pier (£390); various new roads (£1,000); other minor works, such as extensions to sewers, improvements to pleasure grounds and promenades (£1,500); and further wood paving to main streets (£3,000).

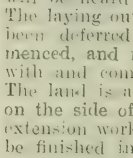
Tring (Mr. S. S. GETTINGS, ASSOC.M.INST.C.E., surveyor to the urban district council). –During the past year, in addition to the ordinary maintenance of highways, all main roads having a flint surface have been strengthened and surfaced with granite, the work costing about £1,500, towards which the Road Board are contributing £342. The council have decided to tar-spray all main roads with refined tar during the coming season, at an estimated cost of £270, and have instructed the surveyor to purchase the necessary plant for executing same departmentally. The council have decided to make up Longfield-road, and to lay the foul-water sewer in Beaconsfield-road, under the Private Street Works Act, the contract price for works being £2,410, and to extend the surface-water sewers in Aylesbury-road and Miswell-lane, the contract price being £226. All the foregoing work has just been commenced. The council have recently had before them a report from the surveyor regarding the provision of a water supply for fire purposes to the isolation hospital, and will probably come to a decision on the matter in the near future.

Tunbridge Wells (Mr. W. H. MAXWELL, ASSOC.M.INST.C.E., borough and waterworks engineer). — The special works under consideration here for the ensuing year include new storm-water and main drainage works in various size sewers up to about 6 ft. in diameter; deep wells, pumping machinery, and engine-house, pumping mains, &c., at the waterworks; waiting-room, office and lavatories at the borough cemetery; the laying out and deep drainage of extensions at the cemetery; new water mains and extensions and other minor works. A winter garden and pleasure ground scheme will also receive consideration. A new sewage pumping station and rising main has recently been completed and brought into daily use.

Uppingham (Mr. GEORGE DOLPHIN, A.R.SAN.I., surveyor to the rural district council).—In addition to the usual routine work the council contemplate carrying out a sewerage scheme for a portion of the town of Uppingham, a sewerage and sewage disposal scheme for the village of Caldecott, and the scavenging of earth closets and house refuse removal for several of the larger villages.

Ulverston (Mr. W. F. Y. MOLINEUX, engineer and surveyor to the rural district council).—During the year several road improvements have been carried out, a new bridge has been built, several patches of road have been treated with Rocmac, which is stated to be admirably suited to this wet district. It is proposed to construct a new bridge of 40 ft. span in the Langdale Valley over the river Brathay, also to construct a footbridge across the river Duddon, with a span of 45 ft., near Seathwaite. During the year some 6 miles of *ratione tenuræ* roads have been taken over from the owners by agreement. In the public health department, some few miles of water main have been laid and small extensions to existing sewerage systems carried out.

Upton-on-Severn (Mr. M. D. PRICE, surveyor and inspector to the rural district council).—The borehole has been sunk to a depth of 1,635 ft., and in the beginning of the year tests to ascertain the quantity of water yielded are to be made. The present overflow at the surface yields about 1,500 gallons per twenty-four hours. Kempsey sewerage and sewage disposal scheme: A contract for the construction of the work has been entered into between the council and Mr. G. Law, of Kidderminster, and the works are being proceeded with. The engineers are Messrs. Priest & Eagles, Birmingham. The district surveyor is proceeding with the works of sewerage and sewage disposal for the parish of Powick. Housing of the Working Classes Act.—Mr. H. P. Smith, architect, of Worcester, has been appointed architect for the council, and his plans for the erection of four cottages in the parish of Castlemorton are under consideration. Madresfield and Gnarlford sewerage and sewage disposal schemes: The engineers, Messrs. Willcox & Raikes, Birmingham, have presented their scheme to the Local Government Board, and in all probability the inquiry will be held soon.



Ventnor, Isle of Wight (Mr. H. HUGHES OAKES, M.R.SAN.I., surveyor to the urban district council).—The new landing stage to the Royal Victoria Pier has just been completed, the cost of which has been considerably over £6,000. The council, however, contemplate a few minor additions, and these it is expected will be carried out during the early part of the year. The question of erecting a band-stand on the pier in front of the pavilion will also be discussed at the January meeting of the council, and if the construction of the same be resolved upon, this work will be pushed forward so as to be completed by Easter. The band-stand will be so arranged that the band will be heard both inside and outside the pavilion. The laying out of the new cemetery land, which has been deferred from time to time, has been commenced, and no doubt the work will be proceeded with and completed about the middle of the year. The land is a very difficult piece to lay out, being on the side of a steep hill. The Eastern Esplanade extension works, which are now well in hand, should be finished in the early months of the year. This very desirable improvement will add about 500 ft. to the promenade, and will also very materially assist in protecting the cliffs, which for so many years have been quietly yielding to the mighty forces of the sea. The wall, which is a very massive one, is built of local ragstone and concrete, the face of the wall being a segment of a circle; over 10,000 cub. yds. of filling have now been used between the wall and the cliffs. The council will consider at their January meeting the advisability of extending this wall. The plans have already been prepared by the engineer and surveyor, and, if carried out, the esplanade will be extended a still further 600 ft. In the event of the plans being adopted, the work would be proceeded with as early as possible, as winter working in this very exposed position is quite impracticable until the wall gets to a certain height. In connection with the new sea wall, several groynes will be required, the plans for which have already been prepared, and these likewise would be constructed during the summer of 1913. Several designs for underground and other conveniences have been prepared, and it is more than likely that one or two

of these will be adopted. The town is at the present time very lacking in this direction. Additional shedding at the council's depot is also contemplated. The old question of an inclined lift or light railway from the esplanade to the railway station has again been revived, and it is confidently hoped by the supporters that the lines on which the council are now proceeding will bring this matter to a successful issue. Private enterprise is also busy in the town. A company has been formed for the conversion of two shops into an up-to-date theatre, and another company is in course of formation for the purpose of running motor-buses. It is claimed by the promoters that this latter scheme will not in any way interfere with the proposed light railway, but will very much assist it by "feeding" the different stations.

Wakefield (Mr. J. P. Wakeford, Assoc.M.Inst.C.E., city surveyor).—The coming year in Wakefield will be an exceptionally busy one. The council are making application for county borough powers, the population of the city being now 52,000. The widening of Warrengate from Kirkgate to The Springs is well advanced, the old premises having been demolished and new and spacious shops erected to the new frontage; it is anticipated that the street works will be completed in the course of the next month. The entire improvement has involved an expenditure of about £6,000. Plans are in course of preparation for the coupling up of the Agbrigg sewage works to the main disposal works at Calder Vale; this will necessitate the construction of ¾ mile of sewer and a syphon under the river Calder. The final layers of media are at present being placed in position in the new percolating filters at Calder Vale, and these will doubtless come into operation at an early date. The council, in conjunction with the rural district council, is considering the drainage of Crigglestone and Newmillerdam, a scheme which will necessitate the provision of a pumping station in the vicinity of Portobello. Allowance is intended to be made in the annual estimates for the reconstruction of several sewers, and also for laying down storm-water sewers in certain low-lying areas of the city. During the past year private street works have been carried out to the value of £1,400, and the council have given instructions for a number of others to be similarly dealt with under the provisions of the Wakefield Improvement Act, 1877, and the Public Health Act, 1875. Application has been made to the Local Government Board for sanction to a loan of £14,000 for granite paving in various thoroughfares in lieu of Yorkshire stone setts as at present existing; also for £1,200 for relaying certain sections of the main sewer in Denby Dale-road. The question of widening Wakefield Bridge, which spans the river Calder, is in contemplation, the present structure, which measures 30 ft. between the parapets, being wholly inadequate for present-day traffic. Plans for extensive alterations and additions to the isolation hospital are in course of preparation, and will be submitted to the Local Government Board in due course. During the past year several miles of main and other roads within the city have been tar-sprayed, the work being carried out partly by administration and partly by contract. Taking into account the unfavourable state of the weather during the performance of the work, the result obtained is most satisfactory, and allowance will therefore be made in the annual estimates for a considerable amount of this class of work during the coming season. The corporation is considering the question of town planning, and instructions have been given for the preparation of a scheme to include about three-fourths of the area of the entire city. The purchase of a steam roller is contemplated, the whole of such work having hitherto been let by contract.

Walmer (Mr. Herbert W. Barker, surveyor to the urban district council).—The construction of new sewers, storage tank, and sea outfall was to be commenced with the New Year, the contract, amounting to £15,200, having lately been signed. The surveyor has deposited plans with the Local Government Board for further new sewers, estimated to cost £2,400, to serve a rapidly developing portion of the district, known as Wellington Parade, lying along the sea-front by Walmer Castle. The council are also carrying out by direct labour the sewering and making up of St. Clare-road under the provisions of the Private Street Works Act, at a cost of £500, and are now considering the advisability of applying the Act to a road of considerable length, known as Granville-road, also near Walmer Castle.

Wantage (Mr. Thomas C. Betts, engineer and surveyor to the urban district council).—The council have under consideration the provision of a recreation ground and a public convenience. Further, new sewer and surface-water drainage works are in hand. Grants have been made by the Road Board for the improvement of two dangerous corners on the main road between Charlton and Letcombe. Surface treatment for dust prevention will again be extensive.

Wantage (Mr. John W. Harris, engineer and surveyor to the rural district council).—In addition to the ordinary maintenance of the highways in the district, it is highly probable the Childrey sewerage and sewage disposal scheme will be completed. A water supply scheme in the parish of East Chalcow will, in all probability, be put in hand. The council have also under consideration a scheme for the extension of the sewerage and sewage disposal works in the parish of Charlton, at a cost of £1 200. Plans have been approved by the council for the erection of houses in the parish of Harwell under the Housing of the Working Classes Act, and the council now have under consideration a similar scheme for the parish of Letcombe Regis.

Ware (Mr. H. Fox Hill, surveyor to the urban district council).—Extensive repairs have just been completed to the engines and deep-well pumps at the Musley Hill waterworks. The widening of Star-street, the main road to Bishop's Stortford from Ware, is now being considered by the council, and it will probably be done during the coming year. Further lengths of the old cobble footway paving will be relaid with artificial stone paving. There will be the usual road repairs and tarring of footways in the spring. Beyond this nothing is contemplated apart from the usual work.

Watford, Herts (Mr. D. Waterhouse, engineer and surveyor to the urban district council).—The most important work during the year will be that in connection with a water scheme, for which the council have obtained Parliamentary powers. The scheme is estimated to cost £114,000, and comprises wells, pumping station, softening works, service reservoirs to hold 2,000,000 gallons, and 5 miles of 18-in. mains. Four 40-in. and one 84-in. diameter bored and lined wells are now in hand, and will be completed during the year. A contract for the pumping plant is shortly to be entered into, and will be followed as soon as possible with contracts for the other units of the scheme. Sewerage and storm-water drainage works for Callowland, costing about £8,000, will be commenced early in the year; these works comprise storm-water sewers from 12 in. to 36 in. in diameter, an electrically-driven sewage pumping plant and other appurtenant works. Two public conveniences are in course of erection, and will be completed during the year, at a cost of £3,000. One of these, in the centre of the town, is built above ground, and comprises two floors. The other convenience is of the châlet type, and is in the Cassiobury Public Park. Paving works, costing £5,000, and comprising the kerbing, channelling and concrete slab paving of footpaths, is in hand, and will be completed during the year. Other works under consideration during the year include a housing scheme of twenty-two dwellings; several streets to be made up under the Private Street Works Act; the laying out of an ornamental garden at a cost of £1,000, and the laying out of two commons, which the council are obtaining power to regulate; and the extension of the siding at the council's depot. The question of providing public slipper baths is also to be considered. The completion of the London and North-Western Railway extensions, and the advent of the Metropolitan Railway will tend to a still more rapid growth of the town.

Watford (Mr. Ernest H. L. Lailey, surveyor to the rural district council).—Considerable works have been undertaken during the year in connection with making up of roads under the Private Street Works Act, 1892—viz.: Abbots-road, in the parish of Abbots Langley, at a cost of about £3,114; Aldenham-avenue (part of), Letchmore-road, Christchurch-crescent (part of), in the parish of Aldenham, at a

cost of about £1,815; Nascot Wood-road, in the parish of Watford rural, costing about £1,009. In the parish of Chorley Wood, owing to the result of an action in the High Courts, some £740 has been expended in putting a portion of Shire-lane into a passable condition. A great improvement has been effected by the removal of a dangerous corner on the main road near Delrow Almshouses, and works of a similar kind have also been carried out at Hunton Bridge. The surveyor has in hand suggested schemes for important widenings of a portion of Watling-street through Radlett, and of Eastbury-road, from near Wiggen Hall, past Hamper Mills, as far as Sandy-lane. These proposals are of considerable magnitude, and if carried through will involve the expenditure of thousands of pounds. A proposal is also in hand for providing a footpath alongside the main road from King's Langley Station to Primrose-hill. This will be a great boon to pedestrians between King's Langley and the railway station, and also for the employees at Messrs. Dickenson's Home Park mills. Extensions of main sewers have been completed at Nash Mills and Letchmore Heath, and plans and estimates are before the Local Government Board for an extension of sewer, Eastbury-road, Northwood, to serve a new estate which is being opened up. The existing filter-beds at Fishery Cottages, Elstree, have been renewed, additional shallow filters constructed, and other improvements carried out to meet the requirements of the Grand Junction Canal Company. Disputes have arisen in connection with alleged obstruction of public footpaths in two or three cases in the district, but there seems a probability of an amicable agreement being come to in all cases.

Wednesbury (Mr. E. MARTIN SCOTT, borough engineer and surveyor).—Flag Paving: Portions of footways in Walsall-street, Oakeswell End and Holyhead-road. Street Improvements: Widening Meeting-street between the new council schools and the Holyhead-road, including the purchase of eleven old houses which will be taken down for the purpose. Open Spaces: Purchase of about 10 acres of land fronting the Holyhead-road, Bilston-road, and Portway-road, levelling the same and laying out as open spaces for use of the public, including fencing, gates, bowling green and seats; enclosing a triangular piece of land with dwarf stone, walling and ornamental wrought-iron palisading and gates at the junction of Holyhead-road and Camphill-lane, opposite the town hall and art gallery as an open space, planting with shrubs and providing seats. Public Urinals: Erection of two additional conveniences in High Bullen-road and Holyhead-road. Steam disinfecting shed and machinery at the isolation hospital, Dangerfield-lane.

Wath-upon-Dearne (Mr. J. H. DREW, M.INST.M. AND C.E., M.R.SAN.I., engineer and surveyor and waterworks engineer to the urban district council).—The present year will be an exceptionally busy one in this growing South Yorkshire district; building operations are brisk, and there is always a good demand for cottages from 5s. 6d. to 7s. rent per week. Municipal housing is not contemplated. The council's engineer and surveyor has been instructed to prepare and submit several large schemes to the Local Government Board, including remodelling and extending the existing sewage works on the bacterial system. The whole of the sewage will have to be pumped, and new centrifugal pumps will be installed. When completed the works will deal with a dry-weather flow of 300,000 gallons. The waterworks will be extended, and a new 18-in. borehole, 162 ft. deep, will be brought into operation as a duplicate to the present deep bore. There is an abundant and wholesome supply from this source. A modern pumping installation (borehole pump and force-pump combined) will be erected with a duty of 25,000 gallons per hour, against a static and friction "head" of 660 ft. from borehole to reservoir. New service reservoirs of a capacity of 600,000 gallons are to be constructed, together with sand filters, and about 2 miles of 4-in. and 6-in. Mannesmann steel tube water mains. About ½ mile of main road will be strengthened by the provision of a 9-in. lump slag foundation, and will afterwards be surfaced with a 3-in. coating of Tarmac, similar to the work completed during the past year. The approximate area of the projected work is 7,000 sup. yds. The intention is to reconstruct a section of road annually in this manner until the whole of the main road is completed. Several private streets will be made up under the provisions of the 1892 Act, and four road widening schemes will be in hand, in addition to the usual routine highway repairs. A 15-in. storm-water drain, about 300 yds. in length, and passing under the canal, is to be constructed to relieve the flooding of low-lying property during heavy rainfall. The Mexboro and Swinton Tramways Company, Limited, have promoted a Railless Trolley Bill, now before Parliament, seeking powers to run trackless cars over a route of 10 miles of macadam roads in this and adjoining districts. The Bill will be opposed by the local authorities concerned until satisfactory terms are arranged, particularly in regard to contribution by the company towards the cost of highway maintenance. A joint meeting of the various councils is to be held, and a proposal is on foot to promote a Municipal Bill for Railless Traction.

Wellingborough (Mr. E. YOUNG HARRISON, ASSOC.M.INST.C.E., A.M. I.MUN.E., surveyor and water engineer to the council).—Plans have been prepared and application to the Local Government Board has been made for sanction to carry out works of sewerage in several streets. The scheme includes the laying of about 2,000 yds. of surface-water sewers varying in size from 24 in. to 9 in. in diameter. It is proposed to do this work during the present year by direct labour. The sanction of the Local Government Board has been obtained for the Cannon-street, Cambridge-street, and Victoria-road improvement, the cost being estimated at £6,000. The county council have agreed to make a contribution equal to half the cost of the works, and one-quarter the cost of the land. Provisional agreements have been entered into with the owners of the properties it is proposed to purchase. The council have given their serious consideration to the advisability of purchasing the electric light company's undertaking. Negotiations are, however, just now at a standstill, pending the result of the company's effort to obtain a Provisional Order for the purchase of the site of their works, which is council property. The bandstand at Bassett's recreation ground has been so popular that the surveyor has been instructed to prepare plans for another in the Castle Fields recreation ground. Further tree planting is proceeding in these public fields and in the streets, all of which is tending to make more attractive this healthy and pleasantly situated manufacturing town. The bathing place at the river Nene is to be improved this year. Trial borings are to be made in the neighbourhood of Bushfield's waterworks with a view to augmenting the water supply there. A new cart shed is being erected at the Cannon-street depot.

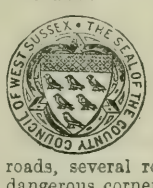
West Bromwich (Mr. A. D. GREATOREX, M.INST.C.E., M.S.A., borough engineer and surveyor).—Sites for two schools have been purchased, and plans for the buildings will come before the committee for consideration during the year. A Bill is being promoted in the present Session of Parliament to obtain powers to carry out several public improvements and provide a system of trackless trolley cars, motor-'buses, &c., at a cost of about £45,000. Contracts have been entered into for the erection of vertical retorts at the gasworks, to cost £14,000. The removal of centre poles and erection of span poles in connection with the tramways is now in hand, and will be completed at an early date. Plans have been approved for a dispensary, and the council will have under consideration during the year plans for remodelling and enlarging the main sewage outfall works, and also for a town planning scheme. The Great Western Railway are widening their main line, and this will necessitate alterations to several road bridges.

West Hartlepool (Mr. NELSON F. DENNIS, M.INST.C.E., borough engineer).—During the past year the council have completed the laying out of a portion (30 acres) of the Stranton Cemetery, which, together with chapel, &c., have been formally opened, and the construction of regulation flat bowling greens for use during the year at the Ward Jackson Park and Burn Valley Gardens. In connection with the latter scheme a member of the council has intimated his desire to present a suitable

pavilion for one of the greens. Another scheme just completed by the education authority is the erection of a secondary school for girls in the Renaissance style of architecture, from the design of the borough engineer, for the ultimate accommodation of 400 scolars; also the extension of the Technical College for housing the engineering works students. The erection of a new power station in connection with the utilisation of waste heat in the production of electrical energy has been commenced, and, it is anticipated, will be in operation by March next. This is the first municipal venture of its kind in the country. The council have acquired and work the whole of the sections of the electric tramways system in the Hartlepools, and one of the routes has since been entirely reconstructed. Powers have also been obtained for the extension of tramways in other directions. The general improvement in the lighting of the town is receiving attention. Experiments are being made with the wave-pressure system of incandescent gas lighting in one of the principal thoroughfares, and in several main lines the illuminant is being supplied from the council's electricity works. In addition to the usual work of maintaining the large mileage of streets, the old sewers in the borough will be reconstructed, and it is intended to extend further seaward two sewer outfalls, and provide an additional underground convenience. The Garth at Stranton has been acquired, and will be laid out as an ornamental space. A site for and the provision of a large covered sea-water swimming bath near the foreshore is under consideration, and the building is likely to be proceeded with in reinforced-concrete construction. A new elementary school is to be provided for Seaton Carew, and the extension of the Cameron Memorial Hospital, through the munificence of a member of the council, is to be carried out, the designing of the structures being undertaken by the borough engineer. Important street corner improvements are being made, and a road is being constructed across the Burn Valley Gardens, in extension of one previously formed, for the accommodation of the populace from the west end of the town going southward. The new road to Middlesbrough, which has been so long urged by the council, by which the distance is reduced by about 5 miles, is now assured. The road from Horden, necessary to give access to the Hartlepools from the collieries on the north side of the borough, is being surveyed with a view to the discussion of definite plans at an early date. With these new roads, and the likelihood of huge developments, the aspect of the district as an industrial centre near to the coalfields is very promising. The extension of the borough boundaries will again engage the attention of the council —indeed, the unification of the municipal government of the Hartlepools, boroughs bound together by permanent interests, seems within the range of practical politics. Outside municipal works the North-Eastern Railway Company are erecting a footbridge over an important level crossing and effecting improvements to their siding and dock accommodation, while consideration is being given to the matter of further relieving the congestion at the docks, and the provision of better passenger station facilities.

West Lancashire (Mr. R. Rosbotham, chief surveyor to the rural district council).—The works projected for the coming year include strengthening the foundations and reconstructing the carriageway on several lengths of the Prescott road—*i.e.*, taking out clay and filling-up with clinkers, forming rubble foundation, and then paving with granite cubes and coating with tar-macadam. This road has been marked down by the Royal Automobile Club as the best road south, branching off the Liverpool main road at Ormskirk boundary and through Prescott and Warrington. It is intended to improve several dangerous bends and "blind corners" on the secondary roads and the more important district roads by widening and by lowering fences and acquiring the necessary lands. Tar-spraying will be done on the more important secondary roads, particularly in populous districts, and round bends and corners where water-bound macadam is scored out by fast traffic. The conversion of ordinary macadam and old grit sett pavement to tar-macadam and granite sett pavement will be continued.

West Suffolk (Mr. W. Lionel Jenkins, assoc.m.inst.c.e., p.a.s.i., county surveyor).—The projected works are: Ferro-concrete bridge at Stowlangtoft; reforming embankment at Ingham; general repairs to bridges in various parts of the county. These works are in consequence of the extensive damage caused by the heavy floods in August, 1912. The chief item as to proposed works is that of the reconstruction of the Bury-Newmarket-Ipswich road. The estimated cost is £24,000. The work will consist of the usual modern methods of road construction, employing bituminous material in the form of grout or prepared macadam.



West Sussex (Mr. H. W. Bowen, assoc.m.inst.c.e., county surveyor).—Works projected in the county surveyor's department include the completion of an £18,000 scheme of road improvement, and consideration of a further extensive scheme of maining and classification of roads, several road widenings and improvements to dangerous corners, and the tar treatment of the main roads throughout the county.

West Ward, Westmorland (Mr. P. M. Hope, surveyor and engineer to the rural district council).—It is expected that a commencement will be made with the water scheme for the parishes of Clifton, Askham, Bampton, Crosby Ravensworth, Hackthorpe, Lowther, Bolton, Kings Meaburn, Sleagill Reagill, and Shap Rural. The supply is drawn from Blea Water, and there will be about 65 miles of mains, the estimated cost being £40,000. A road deviation is contemplated at Morland, and road widenings are to be carried out at Bampton and Howtown. Several miles of roads are to be remetalled, and extensive drainage works carried out.

Weymouth (Mr. Kenneth J. S. Harris, borough surveyor and engineer).—The following works are to be carried out during the coming year—viz., New destructor scheme to be worked in conjunction with electricity works; provision of three sets of centrifugal pumps and motors for sewage pumping; new disinfecting station; two sets of conveniences; extension of breakwater at harbour entrance, and provision of water traps; provision of large covered-in shelter around bandstand in Alexandra Gardens; wood paving of two main thoroughfares; salt-water installation for street watering and sewer flushing; large housing scheme—about 100 houses projected. Furthermore, negotiations are pending, and will, it is hoped, be brought to a conclusion, for laying out 250 acres of "backwater" into a marine lake. It is also hoped that by the combined efforts of the Dorset County Council and the Weymouth Corporation a new bridge over the "backwater" will be provided.

Whitley and Monkseaton (Mr. A. J. Rousell, assoc.m.inst.c.e., engineer and surveyor to the urban district council).—The coming year will be, as the present one has been, a very busy one for the surveyor's department. The district has been enlarged during the past year by the inclusion of an area of 470 acres to the north, and is increasing very rapidly in population, about 200 new houses having been built and occupied during the past twelve months. The following works will probaby be undertaken during the coming year—viz.: Construction of lower promenade fronting the links, at a cost of £4,000 (commenced); housing scheme at Hill Heads, £10,000 (plans, &c., now being prepared); widening and improvement of Hill Heads-road, necessitated by the building of the new secondary school; the reconstruction (kerbing and paving) of the footways of the main streets, £1,850 (commenced); construction of new sewers, widening and improvement of Bygate-road, Beverley-road and Relton-terrace, £3,000; making up of private streets, £1,500 (notices already served); public lighting and water supply to the added area. In addition, the council will also have under their consideration the alteration and enlargement of the main outfall sewers of the district, further reports and information as to the provision of a refuse destructor, the reconstruction of a further list of private streets and various public improvements.

Wigton, Cumberland (Mr. Dyson A. Pearson, surveyor to the urban district council).—During the past year tar-macadam has been laid with very satisfactory results, and this year it is intended to lay down tar-macadam along the main street through the centre of the town, also a secondary street with 1½-in. tar stone. It is considered desirable here that a length of footpath should be laid down permanently each year. To cheapen this work the surveyor suggested concrete kerb, tar-macadam crossings and channels, and asphalt path, which, he points out, works out at about 35 per cent cheaper than the usual stone kerb and channels and granite-setts crossings (channel

2 ft. wide). This class of pavement will be extended towards the residential property during the year. Last year the council purchased a tar-boiler, &c., and the tar-painting work gave every satisfaction. In the summer it is intended to tar-paint all the main roads through the town early; local tar is used here, and appears satisfactory. The council have now purchased additional land for use as a refuse tip, and are at present making application for a loan for the cost of the laying out and fencing in of the present site. The council will probably purchase a proper covered sanitary cart to carry about twice as much as the ordinary cart, and in other ways facilitate and cheapen collection.

Willington (Mr. J. H. GARDNER, surveyor to the urban district council).—Highways.—It is expected that tar grouting on the main road between Willington and Brancepeth will be carried out. Private Street Works.—Several streets are intended to be made up with tar-macadam and taken over. Sewerage.—Several extensions will be necessary owing to the building operations which are going on in the district, and about 1½ miles of new sewers with cast-iron pipes will probably require to be laid down. Sewage Disposal.—Improvements are expected to be carried out at the Willington works so as to provide secondary treatment. At the Page Bank works a pumping scheme is contemplated, and the sewage distributed over the land by means of cast-iron pipes. Lighting.—Owing to the development of the district, new gas mains and lamps are to be provided. Cemetery.—The existing paths are to be improved and new ones laid out.

Wilts (Mr. J. GEORGE POWELL, county architect, engineer and surveyor).—The amount of work to be carried out during the coming year is likely to be very heavy, and is as follows: (*a*) The repair and upkeep of 761 miles of main road; (*b*) repairs to some 90 to 100 bridges; (*c*) the renovation and repair of fifteen to twenty police stations and cottages, and the completion of a new police station at Amesbury and Wootton Bassett; (*d*) general repair at some forty-two council schools, and the completion of new schools at Trowbridge, Rodbourne Cheney, and Idmiston; (*e*) the inspection of various structural works at non-provided schools, 299 in number; (*f*) the usual annual repairs at the county asylum, assize courts county offices, and weights and measures offices. New works passed and works proposed are as follows: (1) Resurfacing with a bituminous-bound material the entire length of the London and Bath trunk road, length 51½ miles; (2) tar-spraying with Tarvia some 90 to 100 miles of main road; (3) strengthening several lengths of weak road. Bridges.—The reconstruction of at least five county bridges. Police Buildings.—Alterations and additions at Swindon police station, and renovations at the Assize Courts, Devizes. Asylum.—Plans have been prepared for the erection of a hospital for 100 beds, and repairs to existing building. Schools.—The erection of a new school for 260 scholars at Melksham; additions and alterations to (1) secondary school, Trowbridge, (2) Adcroft elementary school, and (3) converting Conigre infants' school into a woodcraft centre, also at Trowbridge; providing a woodcraft centre and gymnasium at the secondary school, Malmesbury; converting several gravel-surfaced playgrounds into tarred macadam. Small Holdings.—Alterations, additions and repairs to several farm buildings, and the erection of dwellings suitable for small holders. Public Health and Housing.—Plans and specifications for tuberculosis dispensaries and open-air shelters. County Offices.—Plans and specifications have been approved for the erection of a new building which will provide further accommodation for the following departments: County medical officer, school medical officer, education, small holdings, local taxation, licences, weights and measures, together with committee rooms, record room, strong room and store; alterations and additions to the existing offices necessary to provide a retiring room for members of the county council, and increased accommodation for the county surveyor's department.

Wirksworth (Mr. J. F. WARDLE, engineer and surveyor to the urban district council).—This year is expected to be a very busy one, as it is hoped a start will be made with the new sewerage scheme. A loan of £9,600 for the carrying this out has been sanctioned by the Local Government Board. The work will consist of laying new sewers throughout the district and the construction of outfall works. The roads which have been tar-sprayed during the last two years have proved very successful, the dust and sludge having been reduced to a minimum. The work has also lengthened the life of the roads. It is expected the same lengths will be again treated this year. The usual amount of repairs to the roads will be carried out. A new addition to the water supply has just been completed.

Wokingham, Berks (Mr. C. W. MARKS, M.INST.M. AND C.E., M.R.SAN.I., borough engineer and surveyor).—It is proposed to at once proceed with the laying out and fencing of the 21½ acres of land recently purchased by the corporation for additional recreation ground, allotments and depot. The provision of a second ejector station with the necessary air mains and rising mains, and extension of the sewers for the south-west portion of the borough, for which the sanction of the Local Government Board has been obtained, will be proceeded with, together with the enlargement of the compressor plant and engine-house. Plans are being prepared for the further extension of the sewerage system for the north-east portion of the district. The additional contact beds in course of construction on the same lines as those which have been working so successfully during the last seven years will be completed and put into use. Some new streets, for which plans have already been prepared, will probably be made up under the Private Street Works Act. Some £3,000 of street improvements are now approaching completion, and further work of the same character is under consideration.

Wolverhampton (Mr. GEORGE GREEN, M.INST.C.E., borough engineer and surveyor).—Among the schemes contemplated, mention may be made of two important improvements in congested parts of the borough—viz., North-street, by Molineux-street, and Worcester-street, by Skinner-street, which will considerably widen these thoroughfares at these points. Other schemes are the extension of the car depot for the purpose of workshops and stores, at an estimated cost of £6,000, and the opening up of two estates under the Housing and Town Planning Act, 1909, and the construction of several new streets. In addition, there will be other improvements, and the new street off Villiers-street, adjoining the Sunbeam motor works, which was recently commenced, will be completed. Dust prevention in streets will also be carried out. Although the proposed municipal cemetery has been under consideration for the past two years, the council have not yet adopted a scheme. This will no doubt be further considered during the present year, and definite proposals may possibly be made.

Worcester (Mr. T. CAINK, ASSOC.M. INST.C.E., city engineer, waterworks engineer and surveyor).—Extensions will be made to the waterworks electric pumping plant. A 48-h.p. vertical spindle pump will be used for pumping river water at the rate of 2,500 gallons per minute. Two horizontal spindle pumps, 67-h.p. and 126-h.p., will be installed for pumping to the high-level reservoir. A Venturi meter is also to be provided. An important street widening will be effected in Little Angel-street by the removal of the Bell Hotel, while it is hoped to continue the widening of High-street during the year.

Wood Green (Mr. C. H. CROXFORD, engineer and surveyor to the urban district council).—The present year promises to be a very active one in the municipal work of Wood Green, for in addition to the usual routine of highway maintenance, sewerage works, and the upkeep of the public gardens (a characteristic feature of Wood Green), several important public works are contemplated. Among these may be named the laying out of about 5 acres of common land in the northern portion of the district, the construction of about 700 yds. of 33-in. and 30-in. diam. concrete tube surface-water sewer, and the culverting of the Mus Well stream (sections I. and III.). The erection of a new central fire station will probably be put in hand, and the completion of extensive additions to the town hall (estimated cost, £7,000) carried out. The turfing and other incidental works of completion, including the provision of a pavilion lodge, &c., in connection with the laying out of the new recreation ground of 7½ acres, will be put in hand as soon as

the winter season closes. Schemes also will be prepared for the laying out of a portion of the district under the Housing and Town Planning Act. In view of the satisfactory results accruing from tar spraying, a further large area will no doubt be dealt with in the spring. The success of the public baths recently erected has already called forth a demand for extension, and the council have decided to make provision for this by the erection of six additional slipper baths, &c.

Worthing (Mr. FRANK ROBERTS, ASSOC.M.INST.C.E., borough engineer and surveyor).—In addition to the routine work, the following special works are projected for the coming year—viz., additions to sewage pumping station and outfall works, surface-water drainage and new outfall; wood-block paving; street widenings. The total estimated cost of these works is £20,000. A considerable number of private streets will be taken over under the Act of 1892.

Wrexham (Mr. JOHN ENGLAND, borough engineer and surveyor).—The principal works to be executed during the year are the erection of a public mortuary at the cemetery; the concreting of the river bed for a distance of 700 yds., at a cost of £1,050, and the erection of new abattoirs, which comprise separate pig and cattle slaughter halls, lairages, cooling room, triperies, stores, offices, and separate slaughter hall and lairage for doubtful animals—estimated cost £4,000 exclusive of land. The laying out of the park is being proceeded with, and at the present time two bowling greens are being constructed, and plans have been prepared for the pavilion in connection therewith, which will include lavatories and stores. Consideration is being given to the laying out of the unbuilt portions of land within the borough under the Town Planning Act in view of the important colliery developments on the outskirts of the borough. The Road Board having granted a moiety of the cost of widening lengths of Ruabon-road and Ruthin-road, it is intended to proceed with these works, in addition to the improvement now proceeding at the junction of Grove-road and Rhosddu-road. Application is to be made to the Road Board for a grant towards the cost of paving Bradley-road with granite setts on a concrete foundation, owing to the very heavy traction traffic on the road, the estimated cost being £3,380, and additional dressing-room and lavatory accommodation is to be provided at the baths.

Yiewsley (Mr. J. LEWIS, M.I.MUN.E., A.M.I.S.E., engineer and surveyor to the urban district council).—The present temporary offices, consisting of an old mission room with two cottages adjoining, situated in the main road, have been bought, and plans are in hand for the alterations necessary to make up-to-date public offices, with storage yard, stables, and depot at rear (estimated cost, £750). A much-desired street widening improvement is to be put in hand by the demolition of an obtrusive building, and the area thus occupied is to be thrown into the highway, which runs at right angles to the new offices into the main road (estimated cost, £120). Surface treatment of the whole of the roads with Tarvia is again included in the year's programme (estimated cost, 2½d. per yard super.). The widening of Horton-road by the addition of 8 ft. of land, given free by the owner, for a length of 1,400 ft., will be proceeded with, the cost of reconstructing the road being estimated at £600. This will ultimately join up with the London road here. The making up of new streets under the Private Street Works Act, 1892, for which plans have just been approved, will also be undertaken, at an estimated cost of £500. The inspection of the main surface-water drainage outfall sewer and the construction of manholes and inspection eyes is to be carried out. The street lighting in one of the outlying hamlets is to be converted from oil to incandescent gas. The conversion of gravel footwalks in granolithic pavements is to be carried out departmentally, and it is anticipated that about ¼ mile will be done each season. Heavy motor tractors from the factories have caused much damage to weak foundations in the roads so traversed, and the work of strengthening the foundations is being carried out in sections, so as to cause as little inconvenience to the public as possible. The planting of trees in the open spaces is again recommended during the season. Chestnuts and planes have proved very satisfactory here.

York (Mr. F. W. SPURR, city engineer).—In addition to the usual work incidental to the maintaining by administration of the roads, sewers and properties of the city, the corporation have in hand, or under consideration, many important works. The works now in hand comprise the following: Extension of the sewage disposal works at Naburn (£21,370); extensions at Fulford pumping station and the addition of storm-water storage tanks (£10,764); the conversion of a large number of cobble streets to tar-macadam (£3,976); and various contracts for private street works. Contracts have been accepted for extensions to tramways (Bishopthorpe-road), £14,748, and for a rehousing scheme (thirty cottages), to cost £6,398. Tenders will also be obtained very shortly for covering further streets with tar-macadam, and for the completion of a new street from Pavement to Piccadilly. A shelter and attendant's room at Clarence Gardens bowling green, and a band-stand at Knavesmire, will also be erected during the year, in addition to ladies' and gentlemen's conveniences at Heworth, Clarence Gardens, Peasholme Green and Leeman-road Gardens. Land has been acquired, and a scheme is being prepared, for laying out 8¼ acres of land at Heworth as a garden and recreation ground, including the provision of a bowling green, tennis courts, and the necessary shelters, conveniences and attendant's room. The preliminary plans and schedules are being prepared, under the Town Planning Act of 1909, for three areas, the work being well in hand. A Bill is being promoted for the acquisition by the corporation of the undertaking of the York Gas Company. The usual number of private streets will be carried out during the coming year, the cost of this work during the past year amounting to £1,650. The Yorkshire Show will be held on the Knavesmire at York on July 23rd, 24th and 25th next.

Yorkshire, East Riding (Mr. ALFRED BEAUMONT, county surveyor).—Works are in hand or projected in this county in addition to ordinary repairs and renewals comprise a new opening steel bridge over the river Hull at Hull Bridge, a new court-house and police station at Brough, new houses for police sergeants, and the enlargement of the police office accommodation at headquarters. Several new schools and enlargements are now in hand.

Yorkshire, West Riding (Mr. F. G. CARPENTER, county surveyor).—The county council have approved of an estimated expenditure of £217,000, to be incurred in the maintenance and repair of the main roads in the Riding, the mileage of which is 1,077. This sum includes, for ordinary surface maintenance, surface tarring, the use of bituminous or other binders, the rebuilding of burr walls, various road and footpath improvements, and sett paving works. In addition, Glusburn Bridge is to be reconstructed and the road diverted, and extensive works of repairs will be carried out to Marley North, Paythorne, Talbot and Darfield Bridges. In conjunction with the Sheffield Corporation a scheme is in course of preparation for the widening and reconstruction of High Bridge, which is a border bridge.

Ystradgynlais (Mr. T. WATKINS, surveyor to the rural district council).—The Local Government Board held an inquiry last November respecting the application of the council for sanction to borrow £2,300 to erect new council offices, the result of which was daily expected at the time this return was prepared, and they have intimated that they will shortly hold inquiries as to the council's application for sanction to borrow £2,000 for two ferro-concrete bridges in Cwmtwrch to replace the present timber structures, and £30,000 for sewerage. The council have also applied for £2,800 to lay an 8-in. water main from Abererave to Ystradgynlais to supplement the existing 5-in. main, which has become inadequate owing to the large increase in the population—which has doubled in the ten years 1901-11. The housing question has had the anxious consideration of the council for some time, and it has been decided to erect sixty houses for the working classes, twenty to be erected at Colbren, twenty at Abererave, and twenty at Ystradgynlais. It has also been decided to put up six urinals throughout the district. Several sharp road corners are to be cut off and the roads widened.

THE OZONAIR SYSTEM OF PURE AIR VENTILATION.

(Contributed.)

The efficient ventilation of buildings has always presented considerable difficulties because of the large numbers of factors which enter into every case. Until quite recently, it was understood that the object to be aimed at in ventilation was to remove the carbonic acid gas exhaled from the lungs of human beings, because this was supposed to be the determining factor in the purity, or otherwise, of the atmosphere. It has been shown, however, by scientists during recent years that carbonic acid gas is not only not poisonous, but that the quantities in which it is found in any place where people congregate are not sufficient to produce effects by any means as injurious as the vitiating components of a crowded atmosphere.

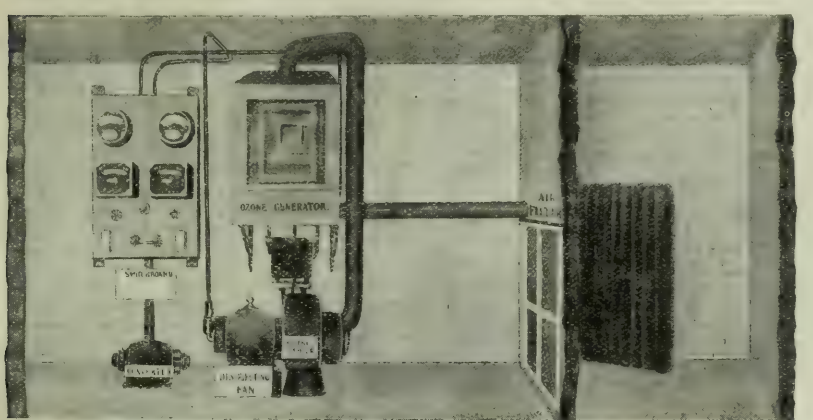
What, then, are the components in question which are so injurious to the health of human beings? These are the organic compounds given off from the lungs, body and clothes, which quickly putrefy and produce an irritant effect on the nervous system; the heat which is given off from the same sources, and which tends to increase the temperature of the air; the moisture, also from the same sources, which increases the humidity of the air and produces a feeling of lassitude; and, finally, the consumption of oxygen, which devitalises the air. Incidentally, places which are not occupied also require ventilation, because the air becomes stagnant, moisture condenses on the walls, and moulds and fungi are produced. These remarks refer especially to such places as cellars, strong rooms, and so forth, where the atmosphere may even become dangerous to those persons who have to visit these rooms occasionally. Hence the chemical impurity of the air has not so much to do with the feelings of discomfort experienced in badly ventilated rooms as the excessive heat and moisture of the atmosphere, the putrefying organic compounds in it, and its motionless uniformity.

A good theoretical definition of ventilation is "the introduction into the place in question of just that quantity of fresh air required to give the necessary degree of change and purity without draughts or uniformity, and without excessive heat or excessive humidity." Now, these results can undoubtedly be obtained if sufficient air is introduced and extracted in a balanced system, but the quantity of air required to do this effectively necessitates not only an unnecessarily large ventilating plant, but is also liable to produce draughts, unless the distribution is very carefully effected; and if some method could be found for removing the vitiated air by chemical means, and, at the same time, introducing just that quantity of fresh air necessary to give the required number of changes without draughts, then an ideal state of affairs would be obtained.

Ozone offers a ready solution for the purification of the air. It is a concentrated form of oxygen produced by passing the latter gas through an electrical discharge, and as oxygen composes one-fifth of the atmosphere, if ordinary air is passed through an ozoniser it becomes ozonised. Ozone is one of the most powerful oxidisers and sterilisers known. It will oxidise, literally burn up, all organic particles in a vitiated atmosphere, and render the latter pure and invigorating. It will also, even in the concentration suitable for breathing, partially sterilise the air. Hence it is clear that if the air introduced into a building is suitably ozonised it will not only maintain a pure atmosphere, but only a sufficient quantity need be blown in in order to provide the necessary number of changes to avoid humidity, uniformity and excessive heat. The Ozonair system of pure air ventilation was designed on this basis, and conforms, in all respects, to the theoretical definition of ventilation before mentioned.

Briefly summarised, its advantages are that stuffiness and all other odours due to, say, cooking smells, and so on, are removed, tobacco smoke and fog are dissipated, and the air is rendered fresh and invigorating. The cost of operating represented by the electrical energy consumed is almost negligible, and no draughts are produced. In fact, the amount of air and the strength of added ozone are adjusted in accordance with the temperature, the state of the barometer, the number of people present, and other desired conditions.

The system consists, briefly, in drawing the air from outside through one of the special ozonair filter screens, during which process it is thoroughly washed, and all smuts and sulphurous acid gases, and so forth are absorbed. The cleaned air then passes into the mixing chamber, where it is purified and partially sterilised by the addition of a small quantity of ozone, which gives it the refreshing character already referred to. It is then blown by a fan into the building through duct work which is provided with openings at suitable points.



GENERAL ARRANGEMENT OF OZONAIR PLANT.

The general disposition of the plant is shown by the diagrammatic illustration. The ozoniser, as will be seen, is in a by-pass circuit to the washed air, because the moisture in the latter might cause a breakdown in the insulation of the ozoniser. The small quantity of air which is to be ozonised enters the ozoniser at the bottom, where it passes through a cotton wool filter; next, over the electrodes of the ozoniser, and thence into the intake of the fan. Where there is only continuous current supply, a converter is employed for producing the necessary alternating current required for the ozoniser; and a switchboard, which will be seen on the walls, is provided with all the necessary apparatus for controlling the plant. It will be seen that everything is extremely simple, and, in fact, the whole control may be left to an inexperienced person. The working of the plant is automatic and depends on the manipulation of two or three ordinary electric switches. The installation is simple, and may be run for long periods with very little attention, while the space taken up is comparatively small. In addition to the foregoing, the cost of upkeep is so trifling as to be almost negligible, a comparatively large building being supplied at the cost of only a few pence per day for power.

The system has been installed in many hundreds of buildings in this country and abroad, and to mention the importance of these we need only refer to the Law Courts, the Wool Exchange, Savoy Hotel, Piccadilly Hotel, the Palladium, and the Palace Theatre of Varieties, in London (not to speak of the Central London Railway); the Council Chamber, Manchester; the Blackburn Sessions Court; the Glasgow Justiciary Court; while, recently, a plant has been fitted for the ventilation of the New Zealand Parliament Houses, and another has been installed in the House of Commons.

London Tramways.—Trailer cars will be running on the London County Council lines within a fortnight.

Office Conversations.

MORE OR LESS IMAGINARY.

[*Contributed.*]

III.—The Macadam Fetish.

". . . Just for five minutes. I will not keep you longer, for I know how busy you are, and——" Yes, and I wish *he* was. He wouldn't be a bad fellow if he wasn't so consumedly long-winded. What another man'd put into a sentence he'll extend to a half-column paragraph. Just my luck, when I'm up to my neck in it; and I can't very well close my door to the great Chairman of the Highways and Bridges Committee, J.P. Ah, that's his step—I'd know it from a thousand when I'm busy—if he'd only break—— Yes, very well, thanks, Mr. Climson; first class. Busy? Oh, as usual, you know; two days' work to do before lunch. You won't keep me a minute or two? Oh, that's all right. You've been doing what? Reading a life of Macadam—what, Macadam, the road chap? Have I read it? No, I'm afraid I haven't time to indulge in that kind of literature. An education? The life of Macadam an education? Really, Mr. Climson, I must confess that I fail to see—— Certainly, certainly. I'm quite prepared to hear your views.

* * * *

And you'd really like to see the roads of the borough made and maintained more upon Macadam's system? You don't like these new-fangled systems? You wouldn't, if you had your way, sanction the use of any of the patented materials? Well, each man to his taste; but I think I've used them all, and it'd be more of an education if you were to read the literature issued by the proprietors of these systems than a hundred volumes like the life of Macadam. Nothing in this world stands still. Everything must either progress or retrogress, and I'm certain sure that road making has (to use an Americanism) progressed a few since the days when Macadam dumped tons of broken material on to soft bottoms and left the result to—— Getting warm, am I? Well, I can't help it when I hear obsolete methods trotted out as the best and the old gag about the decline of British road making and all the rest of it. Do you know that Macadam considered road foundations as worse than useless—that the question of weight-carrying didn't enter into his calculations—that he preferred a yielding morass to solid rock for the reception of his precious broken stone—that to make a road watertight was to him the be-all and end-all of construction? Do you know that——

* * * *

No, of course, you didn't know, or you wouldn't talk as you do. Macadam's life an education! Why, there's not a road in the country made upon his system—and heaven knows there are far too many of them—that doesn't require strengthening to meet the requirements of modern traffic. Just picture to yourself a quagmire with 10 in. of broken stone atop of it, and a 7-ton traction engine with five 2-ton trucks, each loaded with 8 tons of material—total load 57 tons—going over it! I'm not saying that water-bound roads, if properly constructed, won't stand the deuce of a lot of rough wear: what I'm up against in water-bound roads is the Macadam system. He had his good points? Oh, yes, I'll allow that. Drainage, compact surfaces, impenetrability, flattened cross-section—we have much to thank him for; but—oh, what? The father of road making? We owe all our modern roads to him, after all? Really, Mr. Climson, that's a bit too much to swallow. Did he introduce granite setts, or asphalt, or wood pavements? Was he, even most remotely, the inventor of tar-macadam, or of any of the numerous proprietary roads, to which, by-the-bye, you so strongly object? Would you attribute the modern warship to Noah, or the Army aeroplane to Icarus or Roger Bacon? Oh, you allow that there were Roman roads in the country before Macadam's time? and even then you aren't perhaps aware that a lot of humbug has been talked about even them.

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No, you can take it from me, Mr. Climson, that modern road making is miles ahead of anything yet done. Of Macadam as a man I have nothing to say—you know more of him (from your book) than I do; as a modern road maker he wouldn't be tolerated anywhere in this country, except in some little urban district, where he'd get £5 a year, with an additional £5 as sanitary inspector, and 50s. a year maybe as market dues collector, petroleum inspector, or some such responsible post. Do I really believe in these new patented systems? Certainly—why shouldn't I? The duty of a surveyor is to utilise to the best advantage what materials he can procure at the lowest rates compatible with quality. He hasn't time (I know I haven't) to experiment except in the way of use. Research is denied him, not only because of the time it would occupy, but because of the expense. What would the members of our committee say if I asked them to fit me up a laboratory and testing station? No, we must depend, so far as the question of materials goes, largely upon the reports of those who make a life-study of them, coupled, of course, with the knowledge derived from our own experience in their use. Take the articles I say that I have tried. You sneer at them as "proprietary" articles, as though they were so many patent medicines. They are not put forward as panaceas or cure-alls. They each have their value in the world of road making, and the sensible surveyor is he who gives them a fair trial. I've done so, as you know—you see I'm one of the sensible surveyors—and if you can show me better roads than—— Well, if you're satisfied, that's all right. I know you don't mind my plain speaking. You must really be going? Well, if you must, you must. Good-bye. See you at committee to-night.

* * * *

Not a bad sort, old Climson; but why doesn't he stick to his last? I wonder what he'd say were I to trot round to his shop and advise him on the furniture trade! An education, indeed; he—— Come in! Well, and what's wrong with *you* now? Mr. Simms been complaining of your work? And I've no doubt he has good cause. Eh, what? Mr. Simms doesn't know what he's talking about? You'll excuse me, Mr. Skimmer, but really you ought to know better, as a member of the council, than to say such a thing. There isn't, thank heaven, a dud on my staff, and you know that as well as I do. The fact is Simms is too sharp for you—he knows his work too well. You'll see about it, you'll—now, look here, Mr. Skimmer, we're speaking between four walls, and whatever you may be in the council chamber, remember that I'm top dog here, and I'll have no one blustering and threatening in my office. Let's discuss this matter calmly. That's better. Now, what's Simms complained of this time? Drains? Foundations? Brickwork? Oh, that's it, is it? Bats, insufficient bond, empty joints and poor mortar? Pretty comprehensive, eh? Yes, yes, I quite understand—the work's of the very best, properly bonded, solidly put together, with first-class bricks, and mortar composed of good stone lime and clean sharp sand. That went without saying. And you won't move a brick—not a brick? You'll see the case through if it costs you every penny you've got? You've been forty-five years, man and boy, in the building trade, and if you don't know what good work is——

* * * *

I've not the least doubt that you do know good work when you see it; but it seems that Mr. Simms possesses (unfortunately for you) equal perceptive powers. The matter's one between you and him. Of course, if you wish to drag me into it, I'll run down and have a look at the work, and give my opinion, but I've sufficient faith in Mr. Simms—I wouldn't retain him on the staff if I hadn't—to know that I shall back his report. To speak plainly, Mr. Skimmer, your work is not always quite what it should be, in fact it's only too often quite the reverse. What are you to do? Why, what Mr. Simms asks you to do—no more and no less. He's not unreasonable. Wants you to pull half a house down? Well, surely that's quite reasonable, if it'll save the house coming down by itself some day.

* * * *

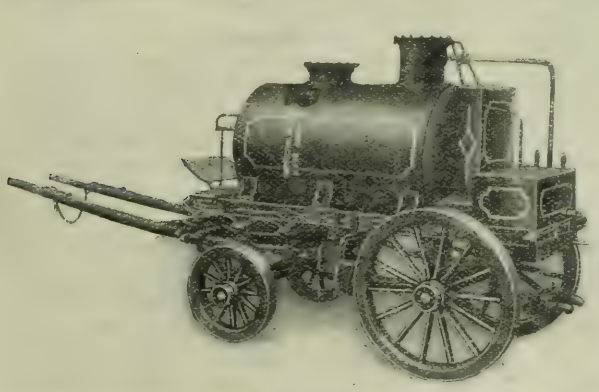
You hope that Mr. Simms will let you alone for a spell after this? Really, I can hold out no such

hope. It all depends upon yourself, as you know without my telling you. I'm here to see that he does his work, and I'll see that he does it. And you? Doesn't it strike you, Mr. Skimmer, that you're here to see that we both do our work? Why, neither Mr. Simms nor I could have looked you in the face again if we neglected our duty so far as to—— Funny? No, I'm not trying to be that, Mr. Skimmer. I haven't time for joking until I get home at night, and then I'm too tired to attempt it. Nothing to complain of? No; and I'm not complaining; but a man wants an hour or two in the bosom of his family sometimes, and even committees lose their freshness after a few years. You'd like my job? No, I don't think you would. There's too much worry about it. It's not a simple, straightforward job like building—just knocking up a wall here and a wall there, and—— Eh? Well, yes, and knocking down a wall here and a wall there, if you will have it so. But not at the bidding of a boy inspector? Mr. Simms has, I think, arrived some time since at years of discretion, and, too——

CESSPOOL EMPTYING PLANT.

Messrs. George Waller & Son, of Stroud, have recently supplied a cesspool emptying apparatus to Windsor Castle. It is worked on the vacuum principle, and the tank holds 500 gallons. The apparatus is mounted on a four-wheeled carriage, with springs and extra wide tyres for horse draught. It is fitted with one of Waller's well-known "Pinkney" petrol engines, with magneto ignition and horizontal air pump (for producing a vacuum) combined on one baseplate and driven through machine-cut gearing. This plant embodies all the latest improvements, and is most economical in working, it being estimated that over 50 per cent is saved as compared with the old methods.

Messrs. George Waller & Son claim to be the pioneers of cesspool-emptying plants. They are manufacturers of the "Bexley" system apparatus, of which they have supplied a very large number both at home and abroad. With the above plants cesspools can be quickly, cheaply and efficiently emptied without nuisance.



MESSRS. GEORGE WALLER & SON'S CESSPOOL EMPTYING APPARATUS.

Messrs. Waller & Son are the oldest and one of the best-known manufacturers of ironwork for water and sewage disposal works, and make a speciality of sewage and water-pumping machinery driven by steam, gas or oil or electric motors. They have supplied a large number of installations for public bodies, private mansions and hotels. They have at present several contracts in hand, notably at Rhyl. They are makers of the E.F.B. patent automatic self-dosing sewage sprinklers and alternating gear for bacteria beds, and the E.F.B. automatic screening apparatus; also of sewage screens with improved mechanical raking apparatus, penstocks, sluice gates, floating arms, ventilating columns, manhole covers, sluice valves, hydrants and air valves.

Any further particulars or information may be obtained from the firm's London representative: Mr. W. E. Horsman, 127 Pendle-road, Streatham, S.W.

Roman Pavement.—Part of a Roman pavement, in good preservation, has been found 6 ft. below the surface in the garden of a seventeenth century house in Leicester.

INSTITUTION OF MUNICIPAL AND COUNTY ENGINEERS.

WEST MIDLAND DISTRICT.

A meeting of the West Midland District of the Institution of Municipal and County Engineers was held at Birmingham on Thursday, the 23rd inst. In the absence of Mr. A. T. Davis (district chairman), Mr. A. D. Greatorex (West Bromwich), the vice-chairman, presided, and the attendance included: Messrs. T. Caink (Worcester), W. B. Chancellor (Lichfield), H. J. Coleby (Atherstone), F. C. Cook (Nuneaton), hon. district secretary, S. Douglas (Kenilworth), A. J. Dickinson (Redditch), R. Dixon (Stratford-on-Avon), G. F. Gettings (Worcestershire), H. H. Humphries (Erdington), C. E. Lawton (Birmingham), H. B. Mathew (Birmingham), R. C. Moon (Nuneaton), A. E. Newey (Foleshill), H. Richardson (Birmingham), E. B. Savage (Birmingham), members; E. J. Goodacre (Nuneaton), H. M. Lawson (Birmingham), students; J. T. Fitch (Birmingham), associate member; and K. V. Cuthbe (Birmingham) and J. Finan (Birmingham), visitors.

Mr. E. B. Savage (Birmingham) and Mr. A. J. Dickinson (Redditch) opened a discussion on the report of the Departmental Committee of the Local Government Board dealing with intercepting traps in house drains. Mr. Savage expressed himself strongly in favour of the retention of the trap, and the opposite view was taken by Mr. Dickinson. An interesting discussion followed, in which, in addition to the chairman, Messrs. W. B. Chancellor (Lichfield), T. Caink (Worcester), S. Douglas (Kenilworth), F. C. Cook (Nuneaton), H. J. Coleby (Atherstone), took part.

At the suggestion of the chairman it was decided to hold another evening meeting of the District Committee at Birmingham early in March.

A Bamboo-matting Road Bed.—The Government engineers in Java have recently constructed a road bridge more than 100 ft. long, with a central span of over 60 ft., completely of bamboo. Even the road bed is composed of bamboo matting, covered with a layer of earth. The bridge resembles a steel structure in profile, but all the members are bamboo rods. It is estimated that such a bridge should last about fifteen years.—The *Contract Record*, Toronto.

Chiswick Council Employee's Invention.—At a recent meeting of the Chiswick District Council it was reported that one of the employees, named Gillett, had made and fixed an ingenious arrangement by which, in the event of a shower of rain occurring, an electrical alarm was given in the engine-room of the sewage works, thus giving timely notice to the engine-drivers of the possibility of having to start additional pumps to deal with the increased flow resulting from the rainfall. The council resolved that a letter of thanks be sent to Gillett, together with a grant of £1, as a mark of their appreciation of his ingenuity.

Petrol Fires. — The British Fire Prevention Committee have had under investigation a system of extinguishing petrol fires that claims the attention of those concerned in the ever-increasing hazards of petrol used particularly for transport purposes. The system comprises either a permanent installation, wheeled fire appliances, or small extinguishers, as the case may be, from which chemicals are forced, the extinguishing effect being obtained by the combination of two liquids which produce a thick foam, which gradually spreads over the surface of the burning petrol, thereby excluding the air and extinguishing the fire. The British Fire Prevention Committee have issued their official report on these extinguishers as Red Book No. 177, and the report states that the tests were largely successful, and that two petrol fires of considerable area and severity were creditably dealt with, as well as numerous smaller fires. In the summary of the report it is shown that the extinguishers were also effective on celluloid fires. Copies of the official report may be had by applying to the assistant secretary of the British Fire Prevention Committee, 8 Waterloo-place, S.W.

Literature of Municipal Engineering in 1912.

[Any book included in this summary will be forwarded, post free, on application to the St. Bride's Press, Limited, 24 Bride-lane, Fleet-street, E.C. The published price must be enclosed.]

In accordance with our usual custom, we publish below a summary of the books which have been issued during the past year dealing with subjects of interest to municipal engineers. In doing so, we may, perhaps, direct the attention of our readers to the Book Department recently inaugurated in connection with The Surveyor through which technical books, issued by various publishers, may be obtained from a single source with the minimum amount of trouble. Orders by post receive careful and prompt attention, and particulars and lists of books on any desired subject may be obtained on application. The references in brackets are to the volume and page of The Surveyor in which a review has appeared.

Annuals and Year Books.

Hazell's Annual, 1912. Edited by Hammond Hall. Price 3s. 6d. nett. London: Hazell, Watson & Viney, Limited. (Vol. 41, p. 226.)

Laxton's Price-Book for 1912. Price 4s. London: Kelly's Directories, Limited. (Vol. 41, p. 535.)

Lockwood's Builders' and Contractors' Price Book, 1912. Edited by F. T. W. Miller, A.R.I.B.A. Price 4s. London: Crosby Lockwood & Son. (Vol. 41, p. 575.)

London Statistics, 1910-11. Price 5s. Published for the London County Council by Messrs. P. S. King & Son. (Vol. 41, p. 379.)

The Englishwoman's Year-Book and Directory, 1912. Edited by G. E. Mitton. Price 2s. 6d. nett. London: A. & C. Black. (Vol. 41, p. 225.)

The Local Government Annual and Official Directory for 1912. Price 1s. 6d. London: The *Local Government Journal* Office. (Vol. 41, p. 225.)

The Municipal Year-Book for 1912. Edited by Albert E. Cave. Price 15s. nett. London: The Municipal Journal, Limited. (Vol. 41, p. 535.)

The Social Guide, 1912. Edited by Mrs. Hugh Adams and Miss Edith A. Browne. Price 2s. 6d. nett (cloth) and 3s. 6d. nett (leather). London: A. & C. Black. (Vol. 41, p. 955.)

The Writers' and Artists' Year-Book. Price 1s. nett. London: A. & C. Black. (Vol. 41, p. 226.)

Transactions of the Institution of Municipal and County Engineers (Vol. xxxviii., 1912-13). Edited by Thomas Cole, assoc.m.inst.c.e., secretary. London: E. & F. N. Spon. (Vol. 42, p. 900.)

Transactions of the Institution of Water Engineers. Vol. xvi. 1911. Edited by Percy Griffith, m.inst.c.e., f.g.s., Secretary. London: The St. Bride's Press, Limited. (Vol. 42, p. 455.)

Where to Look. Price 2s. nett. London: Sir Isaac Pitman & Sons, Limited. (Vol. 41, p. 484.)

Whitaker's Almanack for 1912. Price 1s. paper; 2s. 6d. half-bound. (Vol. 41, p. 226.)

Who's Who, 1912. Price 10s. nett. London: A. & C. Black. (Vol. 41, p. 75.)

Who's Who Year Book, 1912-13. Price 1s. nett. London: A. & C. Black. (Vol. 41, p. 75.)

Willing's Press Guide, 1912. Price 1s. London: James Willing, jnr., Limited. (Vol. 41, p. 51.)

Applied Mathematics.

Applied Mechanics and Mechanical Engineering. Vol. i.; Applied Mechanics. By Andrew Jamieson, m.inst.c.e. Price 6s. London: Charles Griffin & Co., Limited. (Vol. 42, p. 900.)

Applied Mechanics and Mechanical Engineering. Vol. iv. Hydraulics. Eighth Edition. By Prof. A. Jamieson. Price 5s. London: Charles Griffin & Co., Limited. (Vol. 41, p. 840.)

Practical Geometry and Graphics for Technical Students. By E. L. Bates and F. Charlesworth. Price 4s. nett. London: B. T. Batsford. (Vol. 42, p. 760.)

Practical Mathematics for Technical Students. By E. L. Bates and F. Charlesworth. Price 3s. nett. London: B. T. Batsford. (Vol. 42, p. 760.)

Practical Mathematics and Geometry for Technical Students. Part III. Advanced Course. By E. L. Bates and F. Charlesworth. Price 3s. nett. London: B. T. Batsford. (Vol. 41, p. 483.)

Simple Calculations for Sanitary Officials and Students. Price 1s. nett. London: The Sanitary Publishing Company, Limited. (Vol. 41, p. 867.)

Architecture and Building.

Building Construction (Advanced and Honours Courses). By Charles F. Mitchell, m.s.a., &c., assisted by George A. Mitchell, a.r.i.b.a. Price 6s. London: B. T. Batsford. (Vol. 42, p. 760.)

Building Quantities. By H. M. Lewis. 1s. 6d. nett. London: E. & F. N. Spon, Limited. (Vol. 41, p. 192.)

Building Structures in Earthquake Countries. By Ing. Alfredo Montel. Price 8s. 6d. nett. London: C. Griffin & Co., Limited. (Vol. 41, p. 955.)

Common-sense Homes: A Practical Book for Everybody upon the Essential Equipment and Treatment of the Home. By Spencer Sills, member of the Society of Engineers and the Institution of Municipal Engineers. Price 5s. nett. London: Cassell & Co., Limited. (Vol. 42, p. 724.)

Engineering Work in Public Buildings. By R. Owen Allsop. Price 12s. 6d. nett. London: E. & F. N. Spon, Limited. (Vol. 41, p. 575.)

Estimating. Part I. By T. D. L. Piper. Price 3s. 6d. nett. Portsmouth: The Ubique Press, Limited. (Vol. 42, p. 619.)

The Fire Resistance of Doors and Shutters: Tabulated Results of Tests. Price £2 2s. nett. London: The British Fire-Prevention Committee. (Vol. 42, p. 552.)

The Cheap Cottage and Small House. By J. Gordon Allen, a.r.i.b.a. Price 1s. 6d. paper, 2s. 6d. cloth. Letchworth: Garden City Press, Limited. (Vol. 42, p. 688.)

Highways.

A Text-book on Roads and Pavements. By Fredk. P. Spalding. Fourth edition, revised and enlarged. Price $2 nett. New York: John Wiley & Sons. (Vol. 42, p. 800.)

Highway Engineering. By Arthur H. Blanchard and Henry B. Drowne. Price $2 nett. New York: John Wiley & Sons. (Vol. 41, p. 628.)

Highway Engineering as Presented at the Second International Road Congress, Brussels, 1910. By Arthur H. Blanchard, m.am.soc.c.e., and Henry B. Drowne, assoc.m.am.soc.c.e. Price 8s. 6d. nett. New York: Wiley & Sons. London: Chapman & Hall. (Vol. 41, p. 325.)

Modern Road Construction. By Francis Wood, m.inst.c.e., f.g.s., Borough Surveyor of Fulham, with twenty-five illustrations and a coloured map. Price 4s. 6d. nett. London: Charles Griffin & Co. (Vol. 42, p. 402.)

Rocks for Road Building. By Edwin C. E. Lord, Petrographer. United States Office of Public Roads (Bulletin No. 37). (Vol. 41, p. 225.)

Street Pavements and Paving Materials. A Manual of City Pavements: The Methods and Materials of their Construction. By Geo. W. Tillson. Second edition. Price $4 nett. New York: John Wiley & Sons. (Vol. 42, p. 800.)

The Road Material Resources of Minnesota. By George W. Cooley, Secretary and Engineer, Minnesota State Highway Commission. (Vol. 42, p. 150.)

Hygiene, Public Health and Sanitation.

Die Strassenreinigung in den Deutschen Städten (Street Cleaning in German Towns), with Special Reference to the Street Cleaning of Dresden. By Dr.-Ing. Franz Niedner, City Engineer. Price 4 marks. Leipzig: W. Engelmann. (Vol. 41, p. 289.)

Handbuch der Hygiene. By Professors Rubner, Grubner and Ficker. Price (in paper covers) 27 marks. Leipzig: S. Hirzel. (Vol. 41, p. 226.)

Modern Destructor Practice. By W. F. Goodrich. Price 15s. nett. London: Charles Griffin & Co., Limited. (Vol. 41, p. 928.)

Pocket Notes and Remembrancer for Sanitary Inspectors, &c. By J. T. Cowderoy. Price 2s.

nett. London: The Sanitary Publishing Company, Limited. (Vol. 41, p. 483.)

SMALL WATER SUPPLIES. By F. Noel Taylor. Price 6s. London: B. T. Batsford. (Vol. 41, p. 483.)

THE MAIN DRAINAGE OF TOWNS. By Noel F. Taylor, C.E., M.I.MUN.E. Price 12s. 6d. nett. London: Chas. Griffin & Co., Limited. (Vol. 42, p. 122.)

THE THEORY AND PRACTICE OF HEATING AND VENTILATION. By A. H. Barker, B.SC., B.A. Price 25s. nett. London: The Carton Press. (Vol. 41, p. 807.)

Legal.

EVERYBODY'S GUIDE TO THE NATIONAL INSURANCE ACT, 1911. By Thomas Smith, Barrister-at-Law. Price 1s. London: Chas. Knight & Co., Limited. (Vol. 42, p. 88.)

HUNT'S LAW OF BOUNDARIES, WALLS AND FENCES. Sixth Edition. Revised and substantially rewritten by R. G. Nicholson Combe, M.A., LL.M. Price 15s. London: Butterworth & Co. (Vol. 42, p. 337.)

LAW OF REPAIRS AND DILAPIDATIONS. By T. Cato Worsfold, M.A., LL.D. Price 3s. 6d. nett. London: Sir Isaac Pitman & Sons, Limited. (Vol. 42, p. 653.)

LOCAL GOVERNMENT CASE LAW, 1911. By R. A. Glen, M.A., LL.B., Barrister-at-Law. Price 7s. 6d. nett. London: "The Local Government Review," Ltd. (Vol. 42, p. 337.)

LOCAL LEGISLATION, 1909 to 1911. By F. N. Keen LL.B., Barrister-at-Law. Price 5s. nett. London: Walter Southwood & Co., Limited. (Vol. 41, p. 535.)

LOCAL LEGISLATION (Supplement for 1912). By F. N. Keen, LL.B., Barrister-at-Law. Price 3s. 6d. nett. London: Walter Southwood & Co., Limited. (Vol. 42, p. 900.)

NATIONAL INSURANCE ACT: A FULL EXPLANATORY DIGEST. By "An Old Parliamentary Hand." Price 6d. London: Wm. Macdonald & Co. (Vol. 41, p. 628.)

NATIONAL INSURANCE: QUESTIONS AND THEIR ANSWERS. By Gilbert Stone, B.A., LL.B., Barrister-at-Law. Price 1s. nett. London: Butterworth & Co. and Shaw & Sons. (Vol. 42, p. 688.)

PUBLIC HEALTH LAW. By Bertram Jacobs. Price 7s. 6d. London: Sweet & Maxwell, Limited. (Vol. 41, p. 628.)

REPORTS OF RATING APPEALS, 1909-1912. By E. M. Konstam and Harold R. Ward, Barristers-at-Law. Price 16s. London: Butterworth & Co. (Vol. 42, p. 515.)

THE ALPHABET OF THE NATIONAL INSURANCE ACT, 1911. By. C. G. Moran, Barrister-at-Law. Price 1s. nett. London: Methuen & Co., Limited. (Vol. 41, p. 628.)

THE HOUSING, TOWN PLANNING, &C., ACT, 1909. By W. A. Casson, Barrister-at-Law. Price 10s. 6d. nett. London: Chas. Knight & Co., Limited. (Vol. 41, p. 763.)

THE LAW AND PRACTICE OF RATING. By Walter C. Ryde. Price £1 17s. 6d. London: Butterworth & Co., and Shaw & Sons. (Vol. 42, p. 619.)

THE LAW RELATING TO ELECTRIC LIGHTING, POWER AND TRACTION. By the late John Shiress Will, K.C. Fourth edition, by W. E. Tyldesley Jones, of Lincoln's Inn, Barrister-at-Law. Price 27s. 6d. London: Butterworth & Co. (Vol. 42, p. 800.)

THE LAW RELATING TO PRIVATE STREET WORKS UNDER THE ACT OF 1892. By W. Carlyle Croasdell, Barrister-at-Law. Price 8s. 6d. London: Hadden, Best & Co. (Vol. 41, p. 251.)

THE LAW RELATING TO TITHE RENT-CHARGE AND OTHER PAYMENTS IN LIEU OF TITHE. By P. W. Millard, LL.B. Price 4s. 6d. nett. London: Butterworth & Co. and Shaw & Sons. (Vol. 42, p. 337.)

THE PUBLIC AUTHORITIES PROTECTION ACT, 1893 (56 and 57 Vict., c. 61), considered in the light of the relevant judicial decisions on similar statutory protections of earlier date, as well as of all the reported English, Scottish and Irish decisions on the Act itself. By John Chartres, of the Middle Temple and South-Eastern Circuit, Barrister-at-Law, sometime Powell Prizeman in Common Law. Price 12s. 6d. London: Butterworth & Co. (Vol. 41, p. 251.)

Materials.

LABORATORY MANUAL FOR THE USE OF STUDENTS IN TESTING MATERIALS OF CONSTRUCTION. By L. A. Waterbury, Professor of Civil Engineering, University of Arizona, &c. Price 6s. 6d. New York: John Wiley & Sons. London: Chapman & Hall, Limited. (Vol. 42, p. 150.)

RAIL CORRUGATION. Interim Report of Special Committee appointed by the Municipal Tramways Association. Price 10s. 6d. Bradford: Mr. G. Spencer, 7 Hall Ings, Hon. Secretary. (Vol. 42, p. 687.)

THE CLAYWORKERS' HAND-BOOK. By Alfred B. Searle. Price 6s. nett. London: Charles Griffin & Co., Limited. (Vol. 41, p. 840.)

Meteorology.

BRITISH RAINFALL, 1910. Edited by Hugh Robert Mill, Director of the British Rainfall Organisation. Price 10s. London: Edward Stanford, 1911. (Vol. 41, p. 535.)

BRITISH RAINFALL, 1911. Price 10s. London: Edward Stanford. (Vol. 42, p. 294.)

CLIMATE AND WEATHER. By H. N. Dickson, M.A., D.SC., F.R.MET.SOC., President of the Royal Meteorological Society, Professor of Geography at University College, Reading. Price 1s. nett. London: Williams & Norgate. (Vol. 41, p. 710.)

METEOROLOGICAL INSTRUMENTS AND WEATHER FORECASTS. By H. T. Davidge, B.SC., M.I.E.E. Price 1s. 6d. London: Percival Marshall & Co. (Vol. 41, p. 795.)

Miscellaneous.

A PRIMER OF SCIENTIFIC MANAGEMENT. By Frank B. Gilbreth. Price 4s. nett. London: Constable & Co., Limited. (Vol. 42, p. 847.)

CHEMISTRY FOR ENGINEERS AND MANUFACTURERS. By B. Blount and A. G. Bloxam. Second edition. Price 14s. London: Charles Griffin & Co., Limited. (Vol. 41, p. 379.)

DEPRECIATION AND WASTING ASSETS. By P. D. Leake, F.C.A. Price 10s. 6d. nett. London: Henry Good & Son. (Vol. 41, p. 504.)

ENGINEERING AND METALLURGICAL BOOKS, 1907-1911. By R. A. Peddle. Price 7s. 6d. nett. London: Grafton & Co. (Vol. 42, p. 688.)

MEN AND MEASURES: A HISTORY OF WEIGHTS AND MEASURES, ANCIENT AND MODERN. By E. Nicholson, F.I.C., F.C.S. Price 7s. 6d. nett. London: Smith, Elder & Co. (Vol. 41, p. 628.)

PRINCIPLES AND PRACTICE OF ELECTRIC WIRING. By A. Bursill, A.M.I.E.E. Price 3s. nett. London: Longmans, Green & Co. (Vol. 41, p. 955.)

PROBLEMS IN ENGINEERING, WITH SOLUTIONS. Edited by Sydney G. Turner, ASSOC.M.INST.C.E. Price 5s. nett. London: St. Bride's Press, Limited. (Vol. 42, p. 122.)

TAXATION OF LAND VALUES AS IT AFFECTS LANDOWNERS AND OTHERS. By John Orr, M.A. Price 1s. nett. London: P. S. King & Son. (Vol. 42, p. 337.)

THE BACK GARDEN BEAUTIFUL: WHAT TO GROW AND HOW TO GROW IT. By Harry Havart. Price 7d. nett. London: The Amalgamated Press, Limited. (Vol. 41, p. 325.)

THE COMING OF PETROLEUM. Price 2s. 6d. nett. London: Curtis, Gardner & Co., Limited. (Vol. 42, p. 175.)

THE GEOLOGY OF SOILS AND SUBSTRATA: With special reference to Agriculture, Estates and Sanitation. By Horace B. Woodward, F.R.S., F.G.S. Price 7s. 6d. nett. London: Edward Arnold. (Vol. 42, p. 881.)

THE LAND UNION'S HAND-BOOK ON PROVISIONAL VALUATIONS. Price 3s. nett. London: Vacher & Sons, Limited. (Vol. 42, p. 337.)

THE PRACTICAL MECHANIC'S HAND-BOOK. By Franklin E. Smith. Price 4s. 6d. nett. London: Constable & Co., Limited. (Vol. 42, p. 847.)

Reinforced Concrete.

CONCRETE COSTS. By Frederick W. Taylor and Sanford E. Thompson. Price 21s. 1d. nett. New York: John Wiley & Sons. (Vol. 41, p. 867.)

REINFORCED CONCRETE CONSTRUCTION (Advanced Course). By M. T. Cantell. Price 12s. 6d. nett. London: E. & F. N. Spon. (Vol. 42, p. 760.)

REINFORCED CONCRETE DESIGN. By Oscar Faber, B.SC., &c., and P. G. Bowie. Price 12s. 6d. nett. London: Edward Arnold. (Vol. 41, p. 575.)

THE PROPERTIES AND DESIGN OF REINFORCED CONCRETE. Translated and abridged by N. Martin, B.SC., ASSOC.M.INST.C.E., &c. Price 8s. nett. London: Constable & Co., Limited. (Vol. 42, p. 847.)

Sewerage and Sewage Disposal.

PRACTICAL METHOD OF SEWAGE DISPOSAL. By Ogden and Cleveland. Price 6s. 6d. nett. New York: John Wiley & Sons. (Vol. 42, p. 88.)

PRACTICAL SEWERAGE AND SEWAGE DISPOSAL. By H. C. H. Shenton, F.S.E., M.I.MUN.E., M.R.SAN.I. Price 3s. 6d. nett. London: S. Edgecumbe Rogers. (Vol. 41, p. 225.)

SEWAGE SLUDGE. New York: McGraw Hill Book Company. (Vol. 41, p. 403.)

THE PRECISE CALCULATION OF PIPE DRAIN AND SEWER DIMENSIONS. By C. E. Housden. Price 2s. 6d. nett. London: Longmans, Green & Co. (Vol. 41, p. 484.)

THE SEWERAGE ENGINEERS' POCKET-BOOK (in German). By Dr.-Ing. K. Imhoff. Price 2·80 marks. Munich: R. Oldenburg. (Vol. 42, p. 122.)

Structural Engineering.

REFERENCE-BOOK FOR STATICAL CALCULATIONS. By Francis Ruff. Price 4s. nett. London: Constable & Co., Limited. (Vol. 42, p. 337.)

STRESSES AND STRAINS. By F. R. FARROW, F.R.I.B.A. Price 5s. nett. London: Whittaker & Co. (Vol. 42, p. 337.)

STRUCTURAL ECONOMY. By E. A. Slater, ASSOC.M. INST.C.E. Price 6s. nett. London: The St. Bride's Press. (Vol. 42, p. 881.)

STRUCTURAL ENGINEERING. By Joseph Husband, ASSOC.M.INST.C.E., and William Harby. Price 7s. 6d. nett. London: Longmans, Green & Co. (Vol. 41, p. 51.)

THE CIVIL ENGINEERS' COST-BOOK. By T. E. Coleman. Price 5s. nett. London: E. & F. N. Spon. (Vol. 41, p. 575.)

THEORY AND PRACTICE IN DESIGNING. By Henry Adams, M.INST.C.E. Price 6s. nett. London: Constable & Co. (Vol. 41, p. 628.)

THE PRINCIPLES OF STRUCTURAL MECHANICS. By Percy J. Waldram. Price 7s. 6d. nett. London: B. T. Batsford. (Vol. 41, p. 955.)

Surveying.

FERGUSSON'S "PERCENTAGE UNIT" OF ANGULAR MEASUREMENT, WITH LOGARITHMS FOR ITS USE AND FOR DEGREES, MINUTES AND SECONDS. By John C. Fergusson, M.INST.C.E. Price £3 3s. nett. London: Longmans, Green & Co. (Vol. 41, p. 575.)

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WALKS TO LIVE ROUND LONDON (Southern Side). Edited by Prescott Row and Arthur Henry Anderson. Price 1s. nett. London: The Homeland Association, Limited. (Vol. 42, p. 619.)

INSTITUTION OF MUNICIPAL ENGINEERS.

NORTHERN DISTRICT.

A meeting of the Northern District of the Institution of Municipal Engineers was held in the Town Hall, Newcastle-on-Tyne, on January 11th, Mr. J. W. Moncur, chairman of the district, presiding.

A motion by Mr. J. H. Mole to the effect that a committee be appointed to consider the question of superannuation and to frame a resolution to be submitted to the Executive Council at their meeting on February 22nd was withdrawn by the mover in favour of the following resolution moved by Mr. MIDDLETON TURNBULL, seconded by Mr. MOLE—viz.: "That the question of superannuation is of such importance to surveyors that it should form one of the items of the agenda for the Newcastle-on-Tyne meeting on February 22nd, and should be kept to the front at all meetings until it becomes law."

Mr. CHAS. HEARDER moved, and Mr. C. W. HALL seconded, the following resolution: "That the question of security of tenure is of such importance to surveyors that it should form one of the items of the agenda for the Newcastle-on-Tyne meeting on February 22nd, and should be kept to the front at all meetings until it becomes law."

Mr. DAVISON moved as an amendment that the question of security of tenure of office be included in Mr. Turnbull's resolution *re* superannuation, and the amendment was carried.

The hon. secretary was directed to communicate with Mr. Wyand and ascertain what time it is proposed to fix the meeting on February 22nd, and, if time would permit, to call a meeting of the members of the Northern Division half an hour before the executive meeting.

On the motion of the CHAIRMAN, it was unanimously resolved that the sympathy of the members of the institution be conveyed to the family of the late Mr. W. S. Shell, surveyor to the Consett Urban District Council. The resolution was carried in silence, the members standing.

Mr. John Robinson, the hon. district secretary, as requested at the last meeting, read a paper on "Mechanical Haulage," a copy of which had been sent to each member before the meeting. Several members took part in the discussion which followed, and, on the motion of Mr. JOHN DAVISON, seconded by Mr. C. W. HALL, Mr. Robinson was thanked for his valuable paper. The contribution in question appeared in our last issue.

ANNUAL DINNER.

The annual dinner followed the above meeting at 6 o'clock in the Turk's Head Hotel, when some forty members and friends were present. After the toast of "The King, Queen, and members of the Royal Family" had been honoured, Mr. DAVISON proposed "The Institution of Municipal Engineers," coupling with it the name of Mr. J. T. Pegge.

Mr. PEGGE, in reply, stated that it gave him great pleasure to respond to this toast. He said that he had had the experience of going round and seeing the method of working in other districts, but had come to the conclusion that, to use a sort of vulgarism, the Northern Division "took the cake." He went on to say that no doubt there was a good deal of enthusiasm in the Southern Districts of London, but they could not bring together such a good muster of members as they had had at the meeting and dinner that day. In conclusion, he remarked that he felt sure that if every meeting of surveyors was as typical as the one which had been held that day, and as well attended, it would augur well for the future for superannuation and security of tenure.

Mr. JARDINE, town clerk of Morpeth, in a humorous speech, proposed "The County, Borough, Urban and Rural District Councils," coupling the names of Mr. W. Finch, county surveyor, Cumberland, Mr. Geo. Symon, Blaydon-on-Tyne, and Mr. Mole, Chester-le-Street.

Mr. FINCH, in reply, thanked the members most heartily for the way they had proposed and accepted the toast. He stated that it gave him very great pleasure to be present that night, and to have had the opportunity of attending the meeting in the afternoon. As representing county councils, it was, as the members would be well aware, most important that the county surveyor in each county should be in close touch with the municipal surveyors of the

different boroughs. Unless they were in touch with each other, and willing to help each other, it was rather a bad look out for both county councils and borough councils. The county councils were in most cases beholden to the borough councils for the upkeep of their main roads, and it was, as he had already stated, important that the county surveyor and the borough surveyor should be on very good terms with each other; then one got amicable working, and suggestions carried out in a much better way. It was a very simple matter for engineers to make slight mistakes, especially in these days when they were really at their wits' end to know what was the best material to be used on the various roads. He found in Cumberland that some of the borough surveyors had been allowed by their councils to experiment, and to spend money in experimenting, even when they had been restricted from doing so. He found that if he had any inquiries to make from them he was always met in a proper spirit, and they were always willing to give him any particulars they could with regard to any kind of material they had used. He again thanked the members for the opportunity of replying to the toast.

Mr. SYMON and Mr. MOLE also responded.

Mr. G. W. AYTON (Chester-le-Street) said that, as regards the present-day roads, it was a very big question. They were all endeavouring to bring out some new idea which was occasionally coming a "cropper," and was not a success. He was afraid that it would be a long time before they would be able to bring out a perfect road that would stand such traffic and weather as they had been experiencing lately. This was one of the best meetings he had been at for some time, and he hoped, with the energy of their worthy chairman and secretary, that this would be continued. The meetings were very instructive, and the more papers that were read at them the better it would be for the younger surveyors.

Mr. MONCUR proposed the toast of the Northern Division of the institution, coupled with the names of Mr. Gregson and Mr. Davison. The chairman, in his opening remarks, referred to the number of meetings which had been held during the year, and went on to say that he would like to see as many members as possible attend these meetings, as they established and strengthened professional relationship, which might have a value exceeding any immediate benefits. He regarded their profession as one of the most important in the country. It was difficult to know where the services of an engineer began and where they ended. An engineer was supposed to be omniscient and even omnipresent, was supposed to know what was under the surface of the ground at a certain spot, and even what was to be required forty or fifty years hence. He had to make preparations for children being brought into the world, erect buildings to educate them in, prepare schemes to keep them employed and in health, and make provision for their burial. He was pleased to note from the professional papers that they were approaching the dawn of better times in their official capacity, as there were not a few schemes in the air for a more secure tenure of office, while the superannuation scheme was one that ought to be hailed and encouraged in every possible way. It had been said by those who are within the Parliamentary circle that it was not advisable to push forward the scheme this year as Parliament has its hands full of many controversial matters, but that in the next two years would be a most opportune time to put such a scheme forward. Their institution was a most important one; it had been a pioneer of many improvements that had been most beneficial to its vitality, and had welcomed into its fold gentlemen who were debarred from joining other similar associations owing to some technicality in its rules that they could not comply with. He held out great hopes for the future of the institution, and by meeting and discussing engineering schemes and problems they were making themselves better fitted to occupy the positions they held, and by their endeavours were considerably furthering the modern object of conferring the greatest good on the greatest number.

Mr. GREGSON, in responding, referred to the progress of the institution, and the amount of good done by such meetings as were held during the summer at Keswick and Harrogate, and remarked that the institution was bound to be successful when the members stuck together in the manner they had done in the North of England.

Mr. DAVISON also replied, and referred to the vigour of the Northern Division, of which he had had the honour of being chairman for two years, and he regarded the present chairman (Mr. Moncur) as a most capable successor.

Mr. W. WALLIN (Newcastle-on-Tyne) proposed the "Visitors," and gave a hearty welcome to them. He stated that it always added to the success and entertainment of the members at a function such as they had that night, when visitors attended in numbers.

Mr. STEPHENSON, of Messrs. Ord & Maddison, responded, and in his remarks said he hoped that during the summer the members of the Northern Division would pay a visit to Middleton-in-Teesdale, when his firm would be delighted to show them over their extensive quarries. He also made reference to the congress which is to be held in London next June, and suggested that it would be beneficial for surveyors, if possible, to attend this congress, and advocated them applying to their respective councils to defray their expenses.

Councillor YOUNG (Morpeth) also responded on behalf of the visitors, and referred to the excellent speeches and the good songs that had been provided for their entertainment that evening.

The following contributed to the harmony of the evening: Mr. Middleton Turnbull (Shildon), Mr. C. W. Hall (Felling), Lieut. Holloway (Houghton-le-Spring), Mr. W. Finch (Cumberland), Councillor Young (Morpeth), Mr. Jackson (Morpeth) and Mr. J. W. Holbrook (Houghton-le-Spring). Mr. Raw (Houghton-le-Spring) acted as pianist.

TAR-PAINTING APPARATUS.

The Waithman's patent tar-painting apparatus attached to Johnston's patent tar boiler has now gained a firm footing throughout the country, and Messrs. Johnston Brothers, of 79 Mark-lane, E.C., who have made a special study of tar-painting by hand, have placed on the market for the coming season their "1913" pattern patent tar-boiler, which they claim is the most efficient continuous heating boiler yet made.

Although of only 95 gallons capacity, this boiler is capable of heating 1,600 gallons of tar per day to a temperature of 200 deg., and of keeping the tar in the main boiler always at or above that temperature, so that work is continuously carried on, and no stoppage occurs through the tar not being hot enough.

The "1913" boiler has the flue from the front fire carried through the tar in the heater, so that the heating surface is much increased as compared with the "1912" pattern, and no heat is lost through the flue being on the outside of the boiler, as in last year's pattern.

As proving the efficiency of these boilers, and as a contradiction to the idea that hand-work is too slow, we understand this firm carried out a contract for one of the Southern county councils of 600,000 super. yds., and for another county council further North of 260,000 super. yds. During these contracts one day's work with one boiler often reached 12,000 super. yds.

As the firm carry out tar-painting contracts themselves, they are in a position to know exactly the type of boiler, &c., best suited to the efficient and rapid carrying out of such work. Their boilers and apparatus for tar-painting by hand are now in use by nine county councils, besides numerous borough, urban, and rural district authorities. The Waithman's apparatus has also been greatly improved for the coming season, as it is now fitted with chain and loose ring armouring. All surveyors using Tarvia should apply to the firm for particulars of their patent hot-air pump for quickly emptying barrels of Tarvia.

SEA-COAST EROSION.—For a very complete and inexpensive library on the cause, prevention and repair of coast erosion the following three works are recommended: "Coast Erosion and Foreshore Protection," by John S. Owens, M.D., Assoc.M.Inst.C.E., F.R.C.S., and Gerald O. Case (price 7s. 6d., post free 7s. 10d.), with numerous illustrations and diagrams; "Sea-Coast Erosion and Remedial Works," by R. C. Allanson-Winn, M.Inst.C.E.I. (price 1s., post free 1s. 1d.); and "Erosion of the Coast and its Prevention," by F. W. S. Stanton, Assoc.M.Inst.C.E., F.S.I. (price 3s., post free 3s. 2d.), with numerous maps and other illustrations. The publishers are the St. Bride's Press, Limited, 24 Bride-lane, Fleet-street, London, E.C.

Legislation and Legal Precedents, 1892—1913.

The opening instalment of this article appeared in our "Coming-of-Age" Issue, published on the 17th inst.

Having indicated the statutory contributions since 1892 to the law of public health and rivers pollution prevention, and indicated some of the more important judicial decisions in the matter of sewers and drains, besides alluding to the powers conferred upon local authorities by the Housing and Town Planning Act of 1909, we now turn to the subject of

HIGHWAYS,

dealing first with private street improvements.

The first and one of the most important of the enactments relating to the improvement of private streets passed during the period under review is the Private Street Works Act, 1892, which provides a code for the carrying out of works of improvement in private streets alternative to that contained in the Public Health Acts of 1875 and 1890. The old Code was frequently productive of a considerable amount of friction between local authorities and frontagers, leading sometimes to litigation, in which the authorities were not always successful. This led to the not uncommon practice on the part of borough councils and other authorities of large areas of obtaining private Acts of Parliament, and the Act of 1892 was ultimately passed, modelled mainly upon these private Acts. The principal difference between the two methods of procedure is that, under the Public Health Acts, frontagers can raise objections after the expense of making up the street has been incurred, with the possible result that some or all of the expenses may prove irrecoverable, and have to be paid out of the rates. Under the Act of 1892, on the other hand, objections have to be raised and disposed of before the work is taken in hand. Again, under this Act the authority are not tied hard and fast (as they are under the Public Health Acts) to the principle of frontage as the basis of apportionment; but can charge the owners of premises which, though not fronting on the street, have access thereto through a court, passage, or otherwise. They also have power in apportioning the expenses to take into account the greater or less degree of benefit derived by particular premises, and the value of work already done to the street by frontagers. Other advantages are the power to include incidental works for the purpose of bringing the street, as regards sewerage, drainage, level, or other matters, into conformity with other streets (including the provision of separate sewers for sewage and surface water); the power to charge a commission of £5 per cent beyond the actual cost of the work to cover preparation of plans and notices, and suspension, &c.; and the power to enforce the charge upon premises by sale without the necessity of first bringing an action. On the other hand, the Act has been criticised because it gives the magistrates the power, on hearing frontagers' objections, to decide as to the sufficiency and reasonableness of the proposed works, and the propriety of the proposed expenditure thereon, matters which it has been urged are peculiarly within the province of local authorities. Exception has also been taken to the immunity given to railway and canal companies having no direct communication with the street, and to the extended exemption of churches and chapels—and particularly to the provision throwing the cost of the frontages of these latter upon the rates. Upon the whole, however, it is believed that experience shows that the advantages of the new Code outweigh the disadvantages; and this is borne out by the fact that the Act (which is adoptive) has been very extensively adopted throughout the country. The only additional legislation with respect to this subject is that contained in sec. 19 of the Public Health Act Amendment Act, 1907, which is operative only in those districts in which it has been applied by Order of the Local Government Board. The provisions of this section give the local authority power, when a private street is in urgent need of repair, to obviate danger to passengers or vehicles, to carry out the necessary repairs at the expense of the frontagers, unless a majority (in number or rateable value of the latter require the authority to proceed under sec. 150 of the Public Health Act, 1875, or the Private Street Works Act, 1892 (as the case may be), in which event that course must be adopted.

It remains to notice some of the more salient judicial decisions on this subject subsequent to 1891.

Under sec. 146 of the Public Health Act, 1875, urban authorities are authorised to agree with any person for the making of public roads through the lands and at the expense of such persons, and to agree that such roads shall on completion become highways repairable by the inhabitants at large. A liberal construction was given to this section in a case in which an agreement was entered into between the frontagers on a private street and a local board whereby the frontagers were to make up the street and keep it in repair for six months, at the end of which period the local board were to adopt it as a highway repairable by the inhabitants at large. The road had been laid out six years before the date of the agreement, but it was held that the board were bound by the agreement, and could not subsequently proceed under sec. 150 of the Act, having treated the street as a new road under sec. 146 (*Bromley Local Board* v. *Lansbury*, the *Times*, December 5, 1894). But in a later case, where the owners of certain roads and the adjoining land agreed to dedicate the roads and the authority agreed to adopt them, but reserving their rights under sec. 150 of the Act of 1875, the authority were held to be entitled to recover the cost of making up the roads from the frontagers (*Folkestone Corporation* v. *Rooke*, 1907, 71 J.P., 550).

In the case of a street with a footpath on one side only, it has sometimes been doubted whether the entire cost of making up the road and footpath ought to be apportioned among all the frontagers on both sides, or whether the cost of the footpath should be separately charged on the frontagers on that side. Such doubts were set at rest by the decision in *Clacton-on-Sea Local Board* v. *Young* (1895, 1 Q.B., 395), which shows that the former method of apportionment is the correct one.

The important decision in *Barry and Cadoxton Local Board* v. *Parry* (1895, 2 Q.B., 110) established the right of urban authorities to do private street works over and over again, at the expense of the frontagers, as often as occasion may require, until the street has been taken over as a highway repairable by the inhabitants at large. This principle, however, does not extend to the resewering of private streets—sewers being placed in a different category by reason of their vesting in the local authority.

As regards sewers, it was held in 1887 that when a sewer has been constructed the local authority must be taken to have been satisfied with it, unless they express dissatisfaction within a reasonable time. This doctrine was applied in *Hornsey Local Board* v. *Davies* (L.R. 1893, 1 Q.B., 756) to a sewer, without an outfall, constructed by a private individual according to plans approved by the authority, and which had become ruinous before it was provided with an outfall and had come into use. But later cases have somewhat modified this principle. Thus, where a drain for draining seven houses was laid by an owner in a footway not at sufficient depth to drain other properties in the street, and not intended to be regarded as sewerage of that part of the street, the authority were allowed to resewer at the frontagers' expense (*Handsworth Local Board* v. *Taylor*, 1897, 69 L.T., 798); so also where there was only a series of sewers for the drainage of particular houses, and sets of houses, not forming part of one system (*Handsworth District Council* v. *Derringham*, 1897, 2 Ch., 438).

A street is sometimes formed by two landowners agreeing each to contribute a strip of land for the purpose. In such cases the strip first laid out is a "street" on which the owner of the other strip is a frontager, and is chargeable with a proportion of the expenses of making up such "street" (*West Hartlepool Corporation* v. *Robinson*, 1897, 62 J.P., 35). This case was peculiarly hard on the frontager in question, he having not only loyally performed his part of the agreement by throwing in his own strip, but having actually made it up, which he was not bound to do by the agreement.

Apropos of frontagers' objections to proposed works under the Act of 1892, it will be remembered that one of the grounds on which objection can be taken is that the works are insufficient or unreasonable. Cer-

tain frontagers raised this objection with respect to a lane varying in width from 12 ft. to 16 ft., because the urban authority did not include the widening of the lane in their scheme. The objection prevailed with the magistrates, but was overruled by the High Court, who held that "insufficient" means insufficient to effect the objects proposed to be effected by the works, and "unreasonable" means unreasonable with reference to the scheme itself (*Mansfield Corporation* v. *Butterworth*, 1898, 2 Q.B., 274). But where houses were drained from the back into an existing sewer frontagers were allowed to object to a proposal for sewering the street in front of the houses as unreasonable (*Sheffield Corporation* v. *Alexander*, 1894, 64 L.J.M.C., 44). With this decision may be compared a case under the Act of 1875, where the authority proposed to provide a larger sewer than a street required in order to facilitate the drainage of other parts of the district, but apportioned on the frontagers only so much of the expense as it would have cost to sewer the street in accordance with the notices. It was held that the amount so apportioned was recoverable (*Acton Urban District Council* v. *Watts*, 1903, 67 J.P., 400).

The nature and extent of the exemption of premises which are *extra commercium* from private street works charges has been exemplified in several cases decided during the period under consideration. This principle was first established in 1875 with respect to a cross street (abutting on the street to be paved), and in 1883 it was applied to the parapets of a bridge built and maintained by the Great Eastern Railway Company to carry a highway over a cutting. In 1903 the same principle was held to be applicable to Tooting Bec Common, which is vested in the London County Council under the Metropolitan Commons Acts (*London County Council* v. *Wandsworth Borough Council*, 1903, 1 K.B., 797). On the other hand, the exemption has been decided not to extend to a cemetery belonging to a company (*St. Giles, Camberwell* v. *London Cemetery Company*, 1894, 1 Q.B., 699); to common land vested in the lord of a manor by an Enclosure Act (*Meyrick* v. *Attorney-General*, 1894, 3 Ch., 209); to a public garden belonging to a vestry in a square (*Vestry of St. Mary, Islington* v. *Cobbett*, 1895, 1 Q.B., 369); to a national school (*Hornsey Urban District Council* v. *Smith*, 1897, 1 Ch., 843); to the embankment of a navigable river (*Hackney Borough Council* v. *Lee Conservancy*, 1904, 2 K.B., 54); to a strip of land belonging to the Midland Railway Company, which they were bound to keep planted with trees (*Hampstead Corporation* v. *Midland Railway Company*, 1905, 1 K.B., 538); or to a recreation ground purchased by an urban district council under sec. 164 of the Public Health Act, 1875 (*Herne Bay Urban District Council* v. *Payne and Wood*, 1907, 2 K.B., 130). The test is whether nothing short of an Act of Parliament can restore to the premises the capacity to yield a rack rent, or whether that capacity can be restored by the mere act of the parties who have, for the time being, destroyed it. Reference may also be made here to the case of *Rex* v. *Jones, Ex parte Mein* (1907, 71 J.P., 326), in which it was held that land used by the servants of the Barry Railway Company as gardens on payment of a nominal rent was not exempt under sec. 22 of the Act of 1892.

It sometimes happens that a street is partly within and partly without an urban district, or, in other cases, the street itself may be in one district while the houses on one side are in another. There have been two decisions which show that district councils have no power to apportion any part of the cost of making up such a street on owners of premises not within their district (*Shoreditch Borough Council* v. *Wakeham*, 1904, 61 J.P., 239; *Hornsey Borough Council* v. *Birkbeck Freehold Land Society*, 1906, 1 K.B., 521).

It is often a matter of difficulty to decide whether or not a particular road or street is a "highway repairable by the inhabitants at large," so as to exclude the jurisdiction of the local authority to charge the frontagers with the cost of making it up. The following have been held to fall within this designation: A new road substituted by a railway company for part of an old highway (*Friern Barnet Local Board* v. *Great Northern Railway Company*, 1893, 57 J.P., 53); a road substituted in 1842 by resolution of a vestry for an old highway (*Leigh-on-Sea Urban District Council* v. *King*, 1901, 1 K.B., 747); a road dedicated to the public in pursuance of an agreement between a railway company, certain landowners, and a district council, the council agreeing to accept the road as a highway repairable by the inhabitants at large, but purporting to reserve their powers to require the frontagers to make up such parts of the road as had not been made up (*Folkestone Corporation* v. *Marsh*, 1906, 70 J.P., 113); an ancient highway widened by landowners in pursuance of an agreement with the local authority (*Portsmouth Corporation* v. *Hall*, 1907, 24 T.L.R., 76); and an old highway widened by the filling up of a ditch (*Chorley Corporation* v. *Nightingale*, 1907, 2 K.B., 637). The question is generally one of fact rather than of law, but is none the less difficult, sometimes, to determine. When an objection is taken, under the Act of 1892, that a street is a highway repairable by the inhabitants at large, the *onus probandi* that it is not rests upon the local authority (*Rishton* v. *Haslingden Corporation*, 1898, 1 Q.B., 294).

From an *obiter dictum* of Lord Justice Mathew, in *Southampton Corporation* v. *Lord* (1903, 67 J.P., 189), it would appear that if an objection is raised which a local authority think is likely to be fatal, they can drop their scheme, and, without having the objection determined, can proceed *de novo* with a fresh provisional apportionment.

An often vexed question as to whether an item can be added to the estimated expenses under the Act of 1892 for "contingencies" was decided in the affirmative in the case of *Standring* v. *Bexhill Corporation* (1909, 73 J.P., 241), where a percentage of 9 per cent on the estimate was allowed under this head (in addition to the 5 per cent commission allowed by sec. 9).

It has sometimes been doubted whether a local authority can be compelled to adopt the "benefit" principle, under sec. 10 of the Act of 1892. These doubts were set at rest in *Bridgwater Corporation* v. *Stone*, 1908, 72 J.P., 487), in which it was decided that the magistrates have no power to alter the provisional apportionment in respect of the degree of benefit to be derived by any premises, in the absence of a resolution by the authority.

Another important decision sets at rest a difficulty of a different kind which has sometimes been felt, in the application of sec. 10—viz., as to the inclusion of premises not abutting on the street, but access to which is obtained from the street through a court, passage, "or otherwise." It was held in *Newquay Urban District Council* v. *Rickeard* (1911, 2 K.B., 846) that premises, access to which is obtained from the street through another public street, cannot be included.

LOCOMOTIVES, MOTOR CARS, AND EXTRAORDINARY TRAFFIC.

In this department of highway law the changes have been most marked.

By the passing of the Locomotives on Highways Act, 1896, which has been termed "the Charter of the Motor Car"—"light locomotives" were first exempted from the then existing restrictions (the attendant 20 yds. ahead, and the speed limits of 2 miles and 4 miles an hour, &c.). A "light locomotive" was defined by the Act as a "vehicle propelled by mechanical power, if it is under 3 tons in weight, unladen, and is not used for the purpose of drawing more than one vehicle (such vehicle with its locomotive not to exceed in weight unladen 4 tons), and is so constructed that no smoke or visible vapour is emitted therefrom except from any temporary or accidental cause." The Act exempted such "light locomotives" from the provisions of the earlier Locomotive Acts, but county and county borough councils were empowered to make by-laws preventing or restricting their use on bridges. The Act fixed a speed limit of 14 miles an hour.

In 1898 was passed the Locomotives Act of that year, embodying, so far as England was concerned, the recommendations of the Select Committee appointed in 1896 "to inquire into the working of the laws relating to the use of traction engines on roads." By this Act county and county borough councils were allowed to relax the rules as to the weights carried by wagons drawn by locomotives prescribed by the Locomotive Act, 1861. Provisions were also made as to the drivers and attendants of locomotives, the carrying of lights, and the making by the councils of counties or of large boroughs of by-laws prohibiting or restricting the use of locomotives on specified highways or bridges, and generally regulating their use. The Act also provided for the licensing and registration of locomotives by county councils.

Three important amendments were made by this statute in the law relating to extraordinary traffic—viz., (1) expenses, instead of being recoverable summarily, are to be sued for up to £250 in the county court, and beyond that sum in the High Court; (2) proceedings must be begun within twelve months from the time the damage was done, or six months after

the completion of a contract or work extending over a long period; and (3) "by whose order" in sec. 23 of the Highways, &c., Act, 1878, is to read "by or in consequence of whose order." This last alteration was the outcome of the well-known decision of the House of Lords in *Kent County Council* v. *Lord Gerrard* (1897, A.C., 633), that a person who had given an order for goods, but had had no control of the traffic and gave no directions as to the route to be taken, was not a person "by whose order" the traffic was conducted.

No further legislation took place on the subject of locomotives until 1903, when the Motor Car Act of that year was passed, which is to be read as one with the Act of 1896.

Here for the first time the Legislature makes use of the term "motor cars" (instead of "light locomotive"), defining a "motor car" as having the same meaning as "light locomotive" in the Act of 1896 (except that a trailer is not a "motor car" for registration purposes). The Act authorises the Local Government Board to make regulations increasing the maximum limits of weight for motor cars, and deals mainly with three points—viz., (1) driving on the highway and speed limit; (2) the registration of cars; (3) the licensing of drivers.

Anyone driving a motor car on a public highway recklessly or negligently, or at a speed or in a manner which is dangerous to the public, having regard to all the circumstances of the case, is liable to a fine not exceeding £20, or on a second or subsequent conviction to a fine not exceeding £50 or imprisonment for not more than three months. A motor car is to stop if an accident occurs owing to its presence on the road, and the driver must, if asked, give his name and address under penalty of a £10 fine, with a month's imprisonment for the third offence. The speed limit is altered to 20 miles an hour, with power to the Local Government Board, on the application of a local authority, to limit it in places to 10 miles an hour. The penalty for "excessive speed" pure and simple, as distinguished from driving "recklessly or negligently," &c., is £10, £20 and £50 respectively on the first three convictions, but with no alternative of imprisonment. The Local Government Board are also authorised to prohibit or restrict motor traffic, or the use of any particular kind of motor, on roads less than 16 ft. wide, or on any other road where they consider it dangerous.

Motor cars must be registered with a county or county borough council, and must carry a mark with a registered number and the letter of the council, in accordance with the regulations of the Local Government Board.

Everyone driving a motor car must have a licence, which may be issued by the county or county borough council to anyone over seventeen residing in the area. The licence must be produced to any constable demanding it, and it is to be renewable yearly. It may be suspended for offences under the Act other than a first or second excess of the speed limit, and is to be endorsed with particulars of any conviction. General powers are given to the Local Government Board to make regulations as to registration marks, and also as to licensing and the register of licences. Nothing in the Act is to affect any liability of the driver or owner of a motor car at common law, or under any other statute.

Regulations were made by the Local Government Board as to the registration and licensing of motor cars in 1903; regulations as to their use and construction have been made in 1904, 1909, 1911 and 1912; and regulations as to their international circulation in 1909, 1910 and 1912.

The expression "heavy motor car" is not used in the Motor Car Act, 1903, but is defined by the "Heavy Motor Car Order, 1904," as a motor car exceeding 2 tons in weight unladen. But a "heavy motor car," the weight of which, unladen, does not exceed 5 tons, is a "light locomotive" (*Evans* v. *Nicholl*, 1909, 1 K.B., 778).

Turning to the subject of extraordinary traffic, as we have seen, the only relevant legislation is that contained in the Act of 1898. But the evolution of the law in connection with this subject, by means of judicial decisions, has made considerable progress. First and foremost, there is the leading case of *Hill* v. *Thomas* (1893, 2 Q.B., 333), in which, for the first time, an attempt was made to arrive at some sort of definition of the term "extraordinary traffic," as follows: "Extraordinary traffic is really a carriage of articles over the road, at either one or more times, which is so exceptional in the quality or quantity of articles carried, or in the mode or time of user of the road, as substantially to alter and increase the burden imposed by ordinary traffic on the road, and to cause damage and expense thereby beyond what is common. . . . It will include all such continuous or repeated user of the road by a person's vehicles as is out of the common order of traffic, and as may be calculated to damage the highway and increase the expenditure on its repair." This definition does not err on the side of brevity, and leaves ample scope for differences of opinion in particular cases; but it was at least something gained to have an authoritative pronouncement of a definite principle. A further point established by the case was that the standard of comparison is the ordinary traffic on the road in question, and not that on other roads. In accordance with the foregoing principles, the following (among other) cases have been decided, in which "extraordinary traffic" has been brought home to road users—viz.: The carting of coal in a string of five or six carts at a time, following in the same track, six days a week, the loads themselves not being excessive (*Wolverhampton Corporation* v. *Salop County Council*, 1895, 64 L.J.M.C., 179); the carting of timber, partly in carts and partly by means of traction engines, over roads never before used for such traffic (*Norfolk County Council* v. *Green*, 1904, 68 J.P., 223); timber haulage by wagons, in loads of 4 tons or 5 tons each, over a road only once before used for such traffic within living memory, although timber haulage was a recognised industry in the district (*Geirionydd Rural District Council* v. *Green*, 1908, 72 J.P., 321); and extensive stone haulage by traction engines in a district where such haulage was not unusual and had occasionally occurred on the road in question (*Shepton Mallet Rural District Council* v. *Wainwright*, 1908, 72 J.P., 459).

An important point which has been brought into prominence since the advent of the motor car is that traffic which in one year, or at any time, may be extraordinary on a particular road, may, in course of time, become ordinary traffic (*Hemsworth Rural District Council* v. *Micklethwaite*, 1904, 68 J.P., 345; *Shepton Mallet Rural District Council* v. *Wainwright*, *ubi supra*).

It is, of course, obvious, from a perusal of sec. 23 of the Highways, &c., Act, 1878, that the fact of a road having been damaged by extraordinary traffic is not alone sufficient to support a claim. It is necessary also that extraordinary expenses should have been incurred by reason of the damage. In a recent case it was held that, in the absence of evidence as to the average cost of repair of the road in question, and of other similar roads, the authority could not support their claim because they had not proved that the expense incurred was extraordinary as well as the traffic (*Billericay Rural District Council* v. *Poplar Guardians*, 1911, 2 K.B., 801; followed in *Colchester Corporation* v. *Gepp*, 1911, Vol. lxxv., Justice of the Peace, p. 592).

As to the amount recoverable on a claim for extraordinary traffic expenses, it has been decided that it is not sufficient to estimate what the repairs may cost. The work must have been actually done, and no more can be recovered than the amount actually spent (*Little Hulton Urban District Council* v. *Jackson*, 1904, 68 J.P., 451). But it does not follow that the whole of that amount can be recovered; for instance, if a highway authority put a road into a better state than it was in previously, so as to give it a new lease of life, the court, in fixing the damages, will make a deduction corresponding with the added vitality of the road (*Kent County Council* v. *Kent Coal Concessions, Limited*, 1908, 68 J.P., 451).

Another important point established by recent cases is what may be termed the up-to-date standard principle. This was first brought forward in *Attorney-General* v. *Scott* (1905, 2 K.B., 160), which was not, properly speaking, an extraordinary traffic case, being an action for an injunction to restrain the use of a traction engine which had damaged a road. The engine had contributed to the damage, but other factors were the ordinary traffic, the weather, and the failure of the council to maintain the road in a fit state; and the injunction was refused. This decision was approved in *Chichester Corporation* v. *Foster* (1906, 1 K.B., 167). It may be taken as the result of these cases that a road authority must keep its roads in a reasonably fit state to bear whatever traffic may be reasonably expected to come upon them, and that any failure in this respect will be taken into account in reduction of claims for extraordinary traffic expenses.

Reference has already been made to the decision (now obsolete) in *Kent County Council* v. *Lord Gerrard*, *ubi supra*, which led to the clause in the Act of 1898 fixing

responsibility on the person "by or in consequence of whose order" extraordinary traffic is conducted. But even with this alteration it has not always proved plain sailing to fix the responsibility on the right shoulders. The following persons have been held to be liable under the amending Act—viz., a person who employed a contractor to erect buildings (*Epsom Urban District Council* v. *London County Council*, 1900, 2 Q.B., 751); a corporation which employed a contractor to haul stone for road widening (*Kent County Council* v. *Folkestone Corporation*, 1905, 1 K.B., 620); a water company which employed a contractor to construct a reservoir (*Reigate Rural District Council* v. *Sutton District Water Company*, 1907, 78 L.J.K.B., 315); a corporation which employed two contractors to haul flints and ragstone (*Bromley Rural District Council* v. *Croydon Corporation*, 1908, 1 K.B., 353); and a contractor who merely advised a sub-contractor that goods were ready to be hauled, giving no directions as to mode of haulage (*St. Thomas Rural District Council* v. *Siemens Brothers*, 1910, "Local Government Chronicle," p. 555). But a person who ordered 250,000 bricks from a brick company which employed a contractor to deliver them escaped liability, he having given no instructions as to the mode of delivery. The result of the decisions appears to be that, in cases in which, if the order had not been given, damage would not have resulted, the giver of the order is liable, unless he shows that the traffic was not the natural consequence of the order, because the mode of haulage was unusual, and not such as he would reasonably contemplate.

In connection with the surveyor's certificate, required by the Act of 1878, it has been decided that the certificate must be given before proceedings are begun (*Chesterfield Rural District Council* v. *Newton*, 1904, 1 K.B., 62); but cannot be given until the expenses have been incurred (*Little Hulton Urban District Council* v. *Jackson*, 1904, 68 J.P., 451).

With regard to the limit of time for proceedings, the period of six months from the completion of a contract, or work extending over a long period, is not intended to curtail the twelve months from the doing of the damage. The limitation is twelve months from the doing of the damage, or six months from the completion of the work, whichever may be the longer period (*Kent County Council* v. *Folkestone Corporation*, 1905, 1 K.B., 620). "Completion of the contract or work" means completion of the constructional work under the contract; so that a contract for, *e.g.*, the construction of a watertight reservoir, is not complete until the reservoir is made watertight (*Reigate Rural District Council* v. *Sutton District Water Company, ubi supra*). But where damage is caused under a contract which provides that the work shall be at the risk of the contractor for twelve months after completion, the time limit runs from the completion of the work itself, and not from the expiry of the period of maintenance (*Lancaster Rural District Council* v. *Fisher*, 1907, 2 K.B., 517). "Work extending over a long period" does not include the delivery of road materials as and when required during a period of twelve months, but means a particular work to be done (*Bromley Rural District Council* v. *Croydon Corporation*, 1908, 1 K.B., 353). A contract to construct a reservoir and lay pipes is a "work extending over a long period," so that the time limit runs from the completion of the whole work, even although traffic on the damaged roads may have ceased before such completion (*Carlisle Rural District Council* v. *Carlisle Corporation*, 1909, 1 K.B., 471).

Finally, the time limitations prescribed by the Act of 1898 do not repeal or extend the six months' limit imposed by the Public Authorities Protection Act, 1893, where roads are damaged by a public body in pursuance of their statutory duty (*Kent County Council* v. *Folkestone Corporation, ubi supra*).

(To be concluded.)

Public Health Law.—This concise little work* has been prepared mainly for the use of all concerned in local government work who may find the larger books too elaborate. In twenty chapters it covers the ground sufficiently for its purpose, including such matters as highways, but omitting rating, elections, &c. For students it should be of assistance in preparing for examinations in Public Health Law, while the practitioner will find its arrangements well suited for easy reference.—*The Law Times.*

* A Manual for Municipal and County Engineers and Surveyors, Town Clerks, Clerks to District Councils, and other officers and members of local authorities. By S. G. Turner, of the Middle Temple, Barrister-at-Law, A.M.I.C.E., &c. London: St. Bride's Press, Ltd. Price 10s. 6d.

LONDON DISTRICT SURVEYOR'S FEES.

Mr. F. F. W. Oldfield, printer, of Dugdale-street, Camberwell New-road, S.E., was summoned at the Lambeth police court on Monday at the instance of Mr. Percy Hunter, district surveyor for that district, who sought to recover from him £10 17s. 6d. fees, alleged to be due to him under the 3rd schedule to the London Building Act, 1894.

Mr. E. F. Wells (Bryson & Wells) defended.

It appeared from the evidence that the defendant, who employs a large number of workpeople, had received complaints from them as to the fumes arising from a gas engine which was running in the factory, and to obviate this the defendant decided to remove the engine to a building outside the factory. The main building had been erected at a cost of about £6,000, and the defendant obtained an estimate from his builders for the erection of a building 26 ft. long by 25 ft. in depth for the purpose of housing the engine and keeping it apart from the main building. The builders' estimate for the new building was £72 15s.

The district surveyor claimed to be entitled, under the 3rd schedule of the London Building Act, 1894, to one-half the fee charged in the case of a new building calculated upon the area of the whole building upon the ground that the erection was an addition to the main building and not a new building.

In the course of the hearing Mr. Wells elicited that if this were a new building and not an addition to an old one the district surveyor's fees would be £2 2s., which amount the defendant had offered to pay.

Mr. Wells said that he hoped to convince the court that this was a new building and not an addition. Supposing a £50 addition were put up at the Bank of England, could the district surveyor charge half-fee upon the main building?

Mr. Wells further pointed out that the fees worked out at a heavy percentage on the cost of the building. He did not think the Legislature ever intended that the district surveyor should have such fees, which it was conceivable might amount to more than the cost of the addition.

Mr. Hopkins: I don't know what they intended; I have to consider what they said.

Mr. Wells: There is one way out. You can hold that this is a new building and not an addition.

Mr. Hopkins: Can anyone tell me what is an addition if this is not?

Mr. Oldfield said his object in coming into court was to protest against such fees, which were a serious handicap to an employer. He had erected the building in order to remove the engine from his workpeople and entirely for their comfort and convenience, and if such fees could be legally recovered from him he hoped that there would soon be an amendment of the law in regard to them.

Mr. Hunter remarked that the defendant spoke as though he had taken a tyrannical course. As a matter of fact, there had been much correspondence, and he had had every assistance, and had been treated with every consideration possible, and Mr. Hunter read to the magistrate a letter which the defendant had forwarded to him respecting the claim in question, objecting to pay the fees on the ground of the heavy amount of same, and inviting him to take proceedings.

Mr. Hopkins said he thought the defendant was legally liable to pay the amount, and made an order requiring him to pay the district surveyor £10 17s. 6d. claim with 13s. 6d. costs.

James Potts & Son.—From a statement which has reached us with regard to the well-known firm of stone merchants, Messrs. James Potts & Son, of Millburn House, Newcastle-on-Tyne, we gather that the establishment of their now flourishing business dates back to 1847, its founder being Mr. James Potts, who was subsequently joined by his son, Mr. Walter Dunlop Potts. Both are now deceased, and the business is being conducted by Mr. James Potts (son of Mr. W. D. Potts). The chief products of the firm are Caithness flagstones, granite and whinstone kerb, setts, macadam, &c., from British quarries, though they are also importers of Norwegian and other foreign granites. The larger proportion of their trade is in the Northern counties, but they have also supplied large quantities of material to various towns and cities throughout the country. They also have ramifications abroad, and export cargoes of stone occasionally. They have a special department for dealing with polished and fine-axed granites for buildings, quays, docks, and other works.

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The Road Board Trials at Sidcup, Kent.

NOTES FROM ENGINEERING ADVISORY COMMITTEE'S REPORT.

The report just issued relates to the trials of road materials at Sidcup, in Kent, on the new Eltham-Sidcup road; in the borough of Wandsworth; and in the borough of Fulham. In the present article attention will be confined to the Sidcup trials. A glance at the map will show that this is a very important road, since the next great main road on one side of it runs nearly east and west, and the next but one on the other side runs nearly south from London. In so far as the trials are absolute, they relate, therefore, to Greater London traffic conditions, and to one of the driest and sunniest of the English climates. The immediate purpose of the trials is, however, to make comparative tests of different materials; to find the relations between one crust and another as regards cost and efficiency under the same conditions.

It is pointed out that no final opinions can be formed as to the behaviour of the various sections until they require re-coating or renewal, and in the present report the notes made are definitely of an interim character; but to a considerable extent they describe the nature of the service so far performed by each section. At the present stage it may be convenient to readers of THE SURVEYOR to possess a summary indicating briefly the nature of the crust in each case, with notes of the most important, or the immediately important, remarks in the report.

The trial lengths were completed on various dates between June 15th and August 5th, the dates being those given hereunder after the name of each section. With one exception the sections range in area from 694 to 888 sq. yds., more than half of them between 750 and 850 sq. yds.

SECTION 1.

(Water-bound Granite-macadam, by the Kent County Council.)

This section is made with Penlee stone, a Cornish elvan or hornfels, broken to gauges 2½ in. down to 1¾ in., with 5 per cent of chippings, ¾ in. to dust, of the same stone. For final consolidation 5 per cent of local gravel was added, and the consolidated thickness of the crust was 2¾ in. The condition during winter is described as very muddy, and in summer rather dusty, although treated with calcium chloride on the average about once a fortnight. In June, 1912, the surface was practically worn out.

SECTION 2.

(June 17th, 1911.)

This was a somewhat similar crust of the same thickness, and the stone ranged from 2½ in. to 1¾ in. as in the previous section. It was made by the Kent County Council. The surface was tarred with Tar No. 1, Road Board Specification, applied in two coats, and was redressed with two coatings of Tar No. 2 in April, 1912. The condition during winter is described as very muddy, the surface tarring breaking up, but the macadam surface in good condition, and in summer it was satisfactory and comparatively free from dust. In June, 1912, it was expected to last in fair condition for another six months, but was re-coated in September on account of traffic requirements.

SECTION 3.

(July 3rd, 1911.)

This section was coated with single pitch-grouted macadam, 3 in. thick, Road Board Specification No. 3, by the Kent County Council. The stone used was Cornish elvan. During the first twelve months 176 sq. yds. were repaired, this being necessitated by damage done by the stopping and starting of motor-omnibuses. The entire surface was dressed with a pitch mixture in April, 1912. The condition during winter is described as good and not slippery, and in summer it was found to be satisfactory, not unduly soft during extreme heat, nor dusty.

SECTION 4.

(July 11th, 1911.)

This was put down by the Kent County Council—a double pitch-grouted macadam 4½ in. thick, Road Board Specification No. 4, laid and consolidated in two layers. The lower layer was made of Kentish rag stone, graded from 3 in. to 2 in., and the upper layer of Cornish elvan of 1½-in. gauge, with 5 per cent chippings. Owing to the stopping and starting of motor-omnibuses, an inconveniently disturbing factor in these trials, 197 sq. yds. were repaired in January, 1912. In the following April the whole surface was dressed with a pitch mixture. The condition during winter was good, and not slippery, and in summer the road was not unduly soft during extreme heat, nor dusty. It is to be hoped that the highest temperatures which occurred on these road surfaces were duly recorded. In June, 1912, the condition of the surface was still good, and the same was the case last November, except in a few small places.

SECTION 5.

(July 8th, 1911, "Durax" Armoured Paving.)

This section was made with stone setts put down by the Durax Dustless Roads, Ltd., 50 per cent of the cubes being obtained from a quarry at Rixo in Sweden, and the other half from the Enderby quarry. The finished depth of paving is about 3¼ in. The grouting mixture is composed of coal tar pitch, tempered with creosote oil or tar, into which has been stirred about 30 per cent of fine, dried sand. The expected life of the road is stated to be at least twenty years. The condition during summer was satisfactory, the road being fairly free from dust, but comparatively noisy under iron-tyred wheels, and in winter the surface was good and not slippery. The surface was in good condition in November, 1912. The average wear in depth of surface for twelve months was 0·25 in., but it is not stated that setts were taken up and measured.

SECTION 6.

(July 7th, 1911, Macadam Road Surface with "Plascom" as Binder.)

The stone used was 1½ in. (Penlee), the crust being dry-rolled and then grouted with this binder, which is of a bituminous nature. The thickness was 3 in. No repairs were necessary, but the surface was dressed in May, 1912. The condition during winter left little to be desired; but complaints of slipperiness were received during October, 1911. In summer the road was satisfactory, and practically free from dust. Small repairs were necessary in November, 1912. The average wear is given as 0·06 in. in twelve months. The Kent county surveyor is of the opinion that this section is a little on the hard side, and during sudden changes of temperature, with a deposit of heavy dew, it affords "little or no foothold."

SECTION 7.

(August 5th, 1911.)

Surfacing with "Cormastic," by the British Cork Asphalte Company, Ltd. This material is composed of ¼ in. to ⅜ in. granite or basalt chippings, sharp Thames sand, powdered Cicilian rock asphalt containing about 10 per cent of pure bitumen, and Portland cement. The binder employed is refined and fluxed Cuban natural asphalt. Its condition in summer was satisfactory, and it was practically free from dust. In the autumn and early winter complaints were received as to slipperiness. In November, 1912, it was undergoing extensive repairs. The specification provided for a thickness of 1 in., but it was found to be 1¼ in. thick and 2⅛ in. thick respectively in two places where test holes were cut. The contractors gave as a reason for varying thickness that the material was laid on a scarified surface instead of on an undisturbed surface. The average wear in twelve months was 0·29 in.

SECTION 8.

(July 13th, 1911, Tar-macadam, by Messrs. Chittenden & Simmons, Limited.)

The aggregate consists of Kentish Rag, 75 per cent from 2½ to 2 in., and 25 per cent smaller material, the surface strewn with 1 in. to ⅜ in. stone before con-

solidation. The thickness of the crust was 3½ in. The border was prepared tar and pitch. Small repairs were done in January and February, 1912, and the surface was tarred in the following month. The condition during winter was good, not "unduly" slippery, and during the summer it was satisfactory and practically free from dust. In June, 1912, the condition was good, in November it was fair only. This section was disturbed by water-pipe trenching.

SECTION 9.

(July 22nd, Tar Slag-macadam, by Messrs. Constable, Hart & Co., Limited.)

The material is blast furnace slag, 2¼ to ¾, and the border is distilled tar and nothing else. The Rag is tarred before it is brought to the road. This crust was 3 in. thick. Minor repairs were done on three occasions since February, 1912. The condition during winter was "not unduly slippery," and during summer it was satisfactory, and practically free from dust. The condition in June, 1912, was good, in November fair only. The section "has stood well." Some disturbance was probably due to trenching.

SECTION 10.

(July 20th, Tar Slag-macadam, 4 in. thick, also by Messrs. Constable, Hart & Co.)

The repairs in twelve months were trifling. The condition during winter was "not unduly slippery" and in summer satisfactory and practically free from dust. In June, 1912, the condition was "quite good," and in November "good."

SECTION 11.

(July 27th, 1911, "Tarmac," 4 in.)

The details of construction, as described in the "original pamphlet," include the specification of a bottom coat of 2¼-in. gauge material consolidated to 2½in., with an upper coat of 1½-in. material consolidated to 1½ in., making a total thickness of 4 in. The binder is refined tar mixed with pitch and other ingredients. Only trifling repairs were done in the twelve months The condition during winter was "not unduly slippery," and during summer satisfactory and practically free from dust. The condition in July, 1912, and in November, was "quite good." The section was regarded as "quite one of the best."

SECTION 12.

(August 5th, 1911, "Roadoleum" Asphalt, 4 in. thick. by Mr. W. H. Stansbury.)

The stone used is Penmaenmawr enstatite diabase and Penlee elvan, graded from 1¾ to ⅜ in. The binder is a "pure, bituminous asphalt product" called "Roadoleum." The section was repaired in March, 1912, 53 sq. yds. In winter it was "not unduly slippery, not too prolific in the production of mud." In summer it was practically free from dust, but was "uneven and unsatisfactory." In June it was "very uneven, worn in holes, and become extremely wavy." In September the section was relaid with single pitch-grouting, after a life of thirteen months, during which it never gave satisfaction.

SECTION 13.

(August 3rd, 1911, "Rocmac," by Rocmac, Limited.)

The material is Penlee elvan or hornfels, the same as used on sections 1, 2, 3, and 4, of 2¼ to 2 in. gauge. The binder is "silicate-saccharate-carbonate," the foundation of which is silicate of soda, sugar, and carbonate of lime. To form the matrix "Rocmac" solution is mixed with limestone crushed to ¼ in. gauge and dust, 60 per cent being fine dust. The matrix is laid 1 in. thick on the original surface for a complete coat of 3 in. The stone is then spread and rolled in. In May, 1912, 17 sq. yds. were repaired. In winter the surface was free from mud, and provided good foothold for horses. In summer it was distinctly dusty and rather noisy. By June, 1912, it had worn unevenly, and the condition in November was only fair. In November 191 sq. yds. were reconstructed.

SECTION 14.

(August 5th, 1911, Tar-macadam, 4 in., by Taroads Syndicate, Limited.)

Blue Guernsey stone was used, and the crust made in accordance with Road Board Specification No. 2 for tar-macadam. Small repairs, 34 sq. yds., were done in March, 1912, and the surface was dressed with tar mixture in May. The condition during winter and summer was satisfactory; the surface was "not unduly muddy or slippery" in winter and was practically free from dust in summer. The condition in June, 1912, was quite good, and in November fair. The average wear in twelve months was 0·06 in. This section is described as "one of the best."

SECTION 15.

(August 4th, 1911, Tar-macadam (grouted), 3½ in., by Messrs. Bristowe & Co., Limited.)

The stone was 2-in. alivina diabase from Clee Hill, and the binder was "Tarvia;" the surface treated with "Tarviated" chippings, 48 sq. yds. per ton. Some small repairs were done in March, and in June 330 sq. yds. were dressed with "Tarvia." In winter the surface was free from mud and not slippery, and in summer it was practically free from dust. In June the surface was uneven, disintegration having set up, and in November it was "fair only." The twelve months' wear was 0·17 in. The section was never quite satisfactory. The hot weather which followed the completion of the work seems to have caused the binder to flow, resulting in its uneven distribution. A trench was cut across the section by the water company, and a field adjoining it was used as a store for stone and a standing place for rollers during the progress of the whole of the section.

SECTION 16.

(July 26th, 1911, Tar-macadam, by Messrs. Bristowe & Co., Limited.)

This crust, 4 in. thick, was made with Penmaenmawr stone, enstatite diabase, 59 per cent of 2 in., 20 per cent of 1 in., 12 per cent ½ in., 9 per cent of ¼ in. The mixed aggregate is coated altogether. Quarter-inch tipping is applied at the rate of 40 sq. yds. per ton. Where the quantity warrants it, the stone would be coated on the spot. This section was repaired in February and March, and in June it was resurfaced with Tarvia and granite chippings. In the winter it was free from mud and "not unduly slippery," and in the summer it was practically free from dust. In June the condition was "fair only," and in November "fair only; rather rough surface." About 26 sq. yds. were repaired—15 sq. yds. on account of a water-pipe trench. The section shows unevenness of surface, depressions, and waviness.

SECTION 17.

(July 24th, 1911, "Roadamant," by the "Roadamant" Company, Limited.)

The material is refined Trinidad bitumen natural rock ashphalt, stone chippings, and the "Roadamant" mixture (consisting of cement and other ingredients) laid on a bed of concrete, in this case 6 in. thick. The stone is Enderby chippings ¼ in. thick. The bitumen and asphalt are melted in a cauldron and the other materials added. The composition is then laid *in situ*, with hand floats in the same manner as mastic asphalt, the thickness being 1½ in. Several pieces were cut out and relaid after January, 1912, the area repaired in the first twelve months being 95 sq. yds. In winter it was free from mud and gave good foothold; in summer practically free from dust. In June its condition was "pleasant," but indications that several portions would have to be dealt with soon. Its condition in November was "good." Between July 24th, 1912, and November, 1912, 37 sq. yds. were repaired and the remainder taken up and relaid. This section is described as having a "pleasant surface, but unfortunately a creeping one." The contractors think that the concrete base was too smooth.

SECTION 18.

(July 10th, 1911, "Lithomac" Asphalt Paving, by the Limmer Asphalt Paving Company, Limited.)

"The paving proper consists of crushed granite, whinstone, or similar hard stone passed through a 1-in. mesh pan, and therefore includes ¾ in., ½ in., and ⅜ in. sizes, sharp silica sand, and pure limestone powder, mixed and carefully blended with refined elastic bitumen. The hot mixture is spread with hot iron rakes and rolled with a light roller. The thickness after compression by rolling is not less than 2 in." The surface is scaled if this is found to be necessary. Some repairs (59 sq. yds.) were done in the first twelve months. The scale coat provided for in the specification was applied in February, 1912. There was no trouble from want of foothold, in the winter, and it was practically free from dust in the summer. In June, 1912.

the surface was wavy and uneven, and in November it was "fair only," repairs being then in hand. The average wear in twelve months was 0·18 in. The section has not been quite satisfactory, "and has never been considered so by the contractors."

Section 19.

(July 11th, 1911. "Pitchmac, or Pitch-grouted Macadam," by Taroads Syndicate, Limited.)

This crust, 4 in. thick, consists of two layers of "Guernsey stone," both layers being separately rolled and grouted with the company's bituminous mixture, "Pitchmac." No repairs were needed, but the surface was dressed in May, 1912. During winter it gave no trouble as regards foothold, and in summer it was satisfactory and practically free from dust. In June, 1912, it showed little or no sign of wear, and was "quite good" in November. The wear in twelve months was 0·26 in. It is described as "a really good section, and quite one of the best."

Section 20.

(July 3rd, 1911, Natural Asphalt Matrix, by the Val de Travers Asphalte Paving Company, Ltd.)

The stone used is Penlee elvan or hornfels, broken to 1½-in. gauge, the hot matrix being poured into it after it is spread. Chippings are then strewn over the whole area, and when the matrix is cooling off the roller is passed over it two or three times. Thickness 2½ in. In the first twelve months no repairs were done, but a small quantity of chippings was applied. It "affords good foothold" in the winter, and is practically free from dust in summer, but is sticky during hot weather. The condition of the surface in June, and again in November, 1912, was "good." The average wear in twelve months was 0·08 in. The surface is described as "slightly wavy and somewhat sticky."

Section 21.

(June 29th, 1911, Asphalt-macadam, by the Val de Travers Asphalte Paving Company, Limited.)

The 4½-in. crust consists of natural rock asphalt broken into rectangular pieces, laid without the addition of any other material. Warm, fine weather is necessary for the work.

Nearly the whole of the area was repaired at a cost nearly two-thirds that of the original cost of construction; natural asphalt matrix being used. It had broken up by December, and its condition in summer was unsatisfactory. In November, 1912, the condition was "quite fair." The wear in twelve months was 0·14 in. This section, of a definitely experimental character, had broken up so as to become almost dangerous by December, 1911. It now consists of asphalt matrix and granite, and is similar to section 20.

Section 22.

(June 26th, 1911. Trinidad Asphalt-macadam, 3-in. coating, by the Trinidad Lake Asphaltc Paving Company, Limited.)

The aggregate is Channel Islands granite; 60 per cent retained on "⅜-in perforation" and passing 1½ in; 40 per cent retained on a ⅛-in. "perforation" and passing ⅜ in. The binder is refined Trinidad Lake bitumen, sp. gr. 1·25, combined with 80 per cent of fine material, all passing ¼-in. mesh. The materials are mixed before being laid, and are laid hot. A few chippings were applied soon after completion, but no repairs were done in the first twelve months. The surface afforded good foothold in the winter, and though sticky for a short time in summer, was afterwards satisfactory. Measurements showed practically no wear in twelve months. The section is described as "slightly wavy," comparatively noiseless, and "quite one of the best."

Section 23.

Trinidad Asphalt-macadam, 4-in. coating, composed of 3 in. of asphaltic concrete and 1 in. of wearing surface. The former is made as for section 22. The aggregate for the wearing surface is clear, sharp sand, well graded, and all passing ⅛ in. mesh, with a proportion of filler to form 85 per cent of the composition. The binder is refined Trinidad Lake bitumen, having a sp. gr. of 1·25.

No repairs were done in the first twelve months, and the only repairs needed up to November, 1912, were on account of Water Board operations. The average wear in depth in twelve months was 0·10 in. The section is described as "perhaps less wavy than section 22, and quite one of the best."

ENTERPRISE IN THE ASPHALT TRADE.

There are very few actual manufacturers of asphalt in the United Kingdom, that is to say, there are very few asphalt contractors who actually manufacture the asphalt they employ in their work, and one of the best known of these are Messrs. Engert & Rolfe, Limited, Poplar, London, E. To many of our readers it will seem almost unnecessary to add they are an up-to-date and enterprising house, but it is consequent upon this enterprise and the general appreciation of their material and work that the firm have found it necessary to reconstruct their asphalt factory. These new works, and the adjacent bitumen refinery, are now in full operation, and it is no exaggeration to say that the general construction and arrangement of the plant is unique. A large output of both mastic asphalt cakes, manufactured from selected asphalt rock from Sicily, France and Limmer, and refined Trinidad Lake bitumen is secured, and should subsequent events indicate the necessity, arrangements have been made by which this output can be still further largely increased, at comparatively short notice.

Economy of labour has been closely studied, and there is no wasted handling of materials in the whole of the processes. The raw material is waterborne, and is removed from the craft by loco. cranes, which place it in the required positions, and as required the rock is fed into the crushers and so on through disintegrators, mastic asphalt cookers, until it is eventually ready for delivery and moulding into blocks or "locos" for conveyance to the various jobs. Every care is exercised in the selection of asphalt rock, and only Trinidad Lake bitumen, refined on the works, is employed as a flux, with screened Bridport grit added when the asphalt is required hard-graded for paving and similar purposes, and only most experienced foremen and workmen are employed in the factory.

We feel sure that this latest venture on the part of Messrs. Engert & Rolfe, Limited, will enhance their already big reputation with architects, surveyors, and others, for it has always been their object to maintain a high standard of quality in their work, believing that the healthy reputation created thereby provides in itself the best recommendation possible when further requirements arise, and their latest enterprise will enable them better to meet their numerous customers' requirements from the competitive point of view. We are assured that any architect or engineer who is interested in the manufacture of asphalt and in bitumen refining would be cordially welcome to visit the works.

Talbot Cars at the Edinburgh Show.—The Talbot exhibit at the Edinburgh Motor Show is on two stands, those of the Western Motor Company, Glasgow, and Messrs. J. R. Ross & Sons, the former being the sole concessionnaires for Scotland and the latter the Edinburgh agents for Talbot cars. On the Western Motor Company's stand (No. 11) there are two cars—a 25-h.p. Talbot with limousine landaulette body and a 15-h.p. model with a touring body. On Stand No. 87 Messrs. J. Ross & Sons are showing a 25-h.p. model with torpedo body and a 15-h.p. landaulette fitted with electric light, speaking tube, and every other convenience.

Whaley Bridge and District Joint Sewerage Scheme.—The works of sewerage and sewage disposal for which Local Government Board sanction was received in May, 1912, comprise schemes for dealing with the sewage from portions of the districts of Yeardsley-cum-Whaley, Macclesfield (Taxal), Chapel-en-le-Frith, and Disley, and the joint outfall works, covering an area of 6 acres. The length of main and contributing sewers will be about 14 miles. The Joint Board is composed of representatives of the different authorities interested, and the councils are carrying out the works in their respective districts. Considerable delay has been caused in settling negotiations with the railway and canal companies, whose properties have to be crossed in many instances by the lines of sewers. Contracts amounting to about £20,500 have been entered into with Mr. M. A. Boswell, of Wolverhampton, and £1,000 with Messrs. Daniel, Eadie & Co., Limited, Stockport, and work commenced in November last. Messrs. Brady & Partington, Chapel-en-le-Frith, are the engineers to the Joint Board and to the other authorities concerned.

"THE SURVEYOR'S" COMING-OF-AGE.

MORE FELICITATIONS.

We have pleasure in reproducing below a number of additional comments on the recent attainment of our majority:—

Mr. Frank Sumner, city engineer, London.—Hearty congratulations on your majority. May you long continue to be a boon and blessing to surveyors.

Mr. Henry E. Stilgoe, city engineer, Birmingham.—Hearty good wishes to THE SURVEYOR on the attainment of its majority, and for the future all success.

Mr. A. D. Greatorex, borough engineer and surveyor, West Bromwich.—Hearty congratulations on the "coming-of-age" of THE SURVEYOR, and best wishes for future prosperity. It is, I consider, a valuable asset to the municipal engineer.

Mr. Arthur J. Price, engineer and surveyor, Lytham.—Allow me to offer you my warmest congratulations on attaining your majority. Since the first year THE SURVEYOR was issued I have read it with equal pleasure and profit, and I trust you may long be spared to control its destinies and to assist a grateful profession.

Mr. T. de Courcy Meade, city surveyor, Manchester.—It is difficult to realise that twenty-one years have passed since I read the first issue of THE SURVEYOR. I congratulate you upon the steady growth of the journal and its extended usefulness. The management has adopted a wise policy, and kept pace with the times. You have my best wishes for the future success of THE SURVEYOR.

Mr. P. C. Cowan, chief engineering inspector, Local Government Board, Ireland.—I have benefited by reading THE SURVEYOR AND MUNICIPAL AND COUNTY ENGINEER since its foundation. It is, in my opinion, almost indispensable for all engaged in the great and expanding work of local government. No engineer employed in sanitary work in any of its numerous branches should omit to read it regularly, and its articles and notes are invaluable to those who are studying the numerous unsolved problems of the road of to-day. The educative value of the students' page is very great.

Mr. Thomas S. Picton, borough surveyor, Eccles.—Allow me to congratulate you on the "coming-of-age" of your most excellent paper THE SURVEYOR. I have been a subscriber since your first issue, and I have carefully noticed during the years that have passed that the quality of the subject-matter contained therein has advanced in like manner. Your issue of January 17th shows what rapid strides municipal engineering has made during the past twenty-one years. I wish you long life and happiness, and that when you issue your Jubilee number it will be a record of great municipal achievements engineered and carried out by the municipal engineers of this country.

Gas World.—Our congratulations to our contemporary THE SURVEYOR AND MUNICIPAL AND COUNTY ENGINEER on its "coming-of-age," an event which it has just celebrated by an excellent special issue containing reviews of the work done in the past twenty-one years in the sphere of activity which it represents.

Architect and Builder's Journal.—In its issue of January 17th our contemporary THE SURVEYOR AND MUNICIPAL AND COUNTY ENGINEER completes twenty-one years of existence, the first number having appeared on January 21, 1892. The current number is described as a "coming-of-age issue," in which much space is devoted to a most interesting retrospective review possessing considerable value as an historical record—or perhaps "survey" would be a more appropriate word—of the period between "Then and Now, 1892-1913."

Electrical Times.—Our congratulations to our civil engineering contemporary THE SURVEYOR, which has attained the mature age of twenty-one years. In order to commemorate the occasion our contemporary has issued a special number containing some three-score of literary pages and a proportionate quantity of advertisements. The feature of the issue is a *revue* of the progress made in the field covered by THE SURVEYOR since it first saw the light in 1892. Matters then were very different from now—a number of Acts affecting local government, particularly London, have been passed, and large undertakings have been carried out. A special section of the *revue* is devoted to electricity supply, in which, we imagine, progress has been more rapid than in any other direction, for the good reason that the industry in 1892 had not long been out of its swaddling clothes. And the next twenty years should witness a still greater comparative advance.

Municipal Journal.—Congratulations to our contemporary THE SURVEYOR, which last week came of age with a bulky issue, in which were interestingly reviewed the activities and developments of its youth. THE SURVEYOR has good reason to preen itself upon having survived the vital changes that have taken place in the conditions and methods of newspaper enterprise during the past twenty-one years. How many journals professing to deal with local government or some of its multitudinous branches have been born and have ingloriously succumbed within that limited space of time? We will not attempt to estimate their number, but it is considerable. That THE SURVEYOR has lived and prospered, and is able to celebrate its birthday with a bumper issue like that of last week, is proof of its vitality and adaptability, and of the skill with which a necessarily difficult course has been steered. Again congratulations and many happy returns, using the latter phrase in its social and not its publishing sense.

Electrical Review.—We note with pleasure that our valued contemporary THE SURVEYOR arrived at its majority last week, and celebrated the occasion with a special issue dated January 17th. Since its first year the journal has greatly increased in bulk and circulation, and has attained to a very high standing as the organ of the professions included within its full title—THE SURVEYOR AND MUNICIPAL AND COUNTY ENGINEER. During the past twenty-one years THE SURVEYOR has witnessed vast changes in municipal engineering and in the organisation of municipal government, and has been enabled to play a prominent part in safeguarding the interests of municipal engineers. We believe, too, that throughout its existence it has remained in the hands of the original proprietor. In the special issue, besides a general survey of the period, there are given special reviews of the advances made in electricity supply, highways—a subject which our contemporary has made its own—public buildings, refuse disposal, sewerage, street lighting, tramway progress, water supply and legislation, the whole constituting a valuable and interesting *résumé* of the remarkable developments which have taken place in each of these important branches of municipal activity. We congratulate the proprietor and all concerned in the production of this issue and on the attainment of the twenty-first milestone, and hope they will celebrate their Jubilee under conditions no less auspicious.

"The Civic Engineer's Who's Who."—The first issue of "The Civic Engineer's Who's Who" (London: St. Bride's Press, Limited, 24 Bride-lane, E.C., 2s. 6d. nett) gives wonderfully complete lists of the engineering officials of England and Wales. For a first issue it is very creditable.—*Glasgow Herald.*

Chesterfield and Trackless Trolley Cars.—A poll of the burgesses of Chesterfield took place on Monday with respect to a scheme being promoted by the town council for the establishment of a system of trackless trolley cars, estimated to cost £60,000. Of the 7,000 odd persons entitled to vote only 1,290 did so, and the result was: For the Bill, 905; against 383: majority for, 522.

Preliminary Studies in Bridge Design.—This little book,* a reprint of articles which appeared in THE SURVEYOR AND MUNICIPAL AND COUNTY ENGINEER, is intended as the first of a series of similar volumes which, taken together, will form a treatise on the design of ordinary highway bridges of moderate spans. This first volume goes further back in the evolution of the bridge than do most treatises, and considers the bridge in its essential elements, that is as the means of providing a crossing for man and beast across a watercourse. The bridge engineer is apt to forget this primary purpose and to consider his bridge merely as a framework or a carrier of stresses. Mr. Ryves, in a refreshingly original manner, has emphasised the necessity for studying natural and economic predispositions, one might say, of the bridge site, with a view toward producing, not the best type of bridge, but the best method of getting the river and the traffic across one another. . . . —*Engineering News*, New York.

* By Reginald Ryves, ASSOC.M.INST.C.E. London: St. Bride's Press, Limited, 24 Bride-lane, E.C. Price 2s. net.

Assistants' and Students' Section.

CONDUCTED BY SYDNEY G. TURNER, ASSOC.M.INST.C.E.

All communications in regard to this page must be addressed to The Editor, St. Bride's House, 24 Bride-lane, Fleet-street, E.C. *Envelopes must be marked "Assistants' Section" in the top left-hand corner. Correspondents are invited to submit questions for consideration and answers to the questions which appear. For the contributions considered to be the most meritorious, one or more premiums in books will be awarded monthly. Diagrams must be drawn to scale on separate sheets, ready for reproduction.*

QUESTIONS.

This week answers are invited to the following questions:—

300. Retaining Wall.—A retaining wall is required to support a roadway having no footpath, and consequently heavy vehicles such as steam rollers, &c., will seriously surcharge the wall. The height of the roadway above the adjoining ground is 8 ft., and the filling will be good clay. Design a suitable wall in mass concrete, and show calculations. (D. G. B., *Darlington.*)

301. Waterworks.—Two pumping engines deliver water at the rates respectively of 1,620 and 1,150 gallons per minute together into three pumping mains 10 in., 11 in. and 14 in. diameter. What is the velocity in and the discharge of each main? (D. G. B., *Darlington.*)

302. Hydraulics.—By fixing a short tube to the orifice in the side of a vessel, a considerable increase in the discharge is obtained. Explain why this is so, and give the comparative "coefficients of contraction" with and without the tube. (E. S. M., *Luton.*)

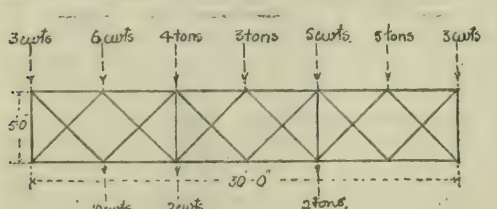
303. Reinforced Concrete.—Give sketches of the usual forms of falsework for reinforced-concrete construction, showing how the moulding is arranged at the junctions, such as between the column and principal rafter, a column and cambered roof, &c. (T. H., *Leicester.*)

304. Geodesy. What is meant by reducing a horizontal measurement to mean sea level? (Perplexed.)

[The Editor is at all times glad to hear from readers who desire to submit questions regarding matters of general interest, points of daily practice, &c., for insertion in the "Assistants' and Students' Section." Questions which are published are taken into consideration, as well as other matter, in awarding the Monthly Premium.]

REPLIES TO QUESTIONS.

297. Lattice Girder.—How would you obtain, graphically and by calculation, the stresses in the members



of a lattice girder braced and loaded as shown in sketch? (T. H., *Leicester.*)

Graphical Method. The reactions at the supports A and B can be obtained graphically as shown [see next page]. Where the top and bottom load are in the same vertical line they are added—*e.g.*, load c d = 4 tons 2 cwts.

The frame is redundant—*i.e.*, contains more bars than are required to resist change of shape—and in this type of frame it is first necessary to calculate by some method the stress in one of the members. In this case the member 1–13 is most convenient, and the stress in that member is due to the action of the loads 1–12, 3–4, 5–6, and 11–12, and is equal to the reaction at A due to these loads.

$3 + 80 \times \frac{1}{2} + 5 \times \frac{1}{2} + 10 \times \frac{1}{2} = 66{\cdot}1$ cwts $= 3{\cdot}32$ tons.

Stress in 1–13 = 3·32 tons, and from the load line of the polar polygon the reactions at A and B can be obtained by scaling a–x and b–x.

Having found these values, the reciprocal diagram is proceeded with in the usual manner, as shown above. The magnitude and kind of stress in each member are easily obtained from the diagram, and are tabulated as below:—

Member.	Stress.	Kind of stress.
1–13	3·32	Compression
13–15	4·68	,,
15–12	3·32	Tension
2–14	3·17	Compression
14–16	4·68	,,
14–13	4·48	Tension
15–16	4·48	,,

The stress in 13–15 is the same as in 14–16, as these denote different parts of the same bar.

By Calculation.—A convenient principle to apply for frames of this kind is that given by Rankine, and is as follows:—

"If a frame be acted upon by any system of external forces, and if that frame be conceived to be completely divided into two parts by an ideal surface, the stresses along the bars which are intersected by that surface balance the external forces which act on each of the two parts of that frame." (See R. C. E., p. 184.)

The reaction at A is easily calculated by taking moment round point B, and is found to be 6·63 tons. The reaction at B is 15·45 − 6·63 = 8·82 tons. The stress in 1–13 is found, as before, to be 3·32 tons.

Applying the above principle, suppose the ideal surface cuts the bars 1–13, 13–15, and 15–12, as shown by line NO. Let x represent the stress in 13–15, and take moment round point B.

$$3{\cdot}32 \times 30 + x \times \frac{30}{\sqrt{2}} = {\cdot}8 \times 25 + 4{\cdot}1 \times 20 + 3 \times 15 + 2{\cdot}25 \times 10 + 5 \times 5 + {\cdot}15 \times 30$$

$$\frac{x\,30}{\sqrt{2}} = 20 + 82 + 45 + 22{\cdot}5 + 25 + 4{\cdot}5 - 99{\cdot}6$$

$$x = \frac{\sqrt{2}\,(199 - 99{\cdot}6)}{30} = 4{\cdot}686 = \text{stress in } 13-15$$

To find stress in 15–12 cut bars by line PQ, and take moments round point C.

$$4{\cdot}686 \times \frac{5}{\sqrt{2}} = x \times 5$$

$$x = \frac{4{\cdot}686}{\sqrt{2}} \quad 3{\cdot}316 = \text{stress in } 15-12$$

Repeat the process for each member of the frame; the surface cutting the frame so that the stress in one member is found at each operation. The point selected for taking moments round should be the one which involves the minimum amount of calculation.

The vertical bars 19–20 and 26–27 are put in to prevent distortion of the rectangles containing them, and so long as these rectangles are not distorted the bars will not be stressed.

In calculating it is safest to assume that these bars will not be stressed. (A. S. C., *Hove.*)

Bridge Building.—Students, young engineers, and surveyors will find much useful information in "Preliminary Studies in Bridge Building," by Reginald Ryves, ASSOC.M.INST.C.E. (London: St. Bride's Press, Limited, 24 Bride-lane, E.C. Price 2s. nett.) The book is described as the "first of a series of small volumes, each complete in itself, dealing with the design of ordinary highway bridges of moderate span." Though highway bridges alone are referred to, the matter contained in this volume is largely applicable to railway bridges, aqueducts, and similar engineering undertakings. The five primary types of bridges are described, and the conditions determining the best site for each of the three types of streams are discussed in detail; while in connection with wandering streams various modes of designing abutments or approach spans are dealt with. Improvements of fords and the effect of eccentric loading of vehicles on the girder loads are among the numerous other items touched on. — *Scotsman.*

CANADA AND THE ROAD CONGRESS.

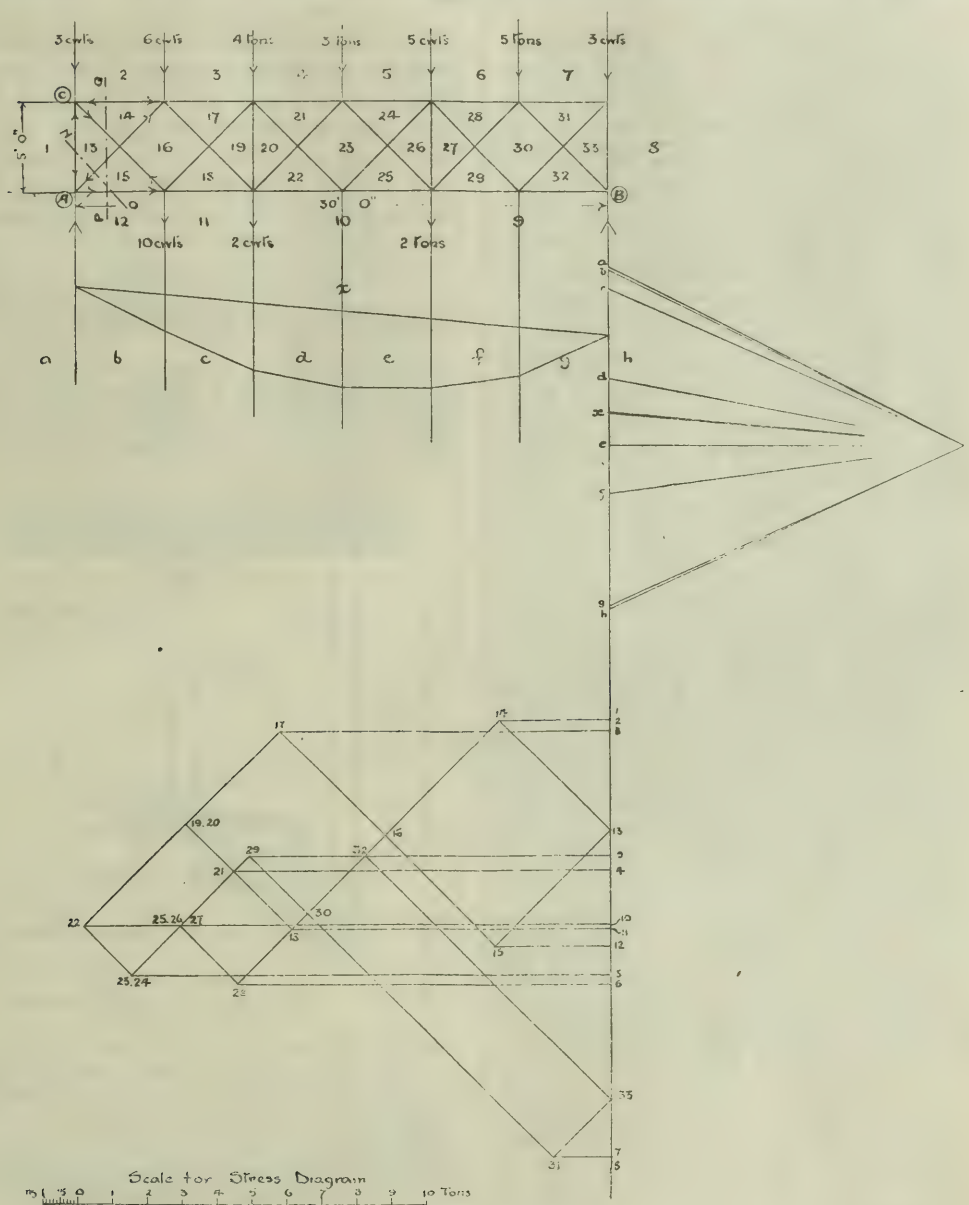
Evidence of the interest which has been aroused in Canada in the forthcoming International Road Congress is furnished by a circular which has just been received and which is being widely circulated to road engineers and road authorities in that country.

When Mr. W. Rees Jeffreys visited Canada last year he formed a committee to represent the Organising Committee of the congress in Canada. Mr. Jeffreys subsequently interviewed the Right Hon. R. L. Borden and interested him in the congress, the result being that the Canadian Premier has accepted the hon. presidency of the Canadian committee.

Dr. John Galbraith, Dean, Faculty of Science, University of Toronto, is chairman of the committee, the members of which are Prof. C. H. McLeod, secretary, Canadian Society of Civil Engineers, Messrs. W. G. Trethewey, Toronto, T. L. Kennedy, president, Ontario Good Roads Association, W. J. Kerr, president, Canadian Highway Association, B. Michaud, deputy minister of roads, Quebec, and Hiram Donkin, commissioner of highways for Nova Scotia. Mr. W. A. McLean, chief engineer of highways for Ontario, Toronto, is acting as hon. secretary.

Municipalities of Canada, the circular points out, are uniformly active in road improvement. Provincial and federal governments are adopting progressive measures. The Canadian public are widely interested in the problem. The approaching congress, in view of the present situation, is therefore considered of especial significance to Canada. Social, commercial, industrial and agricultural conditions are all, it is added, directly or indirectly benefited by good roads. Trunk lines of traffic are being adequately provided by means of railways, canals, and lake and ocean services; but in order that full development may be achieved there is urgent need that the common highways should be constructed and cared for by means that combine true economy and efficiency.

It is considered that the congress will be of service to Canada largely in proportion to the attendance from that country, and it is hoped, therefore, that many Canadians may avail themselves of the opportunity provided to advance the general knowledge of and interest in good roads, it being suggested that every province and district should be fully represented, especially by those who are actively engaged in the construction and maintenance of highways.



STRESSES IN LATTICE GIRDER.

Law Notes.

EDITED BY J. B. REIGNIER CONDER, 11 Old Jewry Chambers, E.C., Solicitor of the Supreme Court.

The Editor will be pleased to answer any questions affecting the practice of engineers and surveyors to local authorities. Queries (which should be written legibly on foolscap paper, one side only) should be addressed to "The Law Editor," at the office of THE SURVEYOR, *accompanied by the writer's name and address, but correspondents who do not wish their names to be published should also furnish a "nom de plume." Where necessary, copies of local Acts or documents referred to should be enclosed.* **All explanatory diagrams must be drawn and lettered in BLACK ink only, and in such style as to be fit for direct reproduction — i.e., without re-drawing or amendment.** *Unless these conditions are complied with we cannot undertake to reply to queries.*

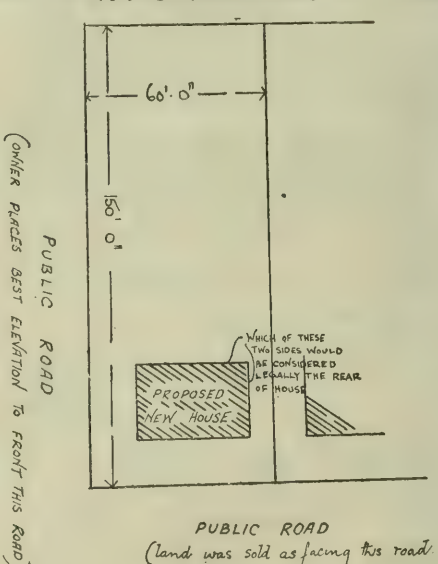
HIGHWAY: STILE ON FOOTPATH: PERSONAL INJURY: LIABILITY OF PARISH COUNCIL.—An important decision in connection with the subject of stiles on public footpaths is reported from the Keswick County Court (*Huntrod* v. *Above Derwent Parish Council*, January 8th). The plaintiff claimed £100 for personal injuries sustained in crossing a stile erected by the council on a public footpath in 1908. The proximate cause of the injury was the giving way of the second step of the stile, and it was alleged on the plaintiff's behalf that this was due to the defective construction of the stile—viz., that the grooves supporting the step were too shallow; that improper nails had been used; that such nails had not been properly driven in; and that the sides had not been bolted together so as to prevent the steps from working out. On behalf of the council it was contended that they were not bound to repair the stile, and were therefore under no duty to the plaintiff; and that the stile had been properly constructed, as evidenced by its having been in use for four years. On behalf of the parish council evidence was given by the Rev. W. R. Burnett, vicar of Thornthwaite, Mr. Anthony Wilson, managing director, and Mr. J. H. Davies, secretary of Thornthwaite Mines, Limited, Mr. P. M. Hope, M.I.MUN.E., A.R.SAN.I., M.R.I.P.H., A.I.S.E., surveyor of the West Ward Rural District Council, Mr. F. P. Farrer, clerk to the parish council, Mr. Walter Surnbirm, joiner. The learned judge decided in favour of the council. In the course of his judgment his Honour said: Assuming there was any breach of duty on behalf of the parish council, that breach of duty was not the proximate cause of the plaintiff's loss. Other points had been argued, namely, that the parish council, like the old inhabitants of the parish, and their successors the surveyor of highways and his successor the urban district council, would not be liable on the ground that failure to repair was merely nonfeasance. With that proposition he did not agree. He thought if a parish council erected an artificial structure on the highway, if they carelessly allowed it to go out of repair, they would be guilty of negligence, and would be liable to anybody who had suffered loss from their negligence. It was said they had been guilty of negligence in the original construction of the stile. There, he thought, on the evidence that they showed no want of care. It remained to see whether they were guilty of any breach of duty in repairing the stile. There was no evidence that the stile being out of repair was brought to their notice. There was no evidence of any complaint that the stile was out of repair in any way. He came to the conclusion that the probable thing was that the stile had been tampered with by mischievous boys. There was no want of repair of the stile. There must be judgment for the defendant council with costs.

HIGHWAY: DEDICATION AFTER 1835: LIABILITY TO REPAIR.—In *Cubitt* v. *Walton-upon-Thames District Council* (Court of Appeal), the question in dispute was whether the council were entitled to proceed, under the Private Street Works Act, 1892, with respect to a street known as Cottimore-lane, or whether it was a highway repairable by the inhabitants at large. The lane was formerly a private bridleway and footway. It became a public highway by user some time after 1835, but there was no record of the requirements of sec. 23 of the Highway Act, 1835, having been complied with. It had been from time to time repaired by the adjoining owners, and no repairs had ever been done at the expense of the public. The appellant, a frontager on the lane, contended that, having regard to the lapse of time, compliance with the section might be presumed, as was done in *Leigh Urban District Council* v. *King* (1901, 1 Q.B., 747). In that case, however, the street had been substituted for an old public road, and there was evidence of repair by the parish. In the present case the Court held that there was no evidence to justify any such presumption, and that the lane was not repairable by the inhabitants at large. They held that the section applied not only to the case of an owner making a road at his own expense with the intention of dedicating it, but also to cases where the dedication was only a presumption raised by user on the part of the public. Their lordships dissented from the view expressed by the Court in the old case of *R.* v. *Thomas* (1857, 7 El. and Bl., 399)—viz., "In this section" (*i.e.* sec. 23 of the Highway Act, 1835), "the Legislature only contemplated the case of a private person or body making a road for the purpose of dedicating it, or setting out a private driftway or horsepath under an Inclosure Act."

QUERIES AND REPLIES.

In order to avoid confusion querists are requested to use distinctive words as noms de plume. ***The letter X, combinations such as X.Y.Z., and words such as "engineer" and "surveyor," should never be used.***

BY-LAWS: AIR SPACE.—"Airspace" writes: An owner has submitted plans for a dwelling house to be erected on a corner site. Which side of the building, in this instance, would be legally considered the "rear" for applying by-law relating to air space


60' 0"
160' 0"
PUBLIC ROAD
(OTHER PLACES BEST ELEVATION TO FRONT THIS ROAD)
WHICH OF THESE TWO SIDES WOULD BE CONSIDERED LEGALLY THE REAR OF HOUSE
PROPOSED NEW HOUSE
PUBLIC ROAD
(land was sold as facing this road)

which says that between any new building over 15 ft. in height and the adjoining property there shall be a clear space of at least 15 ft. in width? I forward an explanatory sketch plan.

I do not know of any reported case deciding what is the "rear" of a building for the purpose of the by-laws as to air space. The heading to the model by-laws as to air space is as follows: "With respect to the sufficiency of the space about buildings to secure a free circulation of air, and with respect to the ventilation of buildings." And provision is made by these by-laws for air spaces "in front" and "in the rear" of buildings. It appears to me, in the present case, that the spaces provided at the two longest sides of the house are sufficient to ensure the object of the by-laws, and I think, therefore, that unless good cause to the contrary could be shown, these two sides would be held to be the "front" and "rear" respectively of the building within the meaning of the by-laws.

BUILDING BY-LAWS: THICKNESS OF PARTY WALL.—"H. C. P." writes: Plans have been deposited with my council for approval showing a rather large house which it is intended to divide into two separate dwellings, also for a small addition at one end. I shall be glad to know if we have the power to ask for a 9-in. party wall to be carried up to the underside of the roof under the by-laws forwarded herewith. The district, as regards building by-laws, is divided into two parts, one styled the rural and the other urban district. The proposed work is situated within the rural area, and, being a new building, plans are necessary, as under sec. 159 of the Public

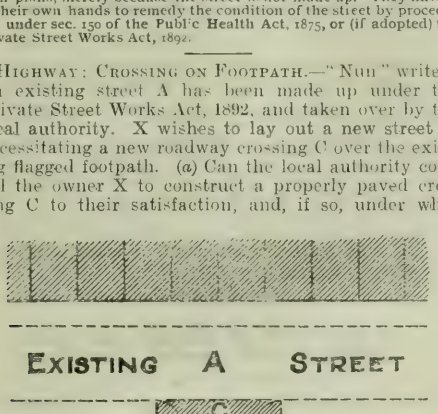
Health Act, 1875. From a fire prevention point of view a party wall is very desirable. The division of the district is only just now being effected, the Local Government Board having recently given their consent. A 9-in. party wall to the under-side of the slates is necessary in the urban area under by-law No. 27.

In my opinion the council cannot require a 9-in. party wall to be carried up to the underside of the roof under the by-laws applicable to the rural area.

BUILDING BY-LAWS: BUILDINGS ABUTTING ON UNPAVED STREET.—"Monmouth" writes: A certain private street in this district is almost completely built upon, both sides; the plans of the houses have been approved by the council and the houses are occupied, but the street is not made up. The council now propose to withhold the passing of any further building plans, or certifying as fit for habitation any houses now in course of erection in this street, until the street is paved, metalled, &c., to their satisfaction. Have the council power to do this?

The council cannot disapprove plans which are in compliance with the by-laws, or refuse to certify houses erected in accordance with such plans, merely because the street is not made up. They have it in their own hands to remedy the condition of the street by proceeding under sec. 150 of the Public Health Act, 1875, or (if adopted) the Private Street Works Act, 1892.

HIGHWAY: CROSSING ON FOOTPATH.—"Nun" writes: An existing street A has been made up under the Private Street Works Act, 1892, and taken over by the local authority. X wishes to lay out a new street B, necessitating a new roadway crossing C over the existing flagged footpath. (*a*) Can the local authority compel the owner X to construct a properly paved crossing C to their satisfaction, and, if so, under what



Act? (*b*) Can the local authority construct the paved crossing C and charge cost against owner X? (*c*) In your opinion does sec. 18 of the Public Health Acts Amendment Act, 1907, have any bearing on the case? (*d*) In case the street B were to be made up under the Private Street Works Act, 1892, could the cost of crossing C be included in cost of street B and charged against the frontagers?

(*a*) Assuming that X is the owner of the soil of the proposed new street, he has a right of access therefrom to street A at common law, and there is no Act empowering the authority to compel him to make a crossing. But his right must be exercised in such a manner as not to be productive of a nuisance: and in the event of his causing injury to the footpath of street A by conveying traffic across it, he would be liable to proceedings under sec. 72 of the Highway Act, 1835, unless he had previously applied to the local authority for leave to make a crossing and such leave had been refused. See *St Mary, Newington* v. *Jacons* (L.R., 7 Q.B., 47). (*b*) Only by arrangement with X. (*c*) This section is only in force in districts where it has been applied by the Local Government Board. Its effect is probably merely to enable a frontager who obtains the local authority's approval to rely upon that approval, instead of having to prove that he was exercising his common law rights. (See "Lumley's Public Health Acts," 17th Ed., p. 1175.) (*d*) No. The crossing forms no part of street B.

HOUSING AND TOWN PLANNING ACT, 1909: INSUFFICIENTLY LIGHTED ROOM.—"Thet" writes: Your information on the following point will be greatly esteemed. Where the windows of a house are not sufficiently large properly to light a room, can the local authority require this to be amended if proceeding under the Housing and Town Planning Act of 1909? If so, will the standard set out in Model By-laws for new buildings be accepted—viz., one-tenth of the floor area?

There does not appear to be any express power under the Act to require a room to be properly lighted. Presumably the only method of enforcing such a requirement would be to get the Medical or other officer of the local authority, or some other person, to complain that the house is in a state so dangerous or injurious to health as to be unfit for human habitation, and then for the authority to make a closing order under sec. 17. The owner would have a right of appeal against the order to the Local Government Board. But if there was no successful appeal it would apparently rest with the authority to decide what was necessary to render the house fit for habitation. This seems to be the effect of the section, but the Act is of course yet in its infancy, and I am not aware of any judicial decision on the points in question.

SEWERAGE AND SEWAGE DISPOSAL APPLIANCES.

MESSRS. J. STONE & CO.'S MANUFACTURES.

Messrs. J. Stone & Co., Limited, of Deptford, S.E., who for upwards of seventy years have been engaged in the manufacture of sewerage and sewage disposal appliances, have completed the erection of an entirely new and extensive factory, equipped with the most modern tools, so as to cope with the increased demand for their specialities. These undoubtedly possess many original and novel features, with improvements embodied which have been dictated by their long experience.

The firm hold patents for five types of sewage distributors, in which are incorporated a number of refinements in detail which make for high efficiency. Their new revolving distributors have been largely adopted, and many repeat orders obtained, due to the simplicity and reliability of the apparatus. The efficiency is increased by decreasing friction, as no joint, seal or coupling is used, and by a special method of balance these machines run easily in high winds. The all-cast-iron construction renders these sprinklers practically indestructible, and the patent self-cleaning distributing arms maintain the orifices clear for long periods without any attention. Stone's new patent travelling distributor permits equal periods of rest and work in dry weather, while in storm time the whole filter surface is covered in both journeys. There are no idle water wheels carried, hence head resistance and live load is reduced, and there are no small holes to choke. This apparatus may be driven by a water wheel mounted on the carriage, or at the end of the filter through a rope drive, or by a petrol, steam, oil, or gas engine, or an electric motor. Concerning fixed sprays, the firm's patent "Bio" nozzle has been largely adopted on account of its superiority of design.

A special feature of the past year's work has been the introduction of an odourless domestic sewage purifier. It cultivates the necessary micro-organisms, and maintains them in a high state of efficiency in the production of a satisfactory effluent, without air pollution. The special distributor used requires little or no attention. This purifier is well thought out, and the difficulties common to most have been overcome. Balancing gear is introduced to check the sudden rush of bath and laundry waste, and every detail spells reliability and efficiency.

Stone's compressed air ejectors, for which a patent has been applied, have been in great demand during the past year, and have been adopted by the British Admiralty, the Crown Agents for the Colonies, and others. These ejectors are usually worked in pairs, and are so arranged that either may be shut out of operation for examination without interfering with the work of the other. An improved alternating device is embodied which renders the action certain, and which is so arranged that it is impossible for both ejectors to fill at the same time; hence one is always ready to receive the sewage. Extreme accessibility of every detail has been aimed at throughout. Continuous current motor-driven air compressors are supplied in duplicate, and are controlled by an automatic switch, which starts and stops the motors automatically, so that the compressing plant is never in motion except when required.

Messrs. Stone & Co. have also secured the contract for a large pumping plant for the town of Suva, Fiji. This comprises the installation of three ejector stations and one power station. The compressed air will be generated by two belt-driven air compressors, driven by two 24-b.h.p. oil engines.

Reference may be made, in conclusion, to the fact that Messrs. Stone & Co. have supplied many thousands of sluice valves, flushing syphons, penstocks, and similar fittings to all parts of the world; they have at present in hand one order alone for fifty syphons for Ceylon; in fact, the amount of work turned out by this old-established company during the past year has been so great that we have not sufficient space at our disposal to describe it in detail.

Birmingham Town Planning.—In a report to the Birmingham City Council the Town Planning Committee state that they have published notice of the council's intention to apply to the Local Government Board for permission to make town-planning schemes in respect of the North Yardley and Stechford areas, and have issued the notices and convened the meeting of owners and others in compliance with the Town-planning Procedure Regulations.

N*

CORRESPONDENCE.

For every ill beneath the sun
There is some remedy or none;
If there be one, resolve to find it;
If not, submit, and never mind it.
— Anon., *circa* 1843.

THE WATER SUPPLY OF RURAL DISTRICTS.

To the Editor of The Surveyor.

Sir,—In the House of Commons on Monday, the 20th inst., the Prime Minister, in reply to a question, announced the impossibility of the Public Health (Acquisition of Water) Bill becoming law in the present Session. The purpose of this Bill was to enable rural district councils to purchase "water rights" in streams compulsorily. At the present time rural councils cannot legally promote Private Bills at all, and their powers as regards compulsory purchase are confined to land. This they can acquire under Provisional Orders granted by the Local Government Board, and confirmed by Parliament under the provisions of the Public Health Act, 1875. Although the purchase of land includes the acquisition of landowners' rights in "underground water" not flowing in a defined channel, it does not include the compulsory acquisition of "water rights" in surface supplies or in water which flows off the land on to adjoining and other property below the site purchased. "Water rights" of this character can only be acquired compulsorily by a Private Act of Parliament, and as rural councils have no power to promote Private Bills (except at the risk of being surcharged with the costs if the Bill is not passed), it is impossible for them, in many cases, to discharge their duty of providing proper water supplies to their districts.

The Bill referred to was of great importance and value, inasmuch as it would have enabled these councils, by Provisional Order from the Local Government Board, to acquire compulsorily water supplies as well as land. The surface supplies in question can rarely be acquired by agreement, as there is usually a very large number of "riparian owners" to be settled with, and a refusal to treat with any one of these is fatal to the whole scheme.

At the present moment I am acting for a rural council where the conditions afford a striking example of the difficulty referred to. Here it is desired to acquire some springs for the supply of a district extending to an area of over 100 square miles, and where no other equally suitable supply is available. One of the forty-two riparian owners interested in the stream flowing from these springs has refused to treat for the acquisition of his interest, and consequently the whole scheme has to be abandoned, at any rate temporarily. The Public Health (Acquisition of Water) Bill was promoted by the Local Government Board to meet cases of this sort, and it is a serious matter to many rural councils, and particularly the one I have mentioned above, that this most useful measure should be held over, because the attention of the House is fully engaged in passing political measures, the advantages of which are strongly disputed by a large section of the members. Surely a question of public health should take precedence of purely political measures?

The case for the proposed Bill could be supported by many arguments of a more technical nature than those given above, but I have confined myself to the broad question of public interest, which, I think, will be appreciated by a large section of your readers.—Yours, &c.,

Percy Griffith, M.Inst.C.E., F.G.S., F.R.San.I.,
Secretary, Institution of Water Engineers.

20 Victoria-street,
Westminster, S.W.
January 24, 1913.

REFUSE DESTRUCTION.

To the Editor of The Surveyor.

Sir,—Your correspondent Mr. G. Watson takes exception to my observation in the article in the "coming-stage" number concerning the liability of the combustion mechanisms to lead to trouble sooner or later.

I think I may content myself with leaving this statement, and only adding that as a general mechanical proposition it will probably be accepted.

While I commend these articles it is essential that they must not resolve themselves into an indiscriminate and all-round approval of whatever is put on the market and advertised, it is also essential that the criticisms be not captious, and I hasten to affirm that there is no desire for them to be so.

Wherever one sees two or three different types of machines for accomplishing the same purpose it generally happens that that which has been designed to overcome a defect in the first has a weakness foreign to the first, and a third, in overcoming this weakness, exhibits another foreign to both. This applies to lathes, radial drills, motors, milling machines, mechanical stokers and almost all mechanical appliances. The final judgment has to be on prime cost, efficiency, economy. One may be strong just where another is weak; but this surely does not preclude observers from suggesting possible weaknesses with a view to arriving at what is generally supposed to be imposible—perfection.

When drafting the outline of the history of refuse destructors I had before me Mr. Watson's valuable paper on the subject read before the Institution of Civil Engineers, which he has been good enough to hand over to me, as also Mr. Warner's three contributions on the history of the subject, and last but not least Mr. Charles Jones' brochure, besides standard works.

With the space at my disposal it was impossible to do justice to all the pioneer workers, and this was suggested in the phrase which was placed in parentheses—"though on actual points of priority we do not concern ourselves here." Only a backward glance was attempted.

Before hard-and-fast conclusions can be drawn on the net economies of destructor practice in 1913 it is necessary that very careful and scientific observations and tests should be made of what is now going on, for it must be admitted that several makers to-day are able to substantiate special claims, as referred to on another page of this issue, and I propose to return to the subject from that point of view as early as possible.—Yours, &c.,

The Writer of the Article.

THE INSTITUTION OF MUNICIPAL AND COUNTY ENGINEERS' TOWN PLANNING COMPETITION.

To the Editor of The Surveyor.

Sir,—It is with regret that I read that the Institution of Municipal and County Engineers had decided to relinquish the conditions relating to perspectives; the type they asked for originally was as easy as anything in perspective work.

Personally, I have found perspective sketches of the very greatest value in making one's ideas clear to the lay mind; and I was more than ever impressed with their work when recently privileged to see how Mr. Thomson had made use of them in connection with his Dundee schemes. American engineers use them to a surprising extent. In these days of bad draughtsmanship they form a branch of our work worth encouraging; therefore, with all deference, I think it would have been better for the institution to have asked for perspectives, either from the competitor direct, or from joint-competitor, also engaged in municipal engineering.—Yours, &c.,

J. E. Wilkes.

Rosyth.
January 29, 1913.

To the Editor of The Surveyor.

Sir,—May I express the disappointment that I feel, and I am sure it is shared by yourself and your readers, at the wretched attempt at revision made in the conditions for the town planning competition promoted by the Institution of Municipal and County Engineers?

The whole affair has been badly bungled from the beginning, for, instead of offering premiums which would attract competitors, and of issuing conditions that would enable satisfactory schemes to be submitted, the premiums offered would disgrace a parish council inviting designs for a parish pump; and the conditions are more like a puzzle or guessing competition than those calculated to guide competitors in an important competition.

The council evidently think more of building up their bank balance than of building up the reputation of the institution; and they are either absolutely indifferent to the prestige of the profession, or they are absurdly optimistic regarding the number and class of competitors likely to compete under such conditions.

The request for a bird's-eye view of a town of 150,000 inhabitants, in addition to laying it out, for a first premium of £10, makes one wonder whether any single member of the committee has ever taken part in a competition, or tried his hand at town

planning even a few hundred acres. The conditions are so vague that I venture to assert that there is no single member of the committee, apart from the prospective president, who can, from the particulars given, plot the area to be laid out, and he can only do so because it is evident the conditions are framed to meet a site with which he is familiar.

The cutting down of the scheme by knocking out the sheet of details is another mistake, as the details for an engineering competition would present the most attractive part of the schemes submitted; and the details should certainly be retained, or, at any rate, left optional to competitors.

If the council are not like Pharaoh in hardening their hearts, may we not hope that they will even yet so revise the premiums and conditions that the competition will attract schemes worthy of our honourable profession, and save us from being humbled at the hands of our architectural friends?—Yours, &c.,

SURVEY.

January 29, 1913.

MOSES AS AN ENGINEER.

To the Editor of THE SURVEYOR.

SIR,—In his presidential address to the Institute of Sanitary Engineers, Mr. Boulnois made reference to Moses' "engineering skill in parting the waters of the Red Sea to allow himself and his followers to escape from the Egyptians." May I be allowed to point out that, as any one may cross the Red Sea at this particular point dry-foot whenever the tide is favourable, no engineering skill whatever was exhibited? The incident is one of those popular fallacies which Mr. Ackermann might well include in the next edition of his work bearing that title.

Napoleon when at St. Helena wrote, referring to an experience of former days: "Profitant de la marée basse, je traversai la mer Rouge à pied sec; au retour, je fus pris par la nuit et m'égarai au milieu de la marée montante; je courus le plus grand danger; je faillis périr de la même manière que Pharaon, ce qui n'eût pas manqué de fournir à tous les prédicateurs de la chrétienté un texte magnifique contre moi."

Alexandre Dumas in his "Quinze Jours au Sinai" says: "Au moment où nous arrivâmes au bord de la mer, les eaux étaient hautes. On la traverse alors, si l'on est pressé, au moyen d'un bateau. Comme rien ne nous pressait, que nous n'étions aucunement poursuivis, et que nous désirions, d'ailleurs, passer la mer à la manière des Israélites, nous résolumes d'attendre le reflux, et de faire pendant cet intervalle une petite visite à la ville de Suez. . . . Lorsque nous nous retrouvâmes au bord de la mer, la marée venait de se retirer, et le moment était parfaitement favorable. Nous fîmes plier la tente, nous remontâmes sur nos dromadaires, et nous nous lançâmes dans la mer; à l'endroit le plus profond, il n'y avait pas plus d'un pied d'eau; quarante minutes nous suffirent pour cette traversée, et, à deux heures, nous mettions le pied sur la terre d'Asie."

The fact of the matter appears to have been that the Israelites had local knowledge and Egyptians hadn't.—Yours, &c.

B. WYAND.

39 Victoria-street, S.W.
January 28th, 1913.

[Freely translated, the passages quoted by our correspondent read as follows:—1. "Taking advantage of the low tide, I crossed the Red Sea dryfoot; on returning I was benighted, and wandered amidst the rising tide, thus incurring the greatest danger, so that I narrowly escaped the same fate as Pharaoh, which, if it had also been mine, would not have failed to furnish all the preachers in Christendom with a splendid text against me." 2. "At the time of our arrival on the coast it was high water. It is crossed then by means of a boat if one is in a hurry. As we were not, since we were not being in any manner pursued, and as we desired moreover to cross the sea in the same manner as the Israelites, we resolved to await the ebb, and to spend the interval in paying a brief visit to the town of Suez. . . . When we again reached the shore the tide had gone down, and the moment was perfectly favourable. We ordered the tent to be folded, remounted our dromedaries, and plunged into the sea; in the deepest spot there was not more than a foot of water; forty minutes sufficed us for this crossing, and at two o'clock we set foot on the soil of Asia."—ED. SURVEYOR.]

BITUMINOUS MATERIALS.

To the Editor of THE SURVEYOR.

SIR,—It is a little surprising to observe in your current issue such an experienced road engineer as Mr. Francis Wood maintaining that a natural asphalt like Trinidad Lake asphalt is in itself a bituminous concrete instead of only a cement for use in the manufacture of an asphaltic concrete.

If Mr. Wood had termed natural rock asphalts as being bituminous concretes no one would take exception to such a simile, but to confuse individual natural asphalts containing free bitumen with natural rock asphalts only proves, if proof were necessary, that a clearly defined nomenclature for all the various bituminous materials at present being used in road construction is imperatively necessary. Yours, &c.,

CECIL NATHAN.

3 London Wall Buildings,
London, E.C.
January 25, 1913.

IRISH ASSISTANT COUNTY SURVEYORS.

A correspondent signing himself "A Northern Assistant Surveyor" writes as follows to the *Irish Independent*:—

"As an assistant county surveyor of some years' standing, I am surprised that the assistant county surveyors have not made any effort to improve their position. Their work has been greatly increased in recent years by the advent of the steam roller and breaker, which entails a very considerable amount of extra work and expense upon the assistant, for which he receives no corresponding increase. I could write at much greater length upon this subject, but trust that now some able assistant will take the matter up and consider the advisability of holding an all-Ireland meeting in Dublin at an early date, when matters concerning our interests could be fully and freely discussed at length."

OFFICE MANAGEMENT.

THE FILING OF PLANS.

In our issue of October 11th last we commented in "Minutes of Proceedings" on the problems of office management that frequently force themselves on the attention of the municipal engineer, our note referring in particular to the necessity for an efficient system by which any documents or plans may be found promptly when required. Having regard to the number and diversity of the methods in vogue for filing and indexing plans, it was suggested to us that a useful purpose would be served if we invited correspondence on the subject from our readers. This was done in the issue above mentioned, and although the invitation has so far failed to elicit any response, we shall still be glad to hear from anyone who has found satisfactory any method of arrangement other than the one to which we alluded, and which we suggested was neither perfect nor necessarily adapted to the peculiar conditions of every office. This system, while found to work very well, depends upon the two fundamental ideas of having three or four stereotyped sizes of paper, to one of which every plan must be cut, and keeping the plans in drawers in specially made cabinets, grouped according to subject matter. The class and number of each plan are stencilled on the back, and correspond to a similar entry in the plan index book. Thus there is a definite place for every drawing.

Richmond (Surrey) Bridge. The Mayor has been informed by the Surrey County Council, with reference to the proposed improvement of Richmond Bridge, that the county council will not take action at present or in the near future, because a possibility exists of the Road Board constructing a new road skirting Richmond, which would involve the building of a new bridge over the Thames; that the council's Highways and Bridges Committee are informed that the present bridge is structurally quite safe to carry the existing traffic, and that the council are spending a large amount of money on the widening of Kingston Bridge, and have recently spent considerable sums on repairing the Surrey portion of Hampton Court Bridge. The council understand, further, that the Middlesex County Council are not prepared to take any action at present or in the immediate future.

SOME RECENT PUBLICATIONS.*

Structural Details of Hip and Valley Rafters. By C. T. Bishop., C.E. Price 7s. 6d. nett. New York: John Wiley & Sons. London: Chapman & Hall, Limited.

In this work the author gives complete directions for making the shop drawings for the steel work of intersecting roofs and similar structures. Both mathematical and graphical solutions are given to the various typical problems that are solved, and the value of the book to the practitioner is much enhanced by the tables which are given, and by which the labour of calculation is much reduced. The six chapters into which the book is divided deal respectively with—General Outline, Flange Connection, Web Connection, Other Cases, Derivation of Formulæ, and Graphic Method of Determining Angles. The author has presented his subject in such a way that anyone with a reasonable knowledge of structural details and of trigonometry can make working drawings for the shop with sufficient accuracy for all practical purposes, at the same time avoiding useless refinements. A feature of the book which is worthy of praise is the simple system of notation, clearly set out at the beginning, and adhered to throughout the work, thus aiding in the production of a clear exposition of the subject in hand.

Land and Mining Surveying. By G. L. Leston. Price 6s. nett. London: Crosby Lockwood & Son.

The author of this book is an experienced mining surveyor, and he has here endeavoured to present to the student a treatise on the application of the science and art of surveying as applied to mining purposes. In order to accomplish this purpose, certain chapters are devoted to an elementary exposition of the principles of surveying which are equally suited for surface or underground work. The greater part of the book, however, is devoted to a description and explanation of those processes which are used in mining and colliery surveying. For example, separate chapters are given to such subjects as the Miner's Dial, Plotting Underground Surveys, Surveying with the Fixed Needle, the Correlation of Underground and Surface Surveys, and Colliery Plans. In style, the work is clear, and it is copiously illustrated and adequately indexed. The literature of this branch of surveying practice is comparatively meagre, so that Mr. Leston's book, which is both sound and practical, should find a ready acceptance by those for whom it has been written.

Laxton's Price-book, 1913. Price 4s. London: Kelly's Directories, Limited.

The new issue of "Laxton" contains many alterations, due in a great measure to the general increase in the price of materials. The main features of this work are so well known as hardly to need description. Suffice it to say that a separate section is devoted to each trade, and that the information given is as comprehensive as in former issues. The number of references now exceeds 73,000. The book also comprises many tables and memoranda of use to the builder, together with full information as to the Acts of Parliament and by-laws relating to building work which are in force. The publishers have endeavoured to maintain for this, the ninety-sixth edition, the reputation which the work has long since attained, as one which may be intrinsically relied upon by all who have recourse to its pages. In this endeavour they have, as heretofore, well succeeded.

Lockwood's Builders' Price-book for 1913. Edited by F. T. W. Miller, A.R.I.B.A. Price 4s. London: Crosby Lockwood & Co.

In preparing the new edition of this well-known work the editor has given due effect to the increase which has taken place in the cost of materials and other matters affecting the prices of builders' work. Each trade is dealt with in the fullest possible manner in a separate section, and the whole has been thoroughly checked and revised. The appendices contain a vast amount of information which will be useful for daily reference by the builder. These include valuation and wages tables, form of agreement for building contract, and legal notes and memoranda. We have never hesitated to recommend Lockwood's Price-book in the past, and all that need be said of the present issue is that it will fulfil all expectations based upon experience of past excellence.

Willing's Press Guide, 1913. Price 1s. London: James Willing, Limited.

This is the fortieth annual issue of this well-known work, and it contains all the usual features which have hitherto conduced to its great popularity. The Guide is so well known and widely used that it is sufficient to say that, as a handy and ready book of reference for all information which is commonly required in regard to the Press of the world, it maintains its position as a thoroughly complete and reliable work. The information is both exhaustive and well-arranged, and the new edition has been thoroughly revised and brought up to date in every particular.

Tithe Rent-charge Table, 1913. By P. W. Millard, LL.B. Price 1s. London: Shaw & Sons.

This is the seventy-seventh annual issue of the Tithe Rent-charge Table, and it shows at a glance the yearly and half-yearly values of any tithe rent-charge for the year. It further contains tables of the official fees payable on the redemption and merger of tithe rent-charge, income-tax tables, and a short summary of the law relating to the collection, redemption, and merger of tithe rent-charge. To those who receive payments in lieu of tithes, or whose land or property is subject to them, these tables are absolutely indispensable.

The Concrete Institute: Transactions and Notes. Vol. IV., Part 3. The full name of the Concrete Institute includes the words, "An Institution for Structural Engineers, Architects, &c.," and the volume before us furnishes evidence of the appropriateness of this title, for the bulk of it is occupied by two papers—the first dealing with one of the most difficult problems in structural engineering, and the other with a subject which is of vital interest alike to architects and to those engineers who are concerned with building design. The first paper is a written contribution, supplementary to a paper read last March at a meeting of the institute, and reported in The Surveyor of March 22nd. It is on "Calculations in the Design of a Thrust Buttress Masonry Dam," by Reginald Ryves, M.Cons.E., Assoc.M.Inst.C.E., and furnishes details of the manner in which the dimensions of the different parts of a dam of this type are calculated. This design is in no sense a development of earlier designs, nor is it based upon the work of other engineers. It is an example of pure designing work on the basic principles underlying structural design generally and the known properties of materials, and the time seems to have come when engineers of repute in the matter of dam design should say definitely whether they believe in it or whether they do not. Would they, for instance, prefer to build a mass dam of the old type, 200 ft. or more clear of the ground, across a wide valley, the height of 200 ft., or nearly that, being maintained for 500 ft. or 600 ft.? Mr. Ryves is prepared to recommend his type for much greater heights than this, with materials which may safely be stressed above 10 tons per square foot, the height of 200 ft. being the limit for that stress. Quite apart from the question of limiting heights for different types of dams, the design seems to offer important advantages as regards both economy and convenience in the building, and it is, perhaps, specially suited to conditions in India. It may be suggested that the Madras Government might allow the profession generally to have the benefit of any opinions which they have obtained as regards the type generally, or the design as intended by its author to fulfil the requirement of one of the great irrigation projects now being studied in that province. The second paper was one read at a recent meeting of the institute—"Fireproofing," by Richard L. Humphrey, M.Inst.C.E., M.Am.Soc.C.E., President of the National Association of Cement Users, Philadelphia. It is a study of great conflagrations, especially those at Chicago (2,125 acres) and San Francisco (2,630), and is liberally illustrated. The author described the manner in which various kinds of construction behaved when exposed to the high temperatures reached in some parts of these great conflagrations, and he explained in a most lucid manner how failures took place. The illustrations include sections of beams, columns and floors, and numerous details of floor, roof and ceiling construction, a useful feature being the sections showing good and bad designs for fire-resisting columns. Important points were raised in the discussion which followed the reading of the paper, and the institute is to be congratulated on this really useful addition to its records.

* Any of the publications reviewed, or referred to as received, will be forwarded by the St. Bride's Press, Ltd., on receipt of published price.

The Surveyor.
And Municipal and County Engineer.

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LOCAL GOVERNMENT BOARD INQUIRIES.

The Editor invites the co-operation of SURVEYOR *readers with a view to making the information given under this head as complete and accurate as possible.*

INQUIRIES HELD.

Ashby-de-la-Zouch R.D.C. (January 17th. Mr. A. A. G. Malet).—£4,875 for works of sewerage at Ravenstone.—Mr. T. I. McCarthy, engineer for the scheme, said he expected to meet with loam gravel and clay in excavations. The greatest depth of the sewer was 16 ft. 7 in., and the least 3 ft., but there would be no sewer on the road of less than 4 ft. depth. Selected manholes would be provided with flushing arrangements. The population of the parish was 1,659, and 1,016 of these would be affected by the scheme; and there were 220 houses to be connected up. The old storm-water drains would be reverted to their former use, so as to keep as much storm water as possible out of the sewers. Arising out of a number of questions, the inspector elicited the information that there was frequently considerable filtration through connecting up old drains.

Newport (Mon.) T.C. (January 22nd. Mr. F. H. Tulloch).—£1,300 for the purpose of making a recreation ground at the Jew's Wood.—Mr. H. A. Newman (town clerk) and Mr. H. Tremelling (borough engineer) explained that the Wood was the gift of Viscount Tredegar, who desired to preserve its woodland character. They proposed to cut down the undergrowth, but not the big trees. It was intended chiefly for children. The greater part of the money would be for fencing and drainage.

Pontypool U.D.C (January 23rd. Mr. F. H. Tulloch).—£1,995 for the purpose of erecting a refuse destructor and a slaughter-house, £270 therefor being the purchase of land.—The chairman of the council (Mr. David Davies) and several members attending the inquiry, with the clerk (Mr. H. H. Hodson) and the surveyor (Mr. J. T. Minhinnick).

APPLICATIONS FOR LOANS.

Bournemouth T.C. £8,000 for improvements at Boscombe Chine.

Eastleigh U.D.C. £397 for works of road improvement.

Golcar U.D.C.—£7,600 for works of sewerage.

Poole T.C. £941 for surface-water drainage works.

Sevenoaks U.D.C. £938 for laying storm-water sewers.

Southampton T.C. £2,200 for extensions to the isolation hospital.

LOANS SANCTIONED.

Brampton R.D.C.—£720 for the Talkin water supply scheme.

Dover T.C.—£1,200 for road improvement purposes.

Luton T.C.—£7,684 for sewerage and surface-water drainage.

Maesteg U.D.C.—£18,912 for works of sewerage.

Radstock U.D.C.—£7,044 for the erection of forty cottages.

Rawtenstall T.C. £8,600 for the Hall Carr housing scheme.

Truro R.D.C.—£600 for a water supply for St. Mawes.

Wimbledon T.C. and Merton U.D.C. £10,000 and £500 respectively for the purpose of contributing towards the purchase of land in Kingston Vale in connection with the scheme for the extension of Wimbledon and Putney Commons, repayable within sixty years. The grants sanctioned now amount to £14,000, and Wandsworth has co-operated by securing in connection with the scheme an area of 30 acres, at a cost of about £10,500. In addition, the voluntary contributions amount to £14,274.

FORTHCOMING INQUIRIES.

FEBRUARY.	£
3.—**Northampton.** For school clinic and recreation ground purposes (Mr. W. H. Collin)	4,100
4.—**Birmingham.** For street improvement and open spaces purposes (Mr. Edgar Dudley)	47,080
4.—**Braintree.** For works of water supply (Mr. W. O. E. Meade-King)	1,500
4. **Chester.** For sewage disposal purposes (Mr. H. R. Hooper)	4,021
4. **Tiverton.** For the purchase of land for dwellings (Mr. H. A. Chapman)	1,600
5.—**Chard.** For the purposes of a market (Mr. F. H. Tulloch)	1,350
5.—**Fareham.** For sewage disposal works (Mr. P. M. Crosthwaite)	12,831
5.—**Hyde.** For works of water supply (Mr. H. R. Hooper)	11,000
5.—**Llandilo Fawr.** For water supply purposes (Mr. F. O. Stanford)	3,150
5.—**Minehead.** For housing purposes (Mr. H. A. Chapman)	2,700
5.—**Newmarket.** For works of water supply (Mr. M. K. North)	5,870
6.—**Bognor.** For works of sewage disposal (Mr. P. M. Crosthwaite)	4000
6.—**Chelmsford.** For a housing scheme (Mr. C. H. Eyles)	3,000
6.—**Croston.** For works of sewerage (Mr. R. H. Bicknell)	2,100
6.—**Llandrindod Wells.** For water supply and pavilion purposes (Mr. F. O. Stanford)	4900
7.—**Denton.** For works of road improvement (Major J. Stewart)	4,809
7.—**Poole.** For surface-water drainage works (Mr. F. H. Tulloch)	3,072
7.—**Swindon.** For sewage works purposes (Mr. F. O. Stanford)	24,000
7. **Worthing.** For surface-water drainage and sewage outfall works (Mr. P. M. Crosthwaite)	[illegible]

Municipal Work in Progress and Projected.

The Editor invites the co-operation of SURVEYOR *readers with a view to making information given under this head as complete and accurate as possible.*

The following are among the more important projected works of which particulars appear below: Buildings—Coventry £15,000, Cheshire £5,000, Dublin, East Ham, Hythe, Shropshire £5,000; housing and town planning—Lurgan £10,000; roads and materials—Aberdeenshire £10,000; Barnes £3,550; Birmingham £7,670; Bournemouth £8,000; Islington £22,432, West Riding £7,000; sewerage and sewage disposal—Birmingham £8,700, Liversedge £17,000; water, gas and electricity—Aberdeen £15,510, Dunbar £20,000, Merthyr £232,000. Particulars of other works projected will be found on our "Local Government Board Inquiries" page.

ADMINISTRATION.

Richmond (Surrey) T.C.—Reporting with respect to the staffing of the surveyor's department, the Surveyor's Committee expressed the opinion that the time and energies of the borough surveyor (Mr. J. H. Brierley) were too much taken up with work in connection with the supervision of the workmen, the repair of roads, and other detail and routine work, and that an assistant borough surveyor, who had had previous municipal experience, and had been accustomed to the supervision of workmen and the repair of roads, should be appointed, at a commencing salary of £250 per annum. They therefore recommended that an assistant borough surveyor be appointed accordingly, and this the council agreed to.

BUILDINGS.

Ayr T.C.—A scheme has been adopted for the provision of a new hospital for consumption at an estimated cost of £1,200.

Bexhill T.C.—The surveyor, Mr. G. Ball, has been instructed to prepare plans and estimates for an entrance to the Colonnade by means of a subway, or covered staircase, or steps.

Blackpool T.C.—A water-filtering plant is to be installed at the Cocker-street public baths.

Burnham-on-Crouch U.D.C.—It has been decided to erect a fire station, public convenience, and ambulance store.

Campbeltown T.C.—Miss Greenlees, Burnbank, has given a sum of £1,000 to the corporation for the erection of a sanatorium pavilion.

Cheshire C.C.—A new school is to be built at Ashton-on-Mersey at an estimated cost of £5,000.

Cleethorpes U.D.C.—The surveyor, Mr. C. H. Waithman, has been instructed to prepare estimates and specifications for the erection of a shelter in reinforced concrete and terra-cotta at the junction of Alexandra-road and Sea-road.

Coatbridge T.C.—The tender of Messrs. W. Bain and Co., at £1,165, has been accepted for the erection of an hospital for consumption, and plans have been approved for additions to the fever hospital.

Coventry T.C.—Extensions are to be made at the public baths at an estimated cost of £15,000.

Cumberland C.C.—The Highways Committee have decided to recommend to the county council, which meets next week, that the old Portinscale Bridge should be saved by grouting and that Sir Francis Fox should supervise the work. Two local gentlemen undertook to refund to the council the estimated sum for the work if, after three years' testing, the bridge proved to be insecure for the heaviest traffic. How far this influenced the Highways Committee is not known.

Dublin T.C.—A scheme for the erection and maintenance of a new art gallery is to be financially assisted by the council to the extent of £22,000 provided that a free site is found and a sum of £3,000 privately subscribed.

East Ham T.C.—The plans of the surveyor, Mr. J. E. W. Birch, have been approved for the new fire station to be built on the town-hall site. Mr. Birch will supervise the building operations.

East Riding C.C.—The education committee have accepted the tender of Mr. J. T. Levitt, of Hull, at £1,995, for alterations and additions to the Cottingham School.

Falkirk T.C.—A sanatorium is to be erected on a site adjacent to the fever hospital, at an estimated cost of £7,403.

Helensburgh T.C.—It has been agreed to rebuild the sea-wall between Glasgow-street and Ardencaple Castle, which was erected at a cost of between £3,000 and £4,000 five years ago. In the November gales breaches were made in the wall, and other parts showed signs of giving way.

Hythe T.C.—Plans have been approved for the rebuilding of the public baths.

Lowestoft T.C.—The surveyor, Mr. G. H. Hamby, has prepared plans, which the council has approved, for the erection of a concert pavilion at an estimated cost of £1,300.

Maesteg U.D.C.—The surveyor, Mr. S. J. Harpur, has been instructed to prepare plans for new municipal offices.

Middlesbrough T.C.—A new police station is to be built at an estimated cost of £2,640.

Newry U.D.C.—A scheme has been prepared for the extension of the bridge at the town-hall and additions to the municipal buildings at an estimated cost of £2,500.

Omagh U.D.C.—A committee has been appointed to carry into effect a project for building a new town hall in the rear of the premises occupied by the council, and to provide in connection therewith suitable accommodation for the municipal technical classes.

Portsmouth T.C.—Public lavatories are to be provided and other improvements carried out at Milton Park at a cost of £500.

Shropshire C.C.—A secondary school is to be provided at Bishop's Castle at an estimated cost of £5,000.

Southampton T.C.—The Health Committee have received authority to provide for twelve additional bedrooms and certain small enlargements at the isolation hospital, at an estimated cost of £2,200.

Stoke-on-Trent T.C.—The council have approved the plans of the borough surveyor, Mr. A. Burton, for a new police-station, officers' quarters, and superintendent's house at Fenton, at an estimated cost of £4,600.

Warwickshire C.C.—The tender of Mr. J. Langley, at £2,384, has been accepted for the erection of a handicraft centre at Baddesley Ensor.

HOUSING AND TOWN PLANNING.

Carshalton U.D.C.—The council have applied to the Local Government Board for authority to prepare a town planning scheme for 2,320 acres of their district.

Coventry T.C.—It has been decided to proceed with another section of the housing scheme.

Doncaster T.C.—The tender of Messrs. Johnson and Moore, of Balby, at £4,153 is recommended for acceptance for the erection of flats at Wheatley—ten with two rooms and twenty with three.

Greenwich T.C.—Plans have been approved for the erection of certain cottages which will form the beginning of a garden suburb scheme arranged on the co-partnership system.

Hadleigh U.D.C.—Eight labourers' cottages are to be built at a cost of £1,274.

Lurgan U.D.C.—The Local Government Board have sanctioned the scheme for the erection of fifty-four houses at a cost of £10,000, and the architect, Mr. Hunter, has been instructed to prepare plans.

Richmond (Surrey) T.C.—The town planning map No. 2 has been prepared by the borough surveyor, Mr. J. H. Brierley, in accordance with the town planning regulations of the Local Government Board.

Wirral R.D.C.—Authority has been received from the Local Government Board to prepare a town-planning scheme.

PARKS AND OPEN SPACES.

Cardiff T.C.—A sum of £250 is to be expended upon the provision of a puddling-pool for children in Roath Park.

Carshalton U.D.C.—The council have completed negotiations for the purchase of about twenty acres of the most beautifully wooded part of the historic Carshalton Park as a public pleasure-ground. The portion obtained contains the main source of the river Wandle, which here emerges from a rustic grotto, and at once becomes a river 50 ft. wide, forming on its way the large pools which are such a remarkable feature in the heart of the village.

Edinburgh T.C.—The Games Sub-Committee have been asked to consider the question of an additional bowling-green at Portobello.

Poole T.C.—The borough surveyor, Mr. S. J. Newman, has been instructed to prepare a plan for a pavilion in Poole Park at a cost not exceeding £150.

York T.C.—The Glen land at Heworth is to be laid out as a recreation-ground at an estimated cost of £1,765.

REFUSE COLLECTION AND DISPOSAL.

Littlehampton U.D.C.—The tender of Messrs. J. Linfield & Son, at £1,039, has been accepted for the erection of refuse destructor buildings.

Tenby T.C.—The council have agreed upon the Cornish Down site as the most suitable for the disposal of the town refuse, and have decided to purchase six dust carts, with proper covers attached, at an estimated cost of £160, the contractor to find horses and men.

ROADS AND MATERIALS.

Aberdeenshire C.C.—It has been decided to spend £200, in addition to the £500 already voted and expended, upon the repair of the Udny road between Pettymuick and Fillycorthie.—The Alford District Committee have decided to apply to the Road Board for a grant towards the estimated cost (£10,000) of improving the main road at Donside.

Balrothery R.D.C.—It has been agreed to take over a private road leading to the Dublin-road, thus shortening the route to Dublin by four miles.

Barnes U.D.C.—Sheen-lane is to be wood paved from High-street to Upper Richmond-road, at an estimated cost of £3,550. Sheen-lane being a county main road, application is to be made to the Surrey County Council asking them for a contribution towards the cost.

Bideford R.D.C.—After considering the recommendations of the county council with reference to the repair of the main roads in the district, the rural district council have decided to divide the district into five parts, and to appoint a full-time labourer in charge of each part, to be responsible for it.—The council have approved of the resolution of the Barnstaple Rural District Council, asking that legislation should be promoted dealing with the width of the wheels of motor lorries, so that they should be at a width commensurate with the weight carried.

Birmingham T.C.—It is necessary in connection with the tramway extension that the paving of Hagley-road from near Francis-road to the Ivy Bush should be taken up and relaid. It is proposed to take up, trim, and relay the existing blocks upon a new concrete foundation. The estimated cost of the foundation and relaying the blocks, for which a loan would be granted, is £3,000, and the Works Committee recommend that the Finance Committee be instructed to borrow the amount, in order that the work may be proceeded with.—In the opinion of the Works Committee it is expedient that a continuation and improvement of Cotterill's-lane should be carried out from Treaford-lane to Stechford-lane. Arrangements have been made for sufficient land to be surrendered to the corporation free to enable the road to be made 50 ft. wide. The estimated cost of the work is £4,670.

Bournemouth T.C.—The council have approved the plans of the borough surveyor, Mr. F. W. Lacey, for a drive and bridge at Boscombe Chine, linking up the Undercliff and the East Overcliff Drive, at an estimated cost of £8,000.

Bridgwater R.D.C.—The question of a new road at Huntspill has been again before the council, and a plan or scheme, which is estimated to cost about £400, has been forwarded to the Works Committee of the Somerset County Council.

Calne T.C.—Kerbing work is to be carried out in several streets, and the pavement of Church-street relaid with granolithic paving.

Celbridge No. 2 (Dublin) U.D.C.—The application of the county surveyor, Mr Collen, for £650 to be expended on steam rolling during the coming year has been approved.

Chippenham R.D.C.—The surveyor, Mr. A. H. Lapham, has recommended the purchase of a tar sprinkler on wheels, and the council have instructed him to supply further particulars at the next meeting.

Cork R.D.C.—It has been decided that all the roads in the Firmount electoral division be handed over to the county surveyor, Mr. J. T. Murphy, to be maintained by direct labour during the ensuing five years.—A new road is to be constructed from Wise's Bridge to Kenry Pike schools at a cost of £560.

East Preston R.D.C.—The surveyor, Mr. H. Vail, has prepared an interim report on a road-widening scheme at Hangleton, Ferring, the cost of which he estimates at £350.

Edmonton U.D.C.—Road improvements estimated to cost £1,382 are to be carried out at the Green.

Hackney B.C.—An offer of a free grant of £7,000 has been made to the council by the Road Board towards the cost of repairing macadam roads subjected to motor-omnibus traffic, in order to enable them to bear this class of traffic. This is the second grant to be made to a London authority for this purpose, Stoke Newington having been granted £1,000 a few weeks ago.—The borough council are recommended by its Works and General Purposes Committee to take steps (if necessary) for presenting a petition against the London County Council Tramways (Trolley Vehicles and Improvements) Bill to be introduced next session. "No provision," the report adds, "is made for any recoupment to the borough council in respect of the heavy additional cost of road maintenance which will be thrown upon the council by reason of the plying of the trolley vehicles on the roads."

Harrogate T.C.—The borough surveyor, Mr. C. E. Rivers, has received instructions to prepare a plan for widening the carriage way of Cornwall-road, and also for dealing with surface water.

Hitchin R.D.C.—Road improvements estimated to cost about £900 are to be carried out.

Horsham U.D.C.—It has been agreed to purchase the frontage of certain premises for the straightening off of a bend from North-street to Park-street at a cost of £750, of which the Road Board offered to contribute £300, the purchase to be subject to the sanction of the Local Government Board.

Huntingdon T.C.—The borough surveyor, Mr. E. Borisson, has prepared plans for a new street on the Cromwell House estate.

Islington B.C.—The Works Committee recommend that applications be made to the Road Board for grants in respect of the cost of paving and repaving works in the following roads:—Green-lanes (from Highbury New-road to Paradise-road), Newington-green, Mildmay-park, Canonbury-road, New North-road, Highbury-park, and Blackstock-road. The total cost of these works is estimated at £22,432. There are in Islington, it was elicited, 124 miles of streets, of which 103½ are macadam-paved—that is to say, in the words of the Works Committee, with a material which "will not withstand the destructive effect of the motor-omnibuses."

Kingston T.C.—Advertisements are to be issued inviting tenders for the making-up, under the Private Streets Works Act, of Woodbines-avenue.

Lewisham B.C.—The borough surveyor, Mr. E. van Putten, has submitted a new form of street name board, consisting of cast-iron letters screwed on to boards, and the Works Committee have authorised him to obtain a supply of letters, which are 11s. 6d. per gross, and to erect some of the boards where required.

Liskeard R.D.C.—It has been agreed to carry out, "as far as practicable," the proposition of the county surveyor, Mr. A. Brookes, that in the forthcoming main roads estimates it should be arranged, when practicable, that permanent lengthsmen should be appointed to definite sections, with a view to more efficient hedging, ditching, and cleaning of water-tables.

Poole T.C.—The council have approved the plan and estimate of the borough surveyor, Mr. S. J. Newman, for providing surface water drainage for Parkstone-avenue and adjacent roads, at an estimated cost of £941.

Swansea T.C.—In connection with the Castle-street widening scheme, by which a bottle-neck in the very centre of the town has been removed, the corporation

have concluded negotiations for the acquisition of a further property belonging to Mr. Benjamin Evans, of Llanfair Grange, Llandovery, for the sum of £6,000. It is the intention to throw most of this site into the public roadway, by which means a sharp turn leading from Temple-street into Castle-street will be obviated, and will also permit of the tramway section being joined up at this point.

Wellingborough U.D.C.—Application has been made to the Road Board for a grant in aid of widening the London-road and Canon-street, estimated to cost £5,002.

West Riding C.C.—It is proposed to spend £7,000 in the ensuing year on tar-spraying, and it is hoped to recover £2,500 of that sum from the Road Board.

SEWERAGE AND SEWAGE DISPOSAL.

Andover T.C.—Extensions to the sewerage works are to be undertaken at a cost of £3,000.

Birmingham T.C.—The Works Committee have accepted the tender of Mr. G. P. Trentham at £727 for relaying part of the sewer in Hagley-road. The committee also propose to deal with the sewage in the Hay Hall estate, Yardley, and the adjacent area of Tyseley, and to carry the storm water into the river Cole which adjoins, by providing new sewers from Hay Mills to Rushey-lane and Wharf-lane, and connecting the same up so as to form an extension of the existing scheme for sewering the district. The estimated cost of carrying out the whole of the suggested new works is £8,700.

Cambridge T.C.—The sewers in Brookfields is to be relaid at a cost of £260 under the direction of the borough surveyor, Mr. J. Julian.

Cannock R.D.C.—The tender of Messrs. Martin and Elemant, at £5,040, has been accepted for the construction of Littlewood sewage outfall works.

Gravesend T.C.—The borough surveyor, Mr. F. T. Grant, has been authorised to prepare plans for a public convenience in Queen-street.

Lambeth B.C.—The council have at length secured the sanction of the London County Council to the construction of an underground convenience on the triangle at Kennington-gate.

Liversedge U.D.C.—The extension of the sewage disposal works—which also serve Cleckheaton and portions of Gomersal and Hunsworth—is to be carried out at an estimated cost of £17,000. The original works, which cost, with trunk sewers and the drainage of the township, about £40,000, have not for some time been adequate for their purposes, and the West Riding Rivers Board have been urging the duty of extension upon the district council. Additional land, costing £2,800, has been acquired, and over £14,000 is to be spent in new tanks, filters, screening-chambers, &c., according to a design by Mr. A. Rothera, M.INST.M.C.E. surveyor and engineer to the council. The normal flow of sewage to the works is about 1,100,000 gallons per day. The method of treatment is by precipitation with lime in the first instance, and afterwards by filtration and land treatment. Under the agreement with neighbouring authorities, the burden of the extra capital cost will be distributed among the different townships in agreed proportions, or failing agreement, by arbitration.

Skirlaugh (Yorks) R.D.C—Sewerage works are to be carried out at Bilton, including the construction of a new main sewer along the main road passing through the village.

Thetford T.C.—Drainage extension works are to be carried out in the Bury-road at a cost of £298.

Woking U.D.C.—The tender of Messrs. Hardy and Co., at £3,556, has been accepted for the Hook Heath main drainage scheme.

WATER, GAS, AND ELECTRICITY.

Aberdeen T.C.—Tenders are being invited for additional generating plant at an estimated cost of £15,510.

Alloa T.C.—Two Venturi meters for the waterworks are to be purchased for £381.

Alnwick R.D.C.—A scheme has been adopted for a new water supply to cost £1,000.

Chapel-en-le-Frith R.D.C—The question of the water supply for Dove Holes and district has occupied the Council for some years. The storage accommodation proved insufficient to tide over the dry periods, and all the available springs had been utilised. It was decided to build another concrete service reservoir of 1½ million gallons capacity, abandoning the old reserve formed in 1887 and using the ground it occupied, and additional land to be acquired, for the purpose. Sanction was obtained from the Local Government Board last autumn to a loan of £4,000. Tenders were invited, and the contractors, Messrs. Daniel Eadie and Co, Ltd., of Stockport, are now constructing the new reservoir, with a view to having it ready for use early in the summer, when it is anticipated there will be sufficient water stored to supply the village and surrounding district for some months during the driest season. The engineers are Messrs. Brady and Partington, Chapel-en-le-Frith.

Croydon T.C.—A well for a water supply is to be sunk at an electricity works at an estimated cost of £1,200.

Darwen T.C.—A new gas-making plant is to be installed at an estimated cost of £25,000.

Dunbar T.C.—Improvements are to be made in the water supply at at estimated cost of £20,000.

Elgin T.C.—It has been agreed to proceed with the formation of a reservoir at Morriston, leading the water from the Blackhills system to that reservoir, and from there back to the town, so as to supply the higher portions, leaving the lower portions of the town to be supplied from Easterton.

Glasgow T.C.—The tender of R. MacLaren & Co., Limited, at £12,145, has been accepted for the supply of cast-iron pipes and special castings for the Craigmaddie reservoir scheme. It has been decided to carry out extensions at the Bridgeton gasworks.

Howden R.D.C.—A report from Mr. Percy Griffith, M.INST.C.E., the engineer for the Howden water scheme, was presented to the council on Saturday. Dealing with the trial boring at South Newbald, Mr. Griffith stated that the results were disappointing. Means had been tried to open communication between the boring and any adjacent fissures, but the effect was not what he had expected. On the other hand, the boring had proved beyond dispute the saturation level in the chalk, and the fact that water percolated very freely through fissures. It was evident that fissures were of comparatively large area, so that if they could be located and tapped a supply of water would be obtained freely. He recommended the deepening of the well to 90 ft., and the driving of about 40 ft. of adit transversely to the valley at the bottom of the well, or at any other level where there may be indications of the chalk being fissured. He asked that expenditure not exceeding £400 be authorised, in addition to the outlay already incurred—about £250. The council agreed to incur the extra expenditure.

Merthyr T.C.—The tender of Messrs. Robert McAlpine and Co., of Victoria-street, Westminster, at £232,000, has been accepted for the construction of a storage reservoir at Pontsticall in the Taff Fechan Valley, Breconshire.

Smethwick T.C.—It is almost certain that a second installation of vertical retorts for the gas undertaking will be commenced at once. Also extensive additions and alterations to mains, new governors and governor-house, high-pressure installation, new fitting shops and stores, and oil storage tank. If not this year, probably next, a new large gasholder and new purifiers will be constructed.

MISCELLANEOUS.

Barnes U.D.C.—Tenders are being invited for two motor fire engines complete.

Battersea B.C.—It has been decided to raise the wages of their hammermen and smiths by 2s. a week, and their labourers by ½d. per hour, to bring them up to the trade union standard.

Fulham B.C.—It has been recommended that the borough surveyor, Mr. Francis Wood, M.INST.Q.E., should be allowed £169 as travelling expenses, to provide and maintain a motor car at his own cost for use in connection with his duties.

Glasgow T.C.—A draft scheme of superannuation has been prepared by the town clerk, the master of works, and the manager of the tramways department. The scheme, which is on the basis of voluntary contributions, applies to all classes in the corporation service.

Wem U.D.C.—A scheme is to be carried out for establishing a public cattle market for the town.

PERSONAL.

Mr. James W. Gordon, burgh surveyor of Cullen, died, we regret to state, on Sunday last.

Mr. Arthur Oddy, borough surveyor of Yeovil, has been granted an increase of salary of £25 per annum.

Mr. R. Chart, jun., has been appointed highway surveyor to the Croydon Rural District Council at a salary of £350 per annum.

Mr. H. R. Hepworth, ASSOC.M.INST.C.E., P.A.S.I., chief assistant engineer to the county surveyor of the West Riding of Yorkshire, has been appointed deputy county surveyor.

Mr. J. B. Holden, surveyor to the Budleigh Salterton Urban District Council, has been granted an increase of salary in respect of his duties as surveyor and inspector of nuisances.

Sir Maurice Fitzmaurice, C.M.G., M.INST.C.E., Messrs. F. R. Gray, council offices, Sheerness-on-Sea, and G. Sturgess, borough surveyor's department, Chelsea, have been elected members of the Royal Sanitary Institute.

Mr. F. W. Pearce, surveyor to the Twickenham Urban District Council, has been appointed one of two delegates to the International Road Congress, and their subscriptions and expenses are to be paid by the council.

Mr. H. Edmund Mathews, F.R.I.B.A., has been appointed surveyor to St. Bartholomew's Hospital in succession to the late Mr. E. B. l'Anson. Mr. Mathews is in partnership with his father, Mr. J. Douglas Mathews, in the City of London.

Mr. F. R. Pearson, who for the last twenty years has been with Messrs. Armitage and Wolff (formerly Mr. G. Faulkner Armitage), architects, of Altrincham, has been appointed as building inspector to the Hale (Cheshire) Urban District Council. The appointment is for a period of six months.

Mr. C. Turton, surveyor to the East Grinstead Rural District Council, has had his salary increased by £15, with a further provision that he is to receive 2½ per cent upon the actual cost as certified for by him under the contract for all new sewerage or waterworks which he shall be called upon to carry out.

Mr. Evan Thomas, Beaumaris, who succeeded his father as surveyor of that borough twenty-five years ago, died, we regret to state, on Saturday, aged sixty-three years. After an accident eighteen months ago he had to have one of his legs amputated, and though he resumed his duties afterwards he felt the effects till his death.

Mr. Bernard Hartley, who has died at his residence at Pontefract, at the age of eighty-five years, was formerly surveyor of bridges for the West Riding, but retired on a pension twenty years ago. He was placed on the Commission of the Peace for the Riding in 1886, and was (the *Times* states) the oldest magistrate in the district.

Mr. R. H. Jeffes, surveyor to the Maldens and Coombe Urban District Council, last week delivered before the members of the New Malden branch of the C.E.M.S. a second lecture on Church Architecture, illustrated by many excellent lantern views. It was given by general request, made because of the success of Mr. Jeffes' first lecture on the same subject in March of last year.

Mr. H. Gilbert Whyatt has been transferred to the class of a full member of the Institution of Civil Engineers. During the twelve years he has been borough engineer and surveyor at Grimsby Mr. Whyatt has carried out many important works, aggregating nearly £84,000 on capital account and over £243,000 on revenue account. Among the works may be mentioned a 6-cell refuse destructor (£11,020), new streets (£9,400), street improvements (£9,970), subways and culverts (£10,400), and many others. He has now on hand schemes for main sewers, part of which will be built on piles £15,500, and flood relief works (£8,000).

Mr. W. H. Makepeace, borough sewage engineer of Stoke-on-Trent, took the chair recently at the first annual staff dinner of the sewage department of the council, and, in the course of a statement, said that during the past fifteen years something like £250,000 had been spent in the borough on works of sewage disposal. Of that sum he personally was responsible for the carrying out of schemes the cost of which amounted to about £150,000. Judging from the recent recommendations of the Royal Commission on Sewage Disposal, he was afraid that the burden placed upon the district authority, instead of becoming lighter, would be increased.

Mr. Reginald Brown, of Southall and 21, Old Queen-street, Westminster, S.W., has been transferred from the class of Associate-Member to that of Member of the Institution of Civil Engineers. Mr. Brown is, as is well known, engineer and surveyor to the Southall-Norwood Urban District Council, and is in private practice as a consulting engineer at Westminster. He is also a Fellow of the Surveyors' Institution, a member of the Institution of Municipal and County Engineers, and a member of the Royal Sanitary Institute. He is the author of several professional papers, including "Artificial Stone for Footways," "The Road Development Act," "Fire Protection in Towns," "The Treatment of Gas Liquor in Relation to Sewage," and "Revolving Sprinklers *v.* Fixed Sprays," read before various societies. He was at one time Lecturer in Sanitary Science at the City of London College, and also for the National Health Society, and is a well-known coach for various professional examinations. In addition to his busy professional life he is an ardent Freemason, and now occupies the J.W. chair of the West Middlesex Lodge; is chairman of the West Middlesex Local Government Officers' Association, president of the Southall-Norwood Rifle Club, president of the West Middlesex Small Holdings Society, and president of the Southall and District Horticultural Society.

ASSOCIATION OF SOMERSET SURVEYORS.

ANNUAL MEETING AT BRIDGWATER.

The annual meeting of the Association of Somerset Surveyors took place at Bridgwater on Saturday last, when the members were cordially received by the Mayor of Bridgwater, who, in an interesting speech, congratulated the association upon its flourishing condition.

This was followed by the election of officers for the current year, Mr. F. Parr, ASSOC.M.INST.C.E., borough surveyor of Bridgwater, being unanimously elected as president in succession to Mr. H. T. Chapman, county surveyor of Somerset, who has guided the deliberations of the association for the first two years of its career with marked success.

Mr. H. T. Chapman, Mr. W. A. Collins, of Bridgwater Rural District, and Mr. F. W. Jones, ASSOC.M.INST.C.E., Frome, were elected as vice-presidents; and Mr. J. Ace Beynon, Frome Rural District, was elected to the post of hon. secretary and treasurer.

The following were elected to serve on the Executive Committee: Messrs. G. Alves, borough surveyor, Glastonbury; T. G. Crump, surveyor, Rural District Council, Taunton; D. Edwards, ASSOC.M.INST.C.E., borough surveyor, Taunton; J. Mathieson, surveyor, Rural District Council, Langport; C. H. Sunderland, surveyor, Midsomer-Norton; E. Stead, assistant county surveyor, Somerset.

The retiring president referred in feeling terms to the loss sustained by the association through the death of Mr. C. Brown, the late city surveyor of Wells.

The meeting were afterwards the guests of the Mayor of Bridgwater at luncheon, following which the new police courts, just completed for the borough from plans prepared by the borough surveyor, were inspected.

The members assembled in the large court-room to hear a paper read upon "Taking out Quantities for Sewerage," by Mr. F. Parr, borough surveyor of Bridgwater, and another upon "Road Maintenance in Rural Districts," by Mr. L. Caplen, surveyor to the Yeovil Rural District Council. The latter paper raised a keen discussion upon the question of adequate locomotion for surveyors, the size of macadam best adopted to withstand traffic, and the practicability or otherwise of using templates for grading the cross-section of highways uniformly.

Discussion upon the paper read by the president was postponed to a future meeting.

About forty took part in the day's proceedings.

Newbury Town Hall.—To take the place of the old town hall at Newbury, Berkshire, which has been demolished for street improvements, the corporation have decided to alter the present corn exchange so as to adapt it for the double purpose of a town hall and an exchange.

THE ROAD PROBLEM.

"JONESWAY" METAL ARMOUR.

A pamphlet issued by "Jonesway," Hampton-in-Arden, sets out a number of reasons for the introduction and advocacy of the "Jonesway" metal armour for roads. The material is a specially prepared one in plates 10 ft. by 2 ft.; it is ductile, and is claimed to resist a crushing weight of no less than 50 tons, and to cover and distribute the moving load over a larger area at a small cost. The local taxation returns are quoted in the pamphlet as proving that the armour is a necessity to the community from the financial point of view, or, in other words, that a stronger road is required in order to resist the destructive forces now at work. The armour is stated to have a minimum endurance of fifteen years. It can be laid down with great rapidity, and among the results of its use are lower costs in the matters of haulage and labour, and a reduction of dust and mud. If only used on one-third the width of the road—namely, the centre—it will, it is pointed out, prove economical by protecting the foundation, retaining the shape of, and attracting the fast and heavy traffic to the strongest part of the road.

INSTITUTION OF MUNICIPAL AND COUNTY ENGINEERS.

President—Mr. R. J. THOMAS, M.INST.C.E., County Surveyor, Buckinghamshire.

EASTERN DISTRICT.

An Eastern District meeting is to be held at the New Middlesex County Council Buildings, Westminster, and Lyons' Victoria Mansions Restaurant, Victoria-street, Westminster, on Friday, February 7th.

PROGRAMME.

3 p.m.—Meet at the Middlesex County Council Offices (in course of construction) opposite Westminster Abbey, and inspect buildings under the guidance of Mr. H. T. Wakelam, M.INST.C.E.

4.30 p.m.—Meeting of the Eastern District Executive Committee at the offices of the institution, 11 Victoria-street, Westminster.

6.30 p.m.—Dinner of the institution at Lyons' Victoria Mansions Restaurant (Victoria-street, Westminster). Tickets, 3s. 6d. each.

7.30 p.m.—Paper on "Sterilisation," with special reference to the ultra-violet rays process, by Dr. Thresh, followed by a short discussion.

8.30 p.m.—Discussion on points of interest or difficulties arising in the ordinary course of practice, to be introduced briefly by members present at the meeting. Important.—It will probably be generally agreed that the number of points of more or less interest and importance which, while not sufficient to form the subject of a paper, might be profitably discussed by the members of the institution must be very great, and members—both senior and junior—and particularly those in the Eastern District, are urged to give to the hon. secretary notice of any points they desire to put forward for discussion at least one week before the date of the meeting.

In order that the necessary arrangements may be made, members must give notice of their intention to be present to the hon. district secretary not later than Monday, February 3rd. Remittance for dinner tickets should be sent to the general secretary in accordance with separate printed notice.

Members are requested to make a special effort to attend this meeting and, if convenient, the dinner. A cordial invitation is extended to members of the institution outside the Eastern District to attend the meeting and discussion.

E. J. ELFORD.
Hon. District Secretary.
Borough Engineer
Southend-on-Sea.

A. FIDLER.
District Chairman.
Borough Engineer.
Northampton.

EAST MIDLAND DISTRICT.

The East Midland District meeting at Newark, [illegible] February 8th, has been altered to Saturday, February 15th.

SOUTHERN DISTRICT MEETING.

A meeting of the Southern District will be held at Southampton on Saturday, February 22nd next.

NORTH-EASTERN DISTRICT.

A meeting of the members of the North-Eastern District will be held in Leeds on Saturday, March 8th.

A meeting of the institution will be held in the North-Eastern District at Newcastle-on-Tyne on May 2nd and 3rd next.

ANNUAL MEETING AND TOWN-PLANNING CONFERENCE.

The Fortieth Annual General Meeting and Conference with delegates from local authorities on Housing and Town Planning will be held at Great Yarmouth on July 23rd, 24th, 25th and 26th next. Those desirous of reading papers at either of these meetings are requested at once to communicate with me.

By order of the Council,
THOMAS COLE,
11 Victoria-street, S.W. *Secretary.*

INSTITUTION OF MUNICIPAL ENGINEERS.

President—Mr. FRANK LATHAM, M.INST.C.E.I., F.S.E., Borough Engineer and Surveyor, Penzance.

COUNCIL MEETINGS.

The following council meetings have been arranged: February 22nd, Newcastle-on-Tyne; March 26th, London; April 30th, London; May 31st, Manchester; June 28th, London; July 30th, London.

WESTERN DISTRICT.

A meeting (of which full programme will be issued later) will be held at Birmingham on Saturday, February 8th or 15th.

GENERAL MEETING.

A visit will be paid to the Building Exhibition at Olympia on April 12th, by kind permission of the promoters. Full particulars will be issued later.

B. WYAND,
39 Victoria-street, S.W. *Secretary.*

ROYAL SANITARY INSTITUTE.

A sessional meeting of the institute will be held at 90 Buckingham Palace-road on Tuesday, February 11th, at 7.30 p.m., when a discussion will take place on "The Eighth Report of the Royal Commission on Sewage Disposal, on Standards and Tests for Sewage, and Sewage Effluents Discharging into Rivers and Streams," to be opened by Samuel Rideal, D.SC., F.I.C., J.P.

The following hope to be present and take part in the discussion: A. P. I. Cotterell, M.INST.C.E., Bristol; Gilbert J. Fowler, D.SC., F.I.C., Manchester; George A. Hart, Leeds; Prof. A. Bostock Hill, M.D., M.SC., Birmingham; Lieut-Colonel A S. Jones, V.C., M.INST.C.E., Finchampstead; W. Kaye-Parry, F.R.I.B.A., M.INST.C.E., Dublin; Baldwin Latham, M.INST.C.E., London; E. G. Mawbey, M.INST.C.E., Leicester; George Reid, M.D., D.P.H., Stafford; J. D. Watson, M.INST.C.E., Birmingham; H. MacLean Wilson, M.D., B.SC., Wakefield.

General discussion is invited.

The chair will be taken at 7.30 p.m. by Colonel T. Walter Harding, D.L., J.P., LL.D.

E. WHITE WALLIS.
Secretary.

Street Moving Stairways.—Lord Montagu of Beaulieu, president of the Automobile Club, giving evidence before the House of Commons Select Committee on Motor Traffic lately, advocated moving stairways at points where traffic was specially congested.

Damages against Council and Contractor.—In the King's Bench Division yesterday, before Mr. Justice Darling and a special jury, Mrs. Ellen Newcombe, widow, of Purley, was awarded £1,000 damages against Mr. Edward Yewen, contractor, and the Croydon Rural District Council, for the loss of her husband, Charles T. Newcombe, a commercial traveller, aged sixty-four. He fell into a trench dug in the road by the defendants for sewer repairs, sustaining fatal injuries. Miss Newcombe, a daughter, was awarded £50. Judgment was entered accordingly.

APPOINTMENTS VACANT.

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ASSISTANT INSPECTOR OF NUISANCES February 1st.—Corporation of Reading. £80—£100.—Mr. W. S. Clutterbuck, town clerk.

ENGINEERING ASSISTANT. — February 1st.—Municipal Engineer's staff in Northern town. £180 per annum.—Box 1,217, office of THE SURVEYOR, 24 Bride-lane, Fleet-street, E.C.

SANITARY INSPECTOR.—February 1st.—Edmonton Urban District Council. £100—£120.—Mr. W. F. Payne, clerk.

CLERK OF WORKS. — February 3rd. — Alsager Urban District Council. £2 per week.—Mr. H. V. Lynam, surveyor.

INSPECTOR OF NUISANCES AND BUILDING SURVEYOR.—February 4th.—Christchurch Rural District Council. £90.—Mr. A. Druitt, clerk.

ROAD SURVEYOR.—February 6th.—Norfolk County Council. £130—£160.—Mr. G. Christopher Davies, clerk, The Shirehouse, Norwich.

SURVEYOR'S JUNIOR ASSISTANT.—February 7th. —Weybridge Urban District Council. £50 per annum. —Mr. John S. Crawshaw, surveyor.

SURVEYOR OF HIGHWAYS AND INSPECTOR OF NUISANCES.—February 8th.—Skirlaugh Rural District Council. £250.—Mr. C. W. Hobson, clerk, Beverley.

ASSISTANT SANITARY INSPECTOR.—February 8th.—Corporation of Southport. £80—£100.—Mr. J. E. Jarratt, town clerk.

INSPECTOR OF NUISANCES.—February 8th.—Bradford Corporation. £85 per annum.—Mr. F. Stevens, town clerk.

INSPECTOR OF NUISANCES.—February 8th.—Failsworth Urban District Council. £135 per annum. —Mr. H. C. Broome, clerk.

INSPECTOR OF NUISANCES.—February 8th.—Cosford Rural District Council. £100 per annum.—Mr. A. Newman, clerk.

SURVEYOR.—February 8th.—For the borough of Clifton Dartmouth Hardness (Corporation of Dartmouth).—Mr. S. J. Pope, town clerk.

BOROUGH ENGINEER'S ASSISTANT.—February 10th.—Corporation of Accrington. £100 per annum.—Mr. William J. Newton, borough engineer.

QUANTITY SURVEYOR.—February 10th.—Beckenham Education Committee.—Mr. F. Stevens, clerk, Council Offices, Beckenham.

BOROUGH ARCHITECT. — February 11th.—Corporation of Swansea. £500 per annum.—Mr. H. Lang Coath, town clerk.

CLERK OF WORKS.—February 13th.—Nantwich Rural District Council. £2 10s. per week.—Mr. H. G. Atkinson, clerk.

INSPECTOR OF MAIN ROADS.—February 15th.—Warwickshire County Council. £175—£210 per annum. —Mr. John Wilmot, county surveyor.

ASSISTANT BOROUGH SURVEYOR.—February 19th.—Corporation of Richmond (Surrey). £250 per annum.—Mr. Henry Sagar, town clerk.

ASSISTANT ENGINEERS. — May 1st.—Indian Public Works and State Railway Departments.—Secretary, Public Works Department, India Office, London, S.W.

JUNIOR ENGINEERING ASSISTANT (Temporary).—No date. The Road Board. £250 and travelling expenses.—Mr. W. Rees Jeffreys, secretary, Queen Anne's Chambers, Westminster.

MUNICIPAL COMPETITIONS OPEN.

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LLANGOLLEN.—February 26th.—Designs for laying out a pleasure garden, for the Llangollen Urban District Council. A prize of 2 guineas is offered.—Mr. J. W. Hughes, surveyor.

RANGOON.—March 1st.—Designs for municipal buildings. Premiums are offered of £300, £200, and £100.—The Clerk to the Rangoon Municipality.

WINNIPEG.—March 1st.—Designs for city hall. Limited to British architects in Canada. Premiums are offered of 5,000 dols., 3,000 dols., and 2,000 dols.—The Clerk.

BARNET.—April 29th. Designs for schemes for the erection of new municipal offices at a cost not exceeding £4,000, for the Barnet Urban District Council. Premiums of £25, £15, and £10 are offered. Mr. H. W. Poole, clerk, 40 High-street, Barnet.

MUNICIPAL CONTRACTS OPEN.

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Buildings.

HYDE.—February 4th.—For erecting mild steel roof principals for public hall, for the corporation.—Mr. Thos. Brownson, town clerk.

WATFORD.—February 4th.—For the erection of a new sub-station and extensions to existing sub-station, for the urban district council.—Mr. W. Hudson, clerk.

STAFFS.—February 6th.—For the erection of a school, for the Education Committee.—Mr. G. Balfour, director of education, County Education Offices, Stafford.

DEVON.—February 6th.—For rebuilding a bridge in reinforced concrete, for the county council.—Mr. F. Bailey, clerk.

CLEETHORPES.—February 7th.—For building a shelter in reinforced concrete, for the urban district council.—Mr. B. Greaves, clerk.

MIDFORD.—February 8th.—For building fifty-two labourers' cottages, for the rural district council.—Mr. S. Watters, clerk.

RADCLIFFE.—February 8th.—For the construction of a footbridge, for the urban district council. Mr. S. Mills, clerk.

BOURNE.—February 8th.—For the erection of six workmen's dwellings, for the urban district council.—Mr. A. R. Agnew, surveyor.

MONMOUTH.—February 10th.—For the erection of stables and coach house, for the county council.—County Surveyor, Newport.

ST. HELENS.—February 11th.—For the erection of a school, for the corporation.—Mr. Perceval Sharp, secretary for education.

EDINBURGH.—February 12th.—For the erection of wash-houses, for the corporation.—Mr. T. Hunter, town clerk.

CARNARVON.—February 17th.—For the erection of twenty-five artisans' dwellings, for the corporation.—Mr. E. Hall, borough surveyor.

BARROW-IN-FURNESS.—February 17th.—For the erection of an infants' school, for the corporation. Borough Engineer and Surveyor.

BRADFORD.—February 18th.—For the erection of eight workmen's dwellings, for the corporation.—Mr. F. Stevens, town clerk.

BRITON FERRY.—February 22nd.—For the erection of sixty-two houses in rows of 9, 10, 11, 12 and 20 houses respectively, for the urban district council.—Mr. H. Alex. Clarke, architect and surveyor.

RHONDDA.—February 25th.—For the erection of refuse destructor and electrical generating works, for the urban district council.—Mr. W. P. Nicholas, clerk.

Iron and Steel.

SHEFFIELD.—February 8th.—For the supply of 1,000 tons of steel tram rails, for the corporation.—Mr. W. J. Hadfield, surveyor of highways.

PENRITH.—February 10th.—For laying and jointing cast-iron piping, with valve and hydrants, for the rural district council.—Mr. J. W. Smith, clerk.

CHARD.—February 10th.—For the supply and delivery of 5-in., 4-in., 3-in. and 2½-in. diameter cast-iron pipes, junctions, bends and other special castings, for the corporation.—Mr. J. A. Forward, town clerk.

CHARD.—February 10th.—For the supply and delivery of 4-in. and 3-in. sluice valves, fire hydrants, air valves, and other special castings, for the corporation.—Mr. J. A. Forward, town clerk.

CHARD.—February 10th.—For laying 5-in., 4-in., 3-in. and 2½-in. diameter water mains, with valves, hydrants, and other works, for the corporation.—Mr. J. A. Forward, town clerk.

BERWICK.—February 12th.—For laying 11 miles of water mains, for the corporation.—Mr. W. Weatherhead, clerk.

Roads.

ESCRICK.—February 4th.—For the supply of best whinstone, tar-macadam, slag and granite, for the rural district council.—Mr. Fred. C. Camidge, clerk, 3 Stonegate, York.

MIDDLESBROUGH.—February 4th.—For the supply of whinstone, limestone, tarred slag and whinstone, for the rural district council.—Mr. W. Richardson, clerk.

WATFORD.—February 4th.—For the supply of distilled tar, for the urban district council.—Mr. D. Waterhouse, engineer.

DESBOROUGH.—February 4th.—For the supply of broken granite and slag, for the urban district council.—Mr. Geo. E. Marlow, surveyor.

MERIDEN.—February 4th.—For the supply of granite, for the rural district council.—Mr. A. W. Liggins, clerk, 11 Priory-street, Coventry.

HORNSEY.—February 4th.—For making up certain roads, for the corporation.—Mr. J. E. Lovegrove, borough engineer and surveyor, Municipal Offices, Highgate.

ALTRINCHAM.—February 4th.—For work of making up, for the urban district council.—Chairman of the Highways Committee.

SHOREHAM.—February 4th.—For making up certain roads, for the urban district council.—Mr. H. Brown, clerk.

MARGATE.—February 4th.—For the supply of large brick burrs and pit flints, for the corporation.—Mr. E. Brooke, town clerk.

CHINGFORD.—February 4th.—For the supply of road materials and hire of steam roller, for the urban district council.—Mr. L. C. Bowen, clerk.

MIDDLESEX.—February 5th.—For the supply of 12,000 tons of hand-broken basalt, for the county council.—Mr. H. T. Wakelam, county engineer, 63 Victoria-street, Westminster, S.W.

HERTFORDSHIRE.—February 5th.—For the supply of broken granite and slag, for the county council.—Mr. Urban A. Smith, county engineer.

MIDDLESEX.—February 5th.—For the supply of basalt and chippings, and the cartage of road materials, for the county council.—The Clerk, 65 Victoria-street, Westminster, S.W.

NORTHAMPTON—February 5th.—For the supply of granite, slag and gravel, for the rural district council.—Mr. W. Fawkes, clerk.

BUCKLOW.—February 5th.—For making up a certain street, for the rural district council.—Mr. George Leigh, clerk, Knutsford.

FULHAM.—February 5th.—For making up the carriageway of Crabtree-lane, for the borough council.—Mr. F. Wood, borough surveyor.

SEDGEFIELD.—February 5th.—For scavenging the townships of Chilton, Cornforth, and Ferryhill, for the rural district council.—Mr. J. W. Lodge, clerk.

STOKESLEY.—February 6th.—For the supply of whinstone, limestone, and tarred slag and whinstone, for the rural district council.—Mr. W. Richardson, clerk.

ISLE OF ELY.—February 6th.—For the supply of broken materials for the repair of main roads, for the county council.—Mr. R. S. W. Perkins, county surveyor, Ely.

DEVON.—February 6th.—For strengthening and resurfacing main roads, for the county council.—Mr. F. Bailey, clerk, Castle of Exeter.

KEIGHLEY.—February 6th.—For work of sewerage, for the corporation.—Borough Engineer.

CLAYTON (Suffolk).—February 6th.—For the supply of granite, pit, and picked stones, for the rural district council.—Mr. R. M. Cook, clerk, 6 Providence-place, Ipswich.

SUTTON (Surrey).—February 6th.—For tar-spraying various roads, for the urban district council.—Mr. Thos. D. Pettiver, clerk.

DEAL.—February 6th.—For the supply of blue Guernsey granite, for the corporation.—Mr. T. C. Golden, borough engineer and surveyor.

BUCKS.—February 6th.—For the supply of hand-picked flints, for the county council.—Mr. R. J. Thomas, county surveyor, Aylesbury.

SELBY.—February 7th.—For the supply of whinstone, for the urban district council.—Mr. Bruce McG. Gray, engineer and surveyor.

STOCKPORT.—February 7th.—For carrying out paving repairs, for the corporation.—Mr. J. Atkinson, borough surveyor.

MONMOUTH.—February 7th.—For works of widening and improving, for the county council.—Mr. W. Tanner, county surveyor, Newport.

BISHOPTHORPE.—February 7th.—For the supply of whinstone, for the rural district council.—Mr. F. Ware, clerk.

BANBURY.—February 8th.—For the supply of broken granite and grouse, for the rural district council.—Mr. E. L. Fisher, clerk.

HORNCASTLE.—February 8th.—For the supply of granite and slag, for the rural district council.—Mr. J. E. Chatterton, clerk.

CRICK.—February 8th.—For the supply of Hartshill granite, Mancetter or Mountsorrel stones, for the rural district council.—Mr. J. W. Pendred, clerk.

FORFAR.—February 8th—12th.—For the supply of highway materials, for the county council.—Mr. D. Ross, Brechin-road, Kirriemuir.

WELLINGBOROUGH.—February 8th.—For the supply of granite, for the rural district council.—Mr. W. Jackson, clerk.

LEES.—February 8th.—For making up part of Stamford-street, for the urban district council.—Mr. W. Ogden, clerk.

REIGATE.—February 10th.—For the supply of road materials and team labour, for the rural district council.—Mr. E. C. Morrison, clerk.

SOUTHAM.—February 10th.—For the supply of granite, for the rural district council.—Mr. W. Wood, clerk.

BIRKENHEAD.—February 10th.—For the supply of horses and drivers for street watering, for the corporation.—Mr. J. Fearnley, town clerk.

BEVERLEY.—February 10th.—For the supply of 3,000 to 4,000 tons of stone for macadamising, for the rural district council.—Mr. F. G. Hudson, clerk.

BIRKENHEAD.—February 10th.—For the supply of granite and Rawtenstall kerbs and channels, Penmaenmawr breaking stone, natural flags, and creosoted red deal paving blocks, for the corporation.—Mr. J. Fearnley, town clerk.

WEETSLADE.—February 11th.—For work of paving, for the urban district council.—Mr. W. Webb, clerk.

MALDENS AND COOMBE.—February 11th.—For works of making up and paving with artificial stone, for the urban district council.—Mr. James W. Johnson, clerk.

BLAYDON.—February 11th.—For the cleansing of ashpits, for the urban district council.—Mr. H. Dalton, clerk.

KINGSTON-UPON-THAMES.—February 12th.—For levelling, paving, metalling, flagging, channelling, sewering, and lighting Woodbines-avenue, for the corporation.—Mr. Harold A. Winser, town clerk.

EASINGWOLD.—February 12th.—For the supply of whinstone and slag, for the rural district council.—Mr. F. J. H. Robinson, clerk.

LUDDENDEN FOOT.—February 12th.—For works of excavating, concreting and granite paving, for the urban district council.—Mr. C. W. Moses, clerk.

ROCHDALE.—February 12th.—For levelling, paving, metalling and flagging, for the corporation.—Mr. W. H. Hickson, town clerk.

RYTON (Durham).—February 12th.—For making up certain streets, for the urban district council.—Mr. H. Dalton, clerk.

REIGATE.—February 12th.—For tar-washing 140,000 yds. super. of roads, for the corporation.—Mr. Alfred Smith, town clerk.

CORK.—February 13th.—For supplying and laying bituminous or other similar street-surfacing materials, for the county council.—Mr. F. W. McCarthy, town clerk.

CORK.—February 13th.—For laying certain streets with Trinidad Lake asphalt-macadam, similar to that laid for the London County Council on the Victoria

Embankment, for the corporation. — Mr. F. W. McCarthy, town clerk.

WOKING.—February 14th.—For the supply of 4,000 tons of broken granite, for the urban district council.—Mr. G. Wooldridge.

ROTHERHAM.—February 15th.—For making up a certain street, for the corporation.—Mr. C. L. Des Forges, town clerk.

COLCHESTER.—February 15th.—For cleansing the cattle market, for the corporation.—Mr. H. Goodyear, borough engineer and surveyor.

WORSLEY.—February 15th.—For making up certain streets, for the urban district council.—Mr. J. F. Monks, clerk.

SURBITON.—February 17th.—For the supply of road materials, brooms, and horse-sweeping brooms, for the urban district council.—The Clerk.

SEVENOAKS.—February 17th.—For the supply of 8,000 gallons of refined tar and 20,000 gallons of crude tar, for the urban district council.—Mr. P. Darbyshire, clerk.

MACCLESFIELD.—February 17th. — For laying sewers, manholes, and flushing tanks, for the rural district council.—Mr. F. May, clerk.

WEST SUFFOLK.—February 17th.—For the supply of broken material, for the county council.—Mr. W. Lionel Jenkins, county surveyor, Bury.

CHERTSEY.—February 17th.—For making up certain streets, for the rural district council.—Mr. H. E. Paine, clerk.

LONG SUTTON (Lincs).—February 18th.—For the supply of broken granite, broken slag, slag screenings and tar macadam, for the urban district council.—Mr. S. S. Mossop, clerk.

LIVERSEDGE.—February 19th.—For the construction of sewage disposal works, for the urban district council.—Mr. T. Mitcheson, clerk.

HORBURY.—February 20th.—For the supply of tarmac, granite, whinstone, limestone, dross, flags, kerbs, and setts, for the urban district council.—Mr. W. Sugars, engineer and surveyor.

LITTLE HULTON.—February 24th.—For the supply of broken granite, grit setts, granite setts, granite and limestone chippings, and grit kerbs, for the urban district council.—Mr. J. H. Heyes, clerk.

TANGIER.—April 10th.—For the construction of a sewer and a road, for the Special Committee of Public Works.—Commercial Intelligence Branch of the Board of Trade, 73 Basinghall-street, E.C.

Sanitary.

ILKESTON.—February 1st.—For laying and jointing cast-iron pipe sewers, concrete tube sewers, stoneware pipe sewers, construction of manholes and flushing chambers, and construction of engine-house, for the corporation.—Mr. S. F. James, town clerk.

LUTON.—February 1st.—For the supply of concrete and stoneware main and socketed pipes, for the corporation.—Mr. W. Smith, town clerk.

SOUTHEND-ON-SEA.—February 1st.—For the construction of six refuse destructor cells, for the corporation.—Mr. H. J. Worwood, town clerk.

HOLYHEAD.—February 1st.—For the construction of sewers, for the urban district council.—Mr. T. R. Evans, clerk.

DRIFFIELD.—February 4th.—For the construction of a 9-in. pipe drain, for the rural district council.—Mr. T. Casson Beaumont, surveyor

ALSAGER.—February 5th.—For the erection and completion of sewage disposal works, to include the building of all tanks, beds, and the work in connection therewith, and the supplying and laying of about 400 yds. of 9-in. stoneware pipe sewer, for the urban district council.—Mr. H. V. Lynam, surveyor.

LEWISHAM.—February 5th.—For the removal of house refuse, for the borough council.—The Surveyor.

THAMES DITTON.—February 5th.—For the extension of sewage disposal works, for the urban district council.—Mr. J. T. Metcalfe, clerk.

PORTWILLIAM.—February 7th.—For laying sewer pipes, for the Machers District Committee.—Mr. C. A. McLean, district clerk, Wigtown.

HORSFORTH.—February 10th.—For laying sewers and constructing manholes, for the urban district council.—Mr. J. Davidson, clerk.

GRIMSBY.—February 10th.—For the construction of a 15-in. glazed stoneware pipe sewer, half to be laid in concrete on piles varying from 8 ft. to 65 ft. in length, for the corporation.—Mr. H. Gilbert Whyatt, borough engineer and surveyor.

DERBY.—February 10th.—For laying earthenware and cast-iron sewers, for the corporation.—Town Clerk.

AMBLESIDE.—February 11th.—For the construction of sewage disposal works, for the urban district council.—Mr. G. Gatey, clerk.

RUSHDEN.—February 12th.—For the construction of sewage disposal works, comprising alteration of existing works, new screening and detritus tanks, sedimentation tanks, storm-water tanks, humus tanks, percolating filters, culverts, drains, ejector house and plant, sludge-drying beds, laying out land, road making and incidental works, for the urban district council.—Mr. W. B. Madin, engineer and surveyor.

HACKNEY.—February 13th.—For the removal of refuse, for the borough council.—Chairman of the Tenders Committee.

GOSPORT AND ALVERSTOKE.—February 13th.—For providing and laying an extension of the sewage outfall, Stokes Bay, in 36-in. cast-iron pipes, for the urban district council.—Mr. E. Talbot Palmer, clerk.

CHIPPENHAM.—February 14th.—For laying a drain and constructing a tank, for the Joint Hospital Committee.—Mr. Edmund M. Awdry, clerk.

WINDERMERE.—February 15th.—For laying and jointing stoneware pipe sewers and cast-iron pipe sewers, and constructing manholes, lampholes, sedimentation tanks, bacteria beds, effluent tanks, sludge lagoons, engine-houses, pump wells and roads, for the urban district council.—Mr. J. T. Bownass, clerk.

BALBY-WITH-HEXTHORPE. — February 17th.—For the construction of detritus tank, sewage tank, percolating filters, humus tanks, sand filters, and other works, for the urban district council. — Mr. Frank Allen, clerk.

PORT SAID.—March 1st.—For the construction of drainage works, for the municipality.—Mr. A. L. Webb, C.M.G., Queen Anne's Chambers, Broadway, Westminster.

Stores.

STEPNEY.—February 8th.—For the supply of bricks, lime, fireclay, brooms, cast-iron work, colours, drainage materials, oilman's goods, Portland cement, pitch, tar, green oil, bitumen, timber, tools, wheelwright's materials, shoeing horses, squaring and redressing old paving materials, ballast, uniform clothing, boots, and disinfectants, for the borough council.—Mr. Geo. W. Clarke, town clerk.

LEIGH.—February 8th.—For the supply of grit setts, flags, kerbstones, macadam, sewerage pipes, castings, brushes, pitch, creosote oil, and tools, for the corporation.—Mr. W. H. Cowburn, town clerk.

FINSBURY.—February 11th.—For the supply of granite patent stone, horse and cart hire, Portland cement, lime, sand ballast, wood-paving blocks, York paving, blacksmith's work, carbolic acid, castings, chandlery, oils, stoneware goods, and timber, for the borough council.—Mr. George Whitehead Preston, town clerk.

EPSOM.—February 11th.—For the supply of sewerage ironwork, gulley gratings, shovels, picks, brooms, forks, disinfectants, Portland cement, stoneware pipes, kerbing, channelling, setts, broken granite, chippings, flints, limestone dust, tarred paving, tarred macadam, coal, coke, hay, corn, straw, bricks, paraffin, artificial stone paving, Thames ballast, veterinary surgeon's services, tar, pitch, and team labour, for the urban district council.—Mr. E. G. Wilson, clerk.

RAWTENSTALL.—February 13th.—For the supply of road metal, earthenware pipes, gullies, timber, pitch, creosote oil, disinfectants, Portland cement, iron castings, flags, setts, tools, brushes, horse-shoeing, and carting, for the corporation.—Mr. James Whalley, town clerk.

HALIFAX.—February 17th.—For the supply of stores required in the electricity department, for the corporation.—Mr. Percy Saunders, town clerk.

RICHMOND (Surrey).—February 17th.—For the supply of ironfounder's work, brooms, forage, road materials, harness, and team labour, for the corporation.—Mr. Henry Sagar, town clerk.

LEEDS.—February 17th.—For the supply of requisites for the tramway department.—Mr. J. B. Hamilton, general manager.

ECCLES.—February 18th.—For the supply of setts, flags, kerbs, broken rubble, granite and macadam chippings, prepared tar limestone, limestone cube chippings, gravel, cinders, castings, pitch, creosote, tar, Simpson's patent street gullies, stoneware-pipe gullies, stoneware pipes, bends, junctions, mortar, and channel stones, for the corporation.—Mr. Edwin Parkes, town clerk.

GOOLE.—February 19th.—For the supply of road metal (Guernsey granite and chippings), granite setts, slag, hardcore, concrete flags, York flags, kerb, channel, stoneware pipes, Portland cement, tar-macadam, brough gravel, coal and bricks, for the urban district council.—Mr. C. G. Bradley, engineer and surveyor.

LEEDS.—February 19th.—For the supply of requisites for the electricity department.—Mr. Robert E. Fox, town clerk.

LEEDS.—February 20th.—For the supply of cement, earthenware drain pipes, sewer ironwork, galvanised dirt-boxes, and sewer ventilating columns, for the corporation.—Mr. W. T. Lancashire, city engineer.

GUILDFORD.—March 5th.—For the supply of broken granite, chippings, granite setts, Durax cubes, brooms, brushes, cast-iron pipes, flints, galvanised steam tubes, disinfectants, horse hire, cartage, iron castings, ironmongery, oils, pitch, tar, Portland cement, lias lime, stoneware pipes, and shoeing, for the corporation.—Mr. A. D. Jenkins, town clerk.

Miscellaneous.

MANCHESTER.—February 6th.—For laying out a recreation ground, for the corporation.—Mr. Thomas Hudson, town clerk.

TENDERS FOR MUNICIPAL WORKS OR SUPPLIES.

The Editor invites the co-operation of SURVEYOR *readers with a view to making the information given under this head as complete and accurate as possible.*

* Accepted. † Recommended for acceptance.

ARGYLL.—Accepted for works of road repair, for the county council:—

T Taylor & Co., Gourock, W.B	£616
J A Paton & Son, Alexandria, Dumbartonshire ...	£374 £352 £279
R Young, Strone	212
J Anderson, Greenock	95

BOSTON.—For the supply of granite and slag, for the rural district council:—

	Tons.
Enderby and Stoney Stanton Granite Company, Leicester ...	9,359
British Macadams, Ltd., Gravesend	3,631
Groby Granite Company, Limited, Leicester	2,134
Holwell Iron Company, Limited, Melton Mowbray	1,896

(At varying prices).

EXETER.—Accepted for the extension of the isolation hospital, for the corporation:—

E. Mudge, Exeter, £16,377.

HUNSLET.—For carrying out private street works, for the rural district council:—

H. C Pullar, Halifax	£194
John Robinson, Wakefield	186
G. L. Briggs & Son, Leeds*	180

LITTLEHAMPTON.—For the erection of a destructor, for the urban district council:—

T. Linfield & Sons, Limited, Littlehampton, £1,039.

LITTLEHAMPTON.—For sewerage alterations, for the urban district council.—Mr. H. Howard, surveyor:—

W. G. Harbour, Littlehampton, £89.

LLANTRISANT AND LLANTWIT FARDRE.—For the completion of the new Ely Valley-road, and branch roads, about three miles in length, for the rural district council.—Messrs Gomer S. Morgan & Thomas Saunders, engineers, School-street, Pontyclun, Glam:—

Ben Jones & Co., Neath	£33,980
Edward Page, Cardiff	30,120
Barnes, Chaplin & Co., Cardiff	26,307
P. J. Davies & Co., Penarth	23,879
J. W. Pearce & Co., Morecambe	22,792
John & West, Llantrisant	22,388
Johnson Brothers, Gloucester*	22,194

MIDDLETON.—For private street works, for the corporation:—

R. Taylor, Middleton	£1,816
R. Partington & Sons, Middleton	1,809
J. Johnson, Lancaster	1,570
R. Heard, Manchester*	1,399
J. T. Hayes, Patricroft	1,308

NEWPORT (Mon.).—Accepted for the construction of an underground convenience, for the corporation:—

W. E. Evans, Newport, £1,440.

POOLE.—The corporation have accepted the following tenders:—

E. P. Pearcey, Parkstone.—Building sanitary conveniences at Sandbanks, £445.

Grounds & Newton.—Private street works in Ravine, Gwynne, Francis, and Douglas roads, at £1,759.

SHERINGHAM.—For the West-end retaining wall and shelter, for the urban district council:—

Thomas W. Pedrette, Enfield	£1,575
E. J. Edwards, Norwich	1,462
Kay Brothers, Huddersfield	1,371
Kirk and Randell, Woolwich	1,339
J. W. Weston, Sheringham*	1,225
R F. May, Norwich	1,198

Surveyor's estimate, £1,250

WATFORD.—For the adaptation of Gisburne House, Watford, for use as an industrial school for girls, for the London County Council:—

I. C. Tennant and Co., Willesden-green	£969
Stevens & Sons, Crouch-hill	867
C. Brettman & Son, Limited, Watford	845
Marchant, Hirst & Co., Kentish-town	779
J. Darvill, Nascot-street, Watford†	721

WILTS.—For alterations at the county offices, for the county council:—

W. E. Chivers & Son, Devizes	£81
Smith & Son, Devizes	62
F. G. Walters, Devizes	57
A. Skull, Corsham*	53

WIRRAL.—For making up work, for the rural district council:—

S. Hutton & Co., Manchester	£1,934
C. L. Warren, Seacombe	1,417
F. Thomas, Birkenhead	1,324
W. P. Meikle, Liverpool	1,279
A. Harris, Birkenhead	1,260

MEETINGS.

Secretaries and others will oblige by sending early notice of dates of forthcoming meetings.

FEBRUARY.

3. Institution of Civil Engineers (Students' Meeting): Vernon Harcourt Lecture on "Canals and Canalised Rivers," by Mr. J. A. Saner, M.INST.C.E. 8 p.m.
3.—Society of Engineers: Mr. Wm. Yorath Lewis on "The 'Bus v. Tram Controversy and other aspects of the London Traffic Problem." Institution of Electrical Engineers, Victoria-embankment. 7.30 p.m.
3. Royal Institute of British Architects: President's address to students; presentation of prizes.
3.—Institute of Sanitary Engineers: Annual Dinner, Holborn Restaurant. 7 p.m.
5.—Insutute of Sanitary Engineers: Paper by Mr. Cuthbert Brown, ASSOC.M.INST.C.E., engineer and surveyor, Edmonton U.D.C., "Reminiscences of a Municipal Engineer."
7.—Institution of Municipal and County Engineers: Dinner and Presentation to President, Lyons' Victoria Mansions Restaurant. 6.30 p.m.
7.—Institution of Municipal and County Engineers: Eastern District Meeting, New Middlesex County Council Buildings and Lyons' Victoria Mansions Restaurant.
8.—Royal Institute of British Architects: President's Address to Students; Presentation of Prizes.
11.—Royal Sanitary Institute: Discussion on Eighth Report of the Royal Commission on Sewage Disposal, on Standards and Tests for sewage, and Sewage Effluents Discharging into Rivers and Streams, 90 Buckingham Palace-road. 7.30 p.m.
15.—Institution of Municipal and County Engineers: East Midland District Meeting at Newark.
17.—Institution of Civil Engineers (Students' Meeting): Vernon Harcourt Lecture on "Canals and Canalised Rivers," by Mr. J. A. Saner, M.INST.C.E. 8 p.m.
17. Institute of Sanitary Engineers: Paper by Mr. A. J. Martin, M.INST.C.E., F.G.S., "A Plea for Scientific Research in the Field of Sewage Purification."
17. Royal Institute of British Architects: Messrs. A. Saxon Snell and Wm. Milburn, on "Modern Hospitals." 8 p.m.
22. Institution of Municipal and County Engineers: Meeting at Southampton.
24.—Surveyors' Institution: Annual Dinner, Whitehall Rooms. 7 p.m.

MARCH.

3.—Society of Engineers: Presidential Address.
8.—Institution of Municipal and County Engineers: North Eastern District Meeting at Leeds.

APPOINTMENTS OPEN.

Official and similar advertisements received up to 3.30 p.m. on Thursdays will be inserted in the following day's issue, *but those responsible for their despatch are recommended to arrange that they shall reach* THE SURVEYOR *office by noon on* **Wednesdays** *to ensure their inclusion in the weekly list of summaries. Such advertisements may, in cases of emergency only, be telephoned (No.* 1359 *Holborn), subject to later confirmation by letter.*

COUNTY BOROUGH OF SWANSEA.
APPOINTMENT OF BOROUGH ARCHITECT.

The Corporation of Swansea invite applications for the appointment of Architect to the Corporation of Swansea, at a salary of £500 per annum.

The gentleman appointed must devote the whole of his time to the duties of the office; staff and accommodation will be provided by the Corporation.

Applicant must be fully qualified and practical architect.

Conditions and particulars of the appointment can be had on application to the undersigned.

Canvassing is prohibited, and will disqualify any candidate.

Applications, accompanied by not more than three recent testimonials, endorsed "Borough Architect," to be sent to the undersigned by 25th February next.

H. LANG COATH,
Town Clerk.

Guildhall, Swansea.
January 21, 1913.

NANTWICH RURAL DISTRICT COUNCIL.

SEWERAGE AND SEWAGE DISPOSAL WORKS.

CLERK OF WORKS.

The above Council require the services of a duly qualified Clerk of Works to take charge of the above under the direction of their Engineer.

The appointment will be temporary, and will last from 6 to 9 months, and whole-time services will be required.

Salary, £2 10s. per week.

Applicants should have had experience in the construction and carrying out of modern sewerage and sewage disposal works, including construction of bacteria filters, &c., and should be able to take levels.

The appointment will be subject to one month's notice on either side.

Applications, stating age, experience and qualifications, and accompanied by copies of three recent testimonials, to be sent to me, the undersigned, on or before the 13th proximo, endorsed "Clerk of Works."

H. G. ATKINSON.
Clerk to the Council.

152 Hospital-street,
Nantwich.
January 27, 1913.

NORFOLK COUNTY COUNCIL.

WESTERN DIVISION HIGHWAYS COMMITTEE.

TO ROAD SURVEYORS.

The above Committee is prepared to receive applications from properly qualified Road Surveyors for the Appointment of a Surveyor for the Watton District of the County.

The Surveyor, acting under the supervision of the County Surveyor, will have charge of all the Main Roads for the time being in his District. At present there are about 105 miles of road.

The Surveyor will be required to devote the whole of his time to the duties. Salary £130 per annum, rising to a maximum of £160. Age not to exceed 45 years.

The Surveyor will be required to provide means of travelling his district to the satisfaction of the County Surveyor.

Three months' notice on either side to terminate the engagement.

Applications, in the candidate's own handwriting, must state age, previous experience in road maintenance and keeping accounts, and when the candidate could commence duties, and must be accompanied by a summary, a Form of which can be obtained from the County Surveyor, and by copies of three testimonials of recent date as to character and practical acquaintance with road work, to be sent to the Clerk to the County Council, at the Shirehouse, Norwich, on or before Thursday, 6th February next.

Any further particulars may be obtained from T. H. B. Heslop, M.INST.C.E., County Surveyor, Shirehouse, Norwich.

G. CHRISTOPHER DAVIES,
Clerk of the Norfolk County Council.

The Shirehouse, Norwich.
January 23, 1913.

PUPIL.—The Borough and Waterworks Engineer of Leamington (A.M.I.C.E.) has a vacancy in his office for a Pupil.—Address, Town Hall.

SKIRLAUGH RURAL DISTRICT COUNCIL.

APPOINTMENT OF SURVEYOR OF HIGHWAYS, INSPECTOR OF NUISANCES, &c.

The Council hereby invites Applications from qualified persons for the Appointment of Surveyor of Highways and Inspector of Nuisances.

The person appointed will be required to perform all the duties of Highway Surveyor and Inspector of Nuisances, including those of Designated Officer under the Housing Acts, and Inspector under the Factory and Workshop Acts, and the Dairies, Cowsheds, &c., Order, 1885.

He will also be required to advise on all building plans submitted under the District By-laws, and to prepare plans and estimates for village sewerage.

He will be required to live in the district, to devote his whole time to his duties, and to provide and maintain an efficient motor cycle or other motor vehicle for locomotion in the district. Applicants should hold the Certificate of the Royal Sanitary Institute, or other competent body, and their ages should not exceed forty years.

The total annual salary will be £230, inclusive of all expenses, and will be apportioned as—Highway Surveyor £100, Inspector of Nuisances £130.

The district is practically purely agricultural, and comprises about 200 miles of highway; the area is about 64,000 acres, and the population 7,162.

Applications, to be made only on the prescribed form (which will be forwarded on receipt of stamped addressed envelope), accompanied by copies of three recent testimonials, must reach the undersigned on or before the 8th proximo.

Security to the extent of £250 will be required.

Canvassing, either directly or indirectly, will be deemed a disqualification.

(By order)

C. W. HOBSON,
Clerk to the Council.

Beverley,
21st January, 1913.

CORPORATION OF ACCRINGTON.

Required, in the Office of the Borough Engineer, a competent Assistant. He must be a person of undoubted ability, well versed in Municipal work, a good Draughtsman and Surveyor, able to prepare Plans, Specifications, Details and Estimates for all classes of work incidental to a Municipal Office.

Salary £100 per annum.

Applications, endorsed "Assistant," stating age, experience, and qualifications, accompanied by not more than three recent testimonials, to be delivered to me not later than Monday, the 10th day of February next.

Preference will be given to those holding the Diploma of the Institution of Municipal and County Engineers or kindred Institution.

WILLIAM J. NEWTON, A.M.I.C.E., M.S.A.,
Borough Engineer.

Town Hall, Accrington,
January 30th, 1913.

BOROUGH OF RICHMOND (SURREY).

The Richmond (Surrey) Town Council invite applications for the position of Assistant Borough Surveyor.

Commencing salary £250 per annum.

Age not to exceed 35 years.

Candidates must have had practical experience of such engineering and building works as are usually carried out by a Municipal Surveyor, and must have been accustomed to the control and management of an outdoor staff of foremen and workmen.

Preference will be given to Candidates who are Associate Members of the Institution of Civil Engineers.

Candidates must also be thoroughly conversant with up-to-date methods of road construction and maintenance, and be competent to set out and superintend works during construction.

The person appointed will be required to attend certain Committee Meetings, held in the evening.

A list of duties, conditions of appointment, and Form of Application will be furnished to intending candidates by the Borough Surveyor, Town Hall, Richmond (Surrey), on receipt of an addressed foolscap envelope.

Canvassing Members of the Council is strictly prohibited, and will disqualify.

Applications, endorsed "Assistant Borough Surveyor," must reach the undersigned not later than Wednesday, the 19th February, 1913.

HENRY SAGAR.
Town Clerk.

Town Hall,
Richmond, Surrey,
28th January, 1913.

WARWICKSHIRE COUNTY COUNCIL.
APPOINTMENT OF INSPECTOR OF MAIN ROADS.

The Council invites Applications for the Appointment of a Road Surveyor to act as Inspector of Main Roads for the Western Division of the County, to take charge (under the superintendence of the County Surveyor) of about 100 miles of main roads.

Applicants must be between the ages of 25 and 40, and must have had practical experience in all the duties of a Road Surveyor, including the use of Tarred Macadam, Surface Tarring, Pitch Grouting, and all modern methods of Road Repair. APPLICATIONS FROM PERSONS WHO HAVE NOT HAD THIS EXPERIENCE CANNOT BE CONSIDERED.

The commencing salary is £175 per annum, rising by annual increments of £5 to a maximum of £210, and is to cover travelling and all other expenses except stationery and postages. The Council will provide a motor-bicycle for the use of the Inspector, but all expenses connected with the running and repairs of the same are to be borne by the Inspector.

The Inspector must enter on his duties not later than 1st April next, and must reside at a place in the district to be approved by the County Surveyor.

Forms of application and particulars of duties and terms of appointment may be obtained at my office, but will only be forwarded through the post on receipt of a stamped and addressed foolscap envelope.

Applications, accompanied by copies of not more than three recent testimonials, *which will not be returned*, to be made on the official form, must reach me not later than 15th day of February, 1913.

Canvassing in any form will be a disqualification.

JOHN WILLMOT,
County Surveyor.

6, Waterloo-street,
Birmingham.

THE URBAN DISTRICT COUNCIL OF WEYBRIDGE.

The Council require a Junior Assistant in the Surveyor's Department.

Applicants must be good penmen, and have a knowledge of municipal accounts and the general routine of the duties of a Surveyor's office, and be competent to assist generally.

Preference will be given to applicants who have had previous experience in a Surveyor's department.

The salary will be £50 per annum.

Applications, in the Candidate's own handwriting, stating age, and accompanied by copies of not more than two recent testimonials, to be sent to the undersigned on or before Friday, February 7th, 1913.

JOHN S. CRAWSHAW,
Surveyor.

Council Offices,
Weybridge.

WANTED, in the office of the Surveyor to an Urban District Council near London, a qualified Assistant for a few months in connection with the preparation of plans for a Town Planning Scheme. Previous experience in Town Planning Schemes necessary. Applications, stating age, particulars of previous experience, and salary required, and accompanied by copies of recent testimonials, to be delivered to Box 1,219, office of THE SURVEYOR, 24 Bride-lane, Fleet-street, E.C.

COMPETITIONS OPEN.

GARDEN SCHEME COMPETITION.

The Llangollen Urban District Council invite Designs for laying out a Pleasure Garden on the banks of the River Dee.

A prize of Two Guineas will be given for the accepted design.

A plan and particulars will be sent on application to the undersigned on receipt of 2s. 6d.

Designs to be sent in so as to reach me not later than Wednesday, February 26th.

JNO. W. HUGHES,
Surveyor.

Town Hall,
Llangollen.

BARNET URBAN DISTRICT COUNCIL.
MUNICIPAL OFFICES.

The above-named Council invite Designs from competent Architects for schemes for the Erection, at a cost not exceeding £4,000, of New Municipal Offices within the Urban District.

The following premiums are offered: First premium £25, second premium £15, third premium £10.

Copies of the Conditions and Instructions to Architects, together with any other particulars, may be obtained on application to the Surveyor to the Council, Mr. W. F. Wilkins, C.E., M.S.E., at his Office, No. 40 High-street, Barnet, Herts.

The designs, endorsed "Municipal Offices," must be addressed to H. W. Poole, Esq., Clerk to the Council, and delivered at the Council Offices, No. 40 High-street, Barnet, not later than the 29th day of April, 1913.

H. W. POOLE,
Clerk to the Council.

January 21, 1913.

TENDERS WANTED.

BOROUGH OF GUILDFORD.

The Town Council invite Tenders for the Supply of the following materials, for a period of twelve months ending March 31, 1914:—

Schedule No.

1. Broken Granite, Chippings, Granite Setts and Durax Cubes.
2. Brooms and Brushes.
3. Cast-iron Pipes.
4. Flints.
5. Galvanised Steam Tubes.
6. Disinfectants.
7. Horse Hire and Cartage.
8. Iron Castings.
9. Ironmongery.
10. Oils.
11. Pitch and Tar.
12. Portland Cement and Lias Lime.
14. Stoneware pipes, &c.
15. Shoeing, &c.

All Particulars, Specifications, Schedules and Forms may be obtained on application to the Borough Engineer, Mr. C. G. Mason, ASSOC.M.INST.C.E., Tuns Gate, Guildford.

Tenders, in separate envelopes, sealed and endorsed on the outside "Tender for ——," must be delivered to me, the undersigned, before 12 noon on Wednesday, the 5th day of March, 1913.

The Council do not bind themselves to accept the lowest or any Tender.

A. D. JENKINS,
Town Clerk.

Town Clerk's Office,
Bridge-street,
Guildford.
January 24, 1913.

CITY OF YORK.

The Corporation of the City of York invite Tenders for the supply of the following material during the year ending March 31st, 1914, in such quantities and at such times as may be ordered—viz.:—

Portland Cement.	Building and Sewage Lime.
Stoneware Pipes.	Pitch and Creosote Oil.
Sludge Press Cloth.	Yorkshire Stone Flags, Kerbing and Edging.

Whinstone (Broken and Rough), Slag (Broken and Rough), and Limestone Chippings.

Forms of Tender will be supplied upon application to the undersigned.

Tenders, sealed and endorsed, to be delivered to me on or before the 8th February, 1913.

The Corporation do not bind themselves to accept the lowest or any Tender, and reserve the right to accept one or more Tenders for any portion of the material required.

F. W. SPURR,
City Engineer.

Guildhall, York.
January 20, 1913.

BOROUGH OF CHARD.

CHARD WATER SUPPLY.

CONTRACT No. 2.

The Corporation of Chard is prepared to receive Tenders from Contractors for the Supply and Delivery of 5-in., 4-in., 3-in. and 2½-in. diameter Cast-iron Pipes, Junctions, Bends and other Special Castings.

Drawings may be seen, and Quantities, Form of Tender and other particulars obtained, on application to Messrs. Dodd & Dodd, MM.INST.C.E., County Chambers, Corporation-street, Birmingham, on and after 23rd January, 1913, on payment of Five Guineas, which will only be returned upon the receipt of a *bonâ-fide* Tender, and the return of all documents to the Engineers.

Sealed Tenders, endorsed "Tender for Contract No. 2," are to be delivered at my Office in Chard at or before noon on 10th February, 1913.

The lowest or any Tender will not necessarily be accepted.

By Order,

J. A. FORWARD,
Town Clerk.

BOROUGH OF CHARD.

CHARD WATER SUPPLY.

CONTRACT No. 3.

The Corporation of Chard is prepared to receive Tenders from Contractors for the Supply and Delivery of 4-in. and 3-in. Sluice Valves, Fire Hydrants, Air Valves, and other Special Castings.

Drawings may be seen, and Quantities, Form of Tender and other particulars obtained, on application to Messrs. Dodd & Dodd, MM.INST.C.E., County Chambers, Corporation-street, Birmingham, on and after 23rd January, 1913, on payment of Five Guineas, which will only be returned upon the receipt of a *bonâ-fide* Tender, and the return of all documents to the Engineers.

Sealed Tenders, endorsed "Tender for Contract No. 3," are to be delivered at my Office in Chard at or before noon on 10th February, 1913.

The lowest or any Tender will not necessarily be accepted.

By Order,

J. A. FORWARD,
Town Clerk.

BOROUGH OF CHARD.

CHARD WATER SUPPLY.

CONTRACT No. 4.

The Corporation of Chard is prepared to receive Tenders from Contractors for laying 5-in., 4-in., 3-in. and 2½-in. diameter Water Mains, together with Valves, Hydrants and other works.

Plans, Sections and detail Drawings of the proposed works may be seen, and Quantities, Form of Tender and other particulars obtained, on application to Messrs. Dodd & Dodd, MM.INST.C.E., County Chambers, Corporation-street, Birmingham, on and after 23rd January, 1913, on payment of Five Guineas, which will only be returned upon the receipt of a *bonâ-fide* Tender and the return of all documents to the Engineers.

Sealed Tenders, endorsed "Tender for Contract No. 4," are to be delivered at my Office in Chard at or before noon on 10th February, 1913.

The lowest or any Tender will not necessarily be accepted.

By Order,

J. A. FORWARD,
Town Clerk.

RUSHDEN URBAN DISTRICT COUNCIL.

SEWAGE DISPOSAL WORKS.

CONTRACT No. 1.

The Rushden Urban District Council invite Tenders for the construction of Sewage Disposal Works, comprising Alterations to existing works, New Screening and Detritus Tanks, Sedimentation Tanks, Storm-water Tanks, Humus Tanks, Percolating Filters, Culverts, Drains, Ejector House and Plant, Sludge Drying Beds, Laying out Land, Road Making and Incidental Works, all within the Urban District of Rushden.

Copies of the General Conditions of Contract, Specification and Bills of Quantities, with Forms of Tender, may be obtained and Drawings inspected on application to the Engineer on or after 23rd January, 1913, on payment of £5, which will be returned on receipt of a *bonâ-fide* Tender, not afterwards withdrawn, and return of all documents entrusted to the Contractor for the purpose of Tendering.

The Council do not bind themselves to accept the lowest or any Tender.

Sealed Tenders, addressed to the undersigned, endorsed "Sewage Disposal Works," are to be delivered at my office not later than 12 o'clock noon on Wednesday, the 12th February, 1913.

By order of the Council,

W. B. MADIN,
Engineer and Surveyor.

Council Buildings.
Rushden.
January 17, 1913.

BRITON FERRY URBAN DISTRICT COUNCIL.

HOUSING OF THE WORKING CLASSES.

TO BUILDERS AND CONTRACTORS.

The Urban District Council of Briton Ferry invite Tenders for the erection of Sixty-two Houses in Rows of 9, 10, 11, 12 and 20 Houses respectively.

Plans and Specifications may be seen at the offices of the undersigned after Saturday, 25th January. Persons desirous of Tendering are requested to notify the Architect, and to deposit with him the sum of One Guinea, which will be returned upon receipt of a *bonâ-fide* Tender.

Sealed Tenders, marked "Tender for Workmen's Dwellings," must be sent to James Revell, Esq., Clerk and Solicitor to the Council, not later than 22nd February, 1913.

The Council do not bind themselves to accept the lowest or any Tender.

H. ALEX. CLARKE,
Architect and Surveyor.

Council Offices.
Briton Ferry.
January 20, 1913.

SUTTON (SURREY) URBAN DISTRICT COUNCIL.

TENDERS FOR TAR-SPRAYING.

Tenders are invited by the District Council for the Tar-spraying of various roads in the district. Full particulars may be obtained from Mr. Wm. Hedley Grieves, the Surveyor to the Council, Municipal Offices, Sutton.

Tenders, sealed and endorsed "Tar-Spraying," must reach the undersigned not later than 4 p.m. on Thursday, the 6th February, 1913.

The Council do not bind themselves to accept the lowest or any Tender.

THOS. D. PETTIVER,
Clerk to the Council.

Municipal Offices,
Sutton, Surrey.
January 27, 1913.

BOROUGH OF REIGATE.

TO ROAD-TARRING CONTRACTORS.

The Reigate Town Council invites Tenders for tar-washing about 140,000 yds. super. of roads within the borough, the price to include cleaning, tarring and gritting the tar surface, and all other necessary works in connection therewith.

Sealed Tenders, which are to state the price per yard super., with full description of the mode of treatment, are to be delivered at my office at the Municipal Buildings, Reigate, on or before noon of Wednesday, the 12th day of February next.

The person whose Tender is accepted will be required to enter into a Contract in accordance with a Form to be seen at my Office aforesaid.

The Council does not bind itself to accept the lowest or any Tender.

Dated this 27th day of January, 1913.

By Order,

ALFRED SMITH,
Town Clerk.

BOROUGH OF RAWTENSTALL.

TENDERS FOR MATERIALS AND LABOUR, PRINTING AND STATIONERY, AND NEWSPAPERS AND MAGAZINES.

The Corporation of Rawtenstall invite Tenders for the Supply of the following:—

(1) Road Metal, Earthenware Pipes and Gullies, Timber, Pitch, and Creosote Oil, Disinfectants, Portland Cement (British), Iron Castings, Local Stone (Flags, Setts, &c.), Workmen's Tools, Scavenging Brushes, and Horse Shoeing. Also for the Carting of Road Metal from the Railway Stations and for Team Labour.

(2) Printing and Stationery required by the various departments.

(3) Newspapers and Magazines required at the public library.

Forms of Tender can be obtained on application to the Borough Surveyor, Town Hall, Rawtenstall.

Sealed Tenders, endorsed with the names of the articles Tendered for, must reach the Town Clerk's Office, Rawtenstall, not later than 12 o'clock noon on Thursday, the 13th February next. The Corporation do not bind themselves to accept the lowest or any Tender.

N.B.—Tender Forms will not be issued unless applied for, and no Tender will be considered that is not delivered within the prescribed time.

By Order,
JAMES WHALLEY,
Town Clerk.

Town Hall, Rawtenstall.
January 30, 1913.

CITY OF LEEDS.

ANNUAL CONTRACTS FOR STORES.

The Sewerage Committee invite Tenders for the Supply of the following Stores during the twelve months ending 31st March, 1914:—

Cement,
Earthenware Drain-pipes, &c,
Sewer Ironwork,
Galvanised Dirt-boxes,
Sewer Ventilating Columns.

Forms of Tender, Schedules, and all particulars may be obtained at the Office of the undersigned.

Tenders must be on the Official Form, properly endorsed, and delivered at the Town Clerk's Office, Great George-street, Leeds, not later than 10 a.m. on Thursday, February 20th, 1913.

The Corporation do not bind themselves to accept the lowest or any Tender.

W. T. LANCASHIRE,
City Engineer.

Municipal Buildings, Leeds,
January 28th, 1913.

BOROUGH OF ECCLES.

The Eccles Corporation invite Tenders for the supply of the following Materials, for the year ending March 31st, 1914:—

Setts (Granite, Grit, Lonkey Paving, Crossing, and Flag Rock), Flags (Best and Seconds Barns), Flags (Concrete), Flags (Manhole, Lampeye, and Gully), Kerbs (Rough, Straight, and Circular), Broken Rubble (per ton), Granite Macadam and Chippings, Prepared Tarred Limestone, Limestone Cube Chippings, Gravel (Pit or River, per ton), Cinders (per ton), Castings, Pitch, Creosote and Tar, Simpson's Patent Street Gullies, Stoneware Passage Gullies, Stoneware Pipes, Bends and Junctions, Mortar (per ton), Channel Stones (Straight and Circular).

Forms of Tender and particulars may be obtained on application to Mr. Thomas S. Picton, Borough Surveyor, Eccles.

Sealed Tenders, which must be enclosed in the official envelope provided, to be forwarded to the undersigned not later than 9 a.m. on Monday, the 17th February, 1913.

Samples of all materials tendered for must be supplied, carriage paid, to the Borough Surveyor, not later than Tuesday, the 18th February, 1913.

The lowest or any Tender will not necessarily be accepted, nor will any allowance be made to persons tendering.

EDWIN PARKES,
Town Clerk.

Town Hall, Eccles,
January 28th, 1913.

URBAN DISTRICT OF FINCHLEY.

TAR FOR ROAD SURFACE TREATMENT.

The Council of the above-named District invite Tenders for the supply in barrels, to the various Depots within their District, of about 30,000 gallons of Tar, in such quantities, and at such times, as may be desired by their Engineer. The Council also to have the option of increasing the quantity up to 50,000 gallons at price quoted.

Persons tendering to give the following particulars with respect to the Tar tendered for:—

(*a*) Specific gravity.
(*b*) Percentage of water, ammonia, and free carbon.
(*c*) Percentage of tar produced from carbonated water gas.

Sealed Tenders, endorsed "Tar," to be addressed to the undersigned, and delivered not later than 5 p.m. on the 17th February, 1913.

The Council does not bind itself to accept the lowest or any Tender.

E. H. LISTER,
Clerk of the Council.

Council Offices,
Finchley, N.,
28th January, 1913.

EPSOM URBAN DISTRICT COUNCIL

TENDERS FOR STORES.

The Council are prepared to receive Tenders from persons willing to enter into Contract for Work and for the Supply of Stores, &c, for the period of one year or under, commencing 1st April, 1913, viz.:—

Sewerage Ironwork.
Gulley Gratings.
Shovels, Picks, Brooms, Forks, Dust Skeps, &c.
Disinfectants.
Portland Cement.
Stoneware Pipes and Gulleys, &c.
Kerbing and Channelling.
Setts.
Broken Granite, Chippings, Flints and Limestone Dust.
Tar Paving and Tarred Macadam.
Coal and Coke.
Hay, Corn, Bran, and Straw.
Bricks.
Paraffin.
Artificial Stone Paving.
Thames Ballast and Thames Sand.
Veterinary Surgeon's Services (inclusive).
Tar, Pitch, &c.
Team Labour.

Forms of Tender, with Schedule, may be obtained, and Specifications seen, upon application to the offices of Mr. Edward R. Capon, Surveyor, Bromley Hurst, Church-street, Epsom, between the hours of 9 a.m. and 5 p.m., Saturdays excepted, when the hours will be 9 a.m. till 1 p.m.

Sealed Tenders, addressed to the Clerk of the Council, and endorsed "Tenders for Stores," to be delivered at the Clerk's Office on or before 5 o'clock p.m. on Tuesday, February 11th, 1913.

The Council do not bind themselves to accept the lowest or any Tender.

E. G. WILSON,
Clerk to the Council.

"Duncannon,"
Church-street,
Epsom.

COUNTY COUNCIL OF WEST SUFFOLK.

MAIN ROADS.

Tenders are invited for the supply of Broken Material, to be delivered at Railway Stations and Wharves in the County.

Conditions of Contract, with Specification and Form of Tender, may be obtained on application to the undersigned.

Tenders to be sent in on or before Monday, 17th February, 1913.

W. LIONEL JENKINS, A.M.I.C.E., P.A.S.I.,
County Surveyor.

County Surveyor's Office,
Shire Hall,
Bury St. Edmunds.
29th January, 1913.

The Surveyor

And Municipal and County Engineer.

Vol. XLIII. FEBRUARY 7, 1913. No. 1,099.

Minutes of Proceedings.

Should the Road Board Make Unconditional Grants?

At a recent meeting of the Staffordshire County Council it was proposed that the Road Board should be asked for grants for highway improvements, such grants to be sufficient, in each case, to cover the whole cost of the improvement, the county council contributing nothing. The view was expressed that it was the intention of Parliament that the Road Board funds should be used in relief of local taxation, and that the action of the board in making a local contribution a condition of the grant is unjustifiable. As our readers are aware, much dissatisfaction has been expressed in other counties with the policy of the board in this matter, and there seems to be an idea slowly forming that if the counties combined to refuse conditional grants the board would be obliged to reconsider this policy. Any such action is strongly to be deprecated. For one thing, the money which the counties refused would be gladly accepted by boroughs and cities for help in carrying out improvements which are in any case almost certain to be regarded as necessary within the next ten years or so. For another thing, the district councils are not obliged to ask for grants through the county councils, and many districts where a rise in annual expenditure is inevitable would be glad, under the cover of the word "improvement," to dilute their expenditure with Road Board grants.

We ask the pardon of the Road Board and of the local councils for the almost indecent candour exhibited in these observations, which have been made in order to clear the ground for a practical suggestion. Works of road improvement fall into two classes—those which result in decreased annual expenditure, or a check upon the rate of increase of such expenditure, and the other class which are undertaken with a view to increasing the usefulness of the road for traffic, and may, in some cases, actually increase expenditure. If the counties and districts are dissatisfied with the results of the latter class, let them confine their applications for grants to the former class. If the lowering of hedges and the easing of turnings result in rapid wear of the crust, and if remetalling with harder and more costly stone increases the annual expenditure, let such improvements be classed together with others tending to increased cost, or failing to reduce costs, and let all applications for grants for such improvements be marked "Without a local contribution to the cost." If the Road Board does not care to make such grants off its own bat, those improvements can wait. The initiative rests with the local councils. This need not, however, lead to a deadlock, for there certainly is a large class of improvements which will, if carried out, lead to reduced costs of maintenance. The opportunity now afforded for the carrying out of such improvements is an exceedingly good one.

As recently pointed out in these columns, the amount of capital which the surveyor can expend upon such an improvement, with distinct economy, is definitely limited to that sum which represents the capital value of the reduction in the cost of maintenance. If, however, the Road Board contributes half the amount, the capital which can be advantageously expended per furlong of the road is doubled. Suppose, for instance, that the expenditure of £500 on remaking a mile of road crust with good foundations would reduce the annual cost of maintenance by £12 a year, that is not good enough as a direct economy; but it becomes quite good enough as a direct local advantage if the board contributes £300 out of the £500, and may be worth doing if the board contributes only £200. A practical difficulty is that the separate grants may be too small for the economic application to the problem of the necessary skill and professional time; but there are ways of getting over this. If, for instance, an area were selected where four counties meet, and if all four counties confined their applications for grants to this area, the highway committees could carry out the work with a special engineer acting under the instructions of the four county surveyors as an executive committee. The work could be strictly confined to such operations as tend to direct economy, and the cost of maintenance of the roads affected would be the subject of a special audit for several years, and special inspection by the Road Board. There are other practical ways in which use might be made of Road Board funds in such a manner as to satisfy the local ratepayers, while, at the same time, they rendered the provision of future improvements in traffic facilities easier of accomplishment, and more economical in regard both to capital expenditure and their effects on maintenance. A dog-in-the-manger policy is not in question; but we trust that none of the counties will imitate the animal which tied its chain with knots and then complained that it could not get into its kennel out of the cold and rain.

* * *

A Year's Work in Chicago.

The vast proportions of the Public Works Department of the city of Chicago are made evident by the annual report for 1911, a copy of which has just reached us. The organisation of the department is on the American system, the various bureaus—each having its own chief—being under the general superintendence of the

Commissioner of Public Works. It does not appear that the year under review in the report was marked by the execution of any works of great magnitude, but an enormous amount of detail and routine work was accomplished. We cannot of course in this place do more than notice the activities of one or two of the bureaus concerned with matters of the greatest interest to British municipal engineers. The head of the Bureau of Sewers complains that the inadequacy of the funds at his disposal renders thoroughly efficient administration a matter of impossibility. This would seem to be a serious matter, more particularly as regards cleansing and maintenance, for a large amount of work has been accomplished during the year in the construction of sewers both by special assessment and private contract. In regard to house drainage, it is interesting to note that a few years ago there was considerable controversy regarding the advisability of using tile pipes, it being doubted whether that material was watertight. Such drains have now been allowed for five years, and they have been submitted to a water test with 2 ft. head before being passed; and the report states that if properly laid the drains are watertight within the limits of this test and of any pressure to which they may be submitted in the ordinary course of their use.

Turning now for a moment to the work of the Bureau of Streets, we find in reference to the disposal of refuse the pious reflection that "in the treatment of a city's wastes, while it is always well to be as economical as possible, the matter of cost should be but a minor consideration." This illustrates the enormous advance which has been made since 1908, when Mr. W. F. Morse wrote in his work on the Collection and Disposal of Municipal Waste that "the sanitary work of Chicago, as connected with waste collection and disposal, has from the first been until within two years in a condition of chronic negligence and resulting constant complaint." The system in vogue is that of reduction by drying and percolation, which has proved thoroughly successful. It is the intention of the bureau, however, to seek authority for the erection of such incinerators as are needed to dispose of miscellaneous refuse which is not adapted to reduction treatment.

In regard to the dust nuisance from macadam streets, the report states that previous to 1911 an emulsion of soap, oil, and water was used with fairly good results. With an emulsion a macadam street must be gone over every two or three weeks, and with such a large mileage of macadam pavements it was found impossible to keep the dust down. With the use of straight oil, however, one application a season is sufficient, and it is possible to cover the entire area of macadam streets. The use of oil is found more satisfactory, as it has proved to be a good binder, and not only acts as a dust preventive, but a good road preserver. The bureau has improved on the method of applying oil by the use of portable boilers, equipped with pumps which enable them to heat the oil in the tank cars, pump directly into the distributing wagons, and apply the oil hot to the pavement. This results in a better penetration, thus doing away with an excess amount of oil on the surface, which previous to this method of application was the source of numerous complaints.

* * *

Councils and Candidates.

The circumstances surrounding the recent reappointment of the surveyor to the Shoreham Urban District Council after the post had been thrown open to competition are such as appear to call for some explanation on the part of that authority. In the first place it is a rather curious proceeding, to say the least, to advertise an appointment, with consequent trouble and expense to those who replied to the invitation to send in applications, and then to reappoint the previous holder of the office. We know nothing and say nothing as to the qualifications of that gentleman, or as to his fitness for the position which he occupies. Other candidates may, however, be forgiven for asking themselves whether there ever was a really *bonâ-fide* vacancy. Moreover, they have further cause of complaint, we understand, inasmuch as no official notification has been sent to them of the non-success of their applications. It is no doubt well known by now to our readers that in our view such a notification is in all cases to be expected as a matter of courtesy. In the present case we say more: when such an extraordinary course as that adopted by the Shoreham Council is taken, candidates are further entitled to some explanation of the facts. It is possible, of course, that there may be perfectly sufficient reasons for what has been done. If this is the case, however, there can be no objection to some official statement on the subject being made. In fact, such a statement would operate to allay any suspicion which may now exist that the council may have acted in any way improperly. Other recent instances of ignoring the applications of unsuccessful candidates have occurred at Eton (Urban) and Rawmarsh respectively. We accordingly take the opportunity of reiterating that every applicant merits at least some acknowledgment of his application, and that this should be sent *under cover*.

* * *

Dangers of the Swimming Bath.

We have more than once commented upon the very real dangers of infection which arise from the use of the swimming-bath, and we therefore note with considerable interest the contents of the report on the subject which has recently been issued by the Special Committee appointed by the Royal Sanitary Institute. The magnitude of the danger may be gathered from the fact that a bath of 100,000 gallons capacity, which contained 500 bacteria per cubic centimetre when newly filled, after being used by 380 bathers was found to contain no fewer than 342,400 bacteria per cubic centimetre. Of course many of these germs are perfectly harmless, and the enormous multiplication is favoured by the warmth of the water. Nevertheless, the figures given are sufficiently alarming. The committee mention two possible remedies for the evil. Continuous aëration and filtration prevents the higher grades of bacterial pollution, and renders the water comparatively clear and odourless. It has, however, no sterilising action; and it appears therefore that it may be positively harmful in banishing the outward and visible warnings of a danger which it does not really remedy. The other process mentioned in the report of the committee is sterilisation by the addition of electrolytic fluid, as practised for some time past in the Borough of Poplar. The good results obtained by this method are commented upon in the report, but it is pointed out that it is unnecessary to erect a special plant for the manufacture of the fluid, as it can be obtained as a commercial product from the manufacturers of chlorinated disinfectants. We have long advocated the use of electrolytic fluid for the purification of bath water, and we hope that the report of the committee will encourage many local authorities to adopt it.

* * *

Concrete Mixing.

The difficulties which occur in regard to the mixing and deposit of concrete are so well known that any attempt to show how they may as far as possible be overcome is bound to arrest the attention of engineers. For this reason, the paper presented by Dr. J. S. Owens at the last meeting of the Concrete Institute will be read with peculiar interest. Broadly speaking, it was divided into two parts. The first consisted of a scientific examination of the phenomena attendant upon the settlement of solids of various gauges and shapes in water; and in this connection the author succeeded

in showing that the chief factors governing the rate at which a body will settle through water are its size, shape, and specific gravity, the temperature of the water or any cause affecting its viscosity, and the quantity of suspended matter present. In the latter half of his paper Dr. Owens proceeded to apply the principles which he had evolved from a theoretical study of the general problem of settlement to the practical questions which affect the mixing and deposit of concrete. The separation of concrete into layers consisting of its different ingredients, according to their gauge or fineness, when it is allowed to fall through water, is, of course, a perfectly familiar phenomenon. It is probably not so generally realised, however, that a somewhat similar action takes place in the case of concrete which has been mixed with an excessive quantity of water and then agitated by ramming. Again, the effects as regards separation of ingredients which are produced by the various mechanical mixers, and the comparative efficiency of machine and hand mixing, are matters which are of the greatest possible importance. The conclusion at which Dr. Owens arrives is that, having regard to the amount of supervision which would be required, it is practically impossible to get uniformity by hand mixing. He points out, of course, that mixing machines themselves vary greatly as regards efficiency, and require a certain amount of supervision. On the whole, however, a good mechanical mixer is to be preferred in order to secure the best results. Full extracts from this very able and interesting paper will be found in another column.

* * *

The Liverpool Housing Problem.

There is undoubtedly something to be conceded to the argument that the housing problem should not necessarily be regarded as strictly a matter of pounds, shillings, and pence. We gather that this was and continues to be a point of view from which the Liverpool Corporation have approached the subject, and it would appear to be fully justified by the very remarkable results obtained at a cost to the rates that is sufficiently moderate to be almost nominal. From a recently published report it appears that the Town Council had erected 2,455 dwellings up to the end of 1911, and rehoused a population of nearly ten thousand. Slum property of a particularly sordid and insanitary kind has been replaced by well built and well equipped houses, and the rents charged are such as the people are or ought to be able to pay. The scheme has involved a capital outlay of £1,045,000, and the net annual charge is £37,000 a year. After the net rents are deducted from the interest and sinking fund there remains a charge upon the rates of a little more than a halfpenny in the £. One practical result of the housing scheme has been that the death-rate in the areas dealt with has declined from 60 to 27 per 1,000, and the consumption rate from 4 to 1·9. A good deal may be said both for and against municipal trading in other matters, but in the matter of housing, especially where slums have to be dealt with, it is essentially a defensible enterprise. The cost, if and when any part of it falls upon the rates, may be reasonably included in the charges for sanitary administration. It would be a misnomer to regard such cost as in any sense a loss for which the municipality should be blamed.

* * *

A Municipal Engineer's Reminiscences.

It was a happy idea on the part of Mr. Cuthbert Brown, in addressing the Institute of Sanitary Engineers last Wednesday evening, to speak in a reminiscent strain of some of the many interesting experiences which have fallen to him in the course of a varied engineering career. When it is remembered that Mr. Brown has been engaged in fields of labour so far apart and so varied in character as Tyneside, the heart of the Northumberland coalfield, and the flat country of the Eastern Counties, and that he is at present engineer and surveyor to the Edmonton Urban District Council, it will readily be realised that he must have much to relate which is of interest. Thus he was able to discourse on the disposal of sewage by direct discharge into a tidal river, and the disposal of refuse by barging out to sea; he further gave an account of the great difficulties which confront an engineer in a district which is intersected by coal workings owing to the extraordinary prevalence of subsidences on a large scale. In one case it appears that a subsidence of land and houses to the extent of 3 ft. had taken place over a large area. Whilst at Chelmsford Mr. Brown was engaged on the construction of an underground reservoir to hold a million gallons. Here considerable difficulties were encountered and overcome in regard to leakages. Altogether Mr. Brown's paper was of special interest, being chiefly an account of obstacles surmounted rather than a mere description of works constructed, which is a more usual feature of such addresses.

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August Traffic in Warwickshire.

We are indebted to the courtesy of Mr. John Willmot, county surveyor of Warwickshire, for an interesting and instructive table embodying the results of a seven days' census of traffic taken on the Warwickshire main roads last August. The figures given in the table are reproduced in another part of this issue, accompanied by a sketch map, prepared in this office, on which the names of the census stations are written and the positions marked with the reference numbers assigned to them in the table. We have added a few notes relating to the county and its position as regards neighbouring counties. The information given will enable the reader to study the matter from several points of view, since it comprises not only the figures for total numbers of vehicles, but also those for motor vehicles and for ordinary cycles. Our Kentish and Surrey readers will, no doubt, be struck by the figures given for the Sunday traffic at Elmden, and will note that, whereas the proportion of motor vehicles to the total (excluding ordinary cycles) was about 65 per cent. on the six week days taken together, it rose to only 71 per cent on the Sunday. The Sunday increase for motor vehicles themselves was nearly 84 per cent, for other vehicles about 38 per cent, and for ordinary cycles nearly 277 per cent.

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Meetings.

In our issue of the 24th ult. we were able to announce that Mr. H. Percy Boulnois, M.INST.C.E., the chairman of the council of the Royal Sanitary Institute, has been selected by the committee of the Chadwick Trust to give three lectures on "The Hygiene of the Home." The first of these lectures will be delivered this evening at 8.15 at the Royal Sanitary Institute, and it is rather unfortunate that it clashes with the later part of the Eastern District meeting of the Institution of Municipal and County Engineers, which is also to be held in London to-day. At the latter meeting an inspection will be made of the new Middlesex Guildhall now in course of erection at Westminster, and a paper on "Sterilisation" will be read by Dr. J. C. Thresh. At 6.30 p.m. the members will foregather for dinner at the Victoria Mansions Restaurant, and the opportunity will be taken of presenting to Mr. R. J. Thomas, the president of the institution, the wedding gift which has been subscribed for by the members. Those of our readers who are interested in sewage disposal should make a special note of the meeting of the Royal Sanitary Institute which is to be held on Tuesday next, when an important discussion, which is to be opened by Dr. Rideal, will take place on the eighth report of the Royal Commission.

Reminiscences of a Municipal Engineer.*

By CUTHBERT BROWN, assoc.m.inst.c.e., Engineer and Surveyor to the Edmonton Urban District Council.

In preparing this paper the author was somewhat at a loss to know on what subject to write, as "Sanitary Engineering" has been so much discussed during the past few years that there is little fresh or new matter to bring forward on the subject, although great strides have been made in grappling with the various problems of water supply and sewage disposal. It may be interesting, however, to some of the sanitary engineers in London to know the practice and procedure of districts in the Northern Counties which might be contrasted with the practice in other parts of the country.

In the 'eighties the author was engaged in a large city in the North of England which has an ancient history and was one of the border towns between England and Scotland, and therefore laid out originally in a very primitive manner. Since that time it has grown enormously, and has now a population of 300,000 people.

SEWER LAYING DIFFICULTIES.

It originally was the custom in dealing with the sewage of the town to follow the lines of the old watercourses which made their way from the uplands down to the river. These watercourses were culverted over, and vary in diameter from 3 ft. to 9 ft.; they were generally circular in shape, and have now become the main sewers and surface-water sewers in the district. In the growth of the city these sewers and watercourses are not on the lines of the main roads, and in very many cases are under the houses. The valleys have been filled in and houses built on the top, and this has made it very difficult to locate the position of the sewers whenever an important connection has to be made to them.

The author was engaged in taking sections through these sewers so that the exact depth could be defined at any point on the surface (owing to the non-existence of manholes), and it was also necessary to make a very accurate underground survey of the line of the sewers which were then plotted on a large ordnance scale 42 ft. to the inch; when it was necessary to make a connection direct to the main sewer it was always done by drifting. The commencement of the proposed branch main was noted in relation to the position of the main sewer, and the angle very accurately ascertained, and this was given to the contractor as his basis for striking the sewer.

You will see that it was not possible to make a connection in any other way owing to the buildings which stand on the top of the sewers, which averaged in depth from 20 ft. to 60 ft.

The whole of the sewage and surface water from the sea at the mouth of the river Tyne up to the point to which the tide runs—namely, Newburn—for a distance of about 12 miles is emptied into the river, and on this length the population amounts to 750,000. As the sewers take both the surface water and the sewage, it will be seen that an enormous amount of sludge must be deposited daily; however, it is rather remarkable that, during the last twenty-five years at least, the author has never heard of any complaint having been made from the River Tyne Commissioners, who are responsible for the dredging of the river Tyne. The waterway from the sea must be kept deep enough to allow one of His Majesty's battleships to proceed to the upper reaches as far as Messrs. Armstrong, Whitworth & Co.'s shipyard.

In these days of sewage disposal, when so much difficulty is experienced with reference to the disposal of sludge of very small towns, it is rather remarkable that the sludge from such a large population should be emptied daily into a river which must be kept practically clean and to a satisfactory standard of depth without causing a very serious trouble to those who are responsible for its maintenance. There is one point, however, which has never been considered, to my knowledge, from a sewage point, and that is the formation of the bar at the mouth of the river Tyne between the North and South Piers. This forms very rapidly and it is necessary for the dredgers to be continually at work so as to keep the waterway clear for big liners. The theory of the harbour engineers is that the bar is caused from the scour from the outside, and it has also been held that the bar was caused from the scour of the river bringing down the washings from the upper reaches; but I think that the latter theory was not accepted, and it was always held that the bar or bank was caused from the current of the sea from the outside.

However, the question as to whether the sludge from the sewage was in any way responsible for the formation of the bar at the mouth of the river Tyne has never been discussed, although it is quite probable that this might very seriously deposit itself at the mouth of the river when it meets the sea.

BARGING OF REFUSE TO SEA.

In considering this question another very interesting item is the disposal of house refuse at sea.

In the author's time a large 12-cell destructor was built at the east end of the town to deal with the house refuse at that end, and a further piece of ground was bought at the west end of the town at the Sand Quay to erect a similar destructor for the disposal of the refuse at that portion of the town. Some considerable opposition was experienced from the inhabitants, as they were afraid of the smoke from the destructor causing a nuisance to the people who lived on the higher levels of the town, and the destructor scheme was abandoned. It was then decided to send the refuse to sea, and a timber jetty was built out into the river for a distance of about 50 ft. for the purpose of mooring the barges.

When the timber quay was completed a contract was entered into with the Tyne Wherry Company to deposit the refuse at sea at a cost of 6d. per ton. The first barge that was brought alongside the quay was supposed to hold 200 tons, but owing to the lightness of the material, which was mostly shop refuse, and composed of straw, paper, bottles, &c., when the barge was full the refuse did not weigh more than 60 tons.

The author proceeded to sea with the first barge load, which was towed out by a steamer, to see how it would act. The Tyne Commissioners make it a definite rule that no refuse shall be shot within 3 miles of the pier, and if this is done the persons doing so are prosecuted. When we arrived at the 3-mile limit the wedges were knocked out of the cotters at the side of the barge and the false bottom lowered. It was then fully expected that the refuse would sink to the bottom, but instead of doing that it floated, and after a time it was decided to send the steamer back to the Tyne dock and bring out a gang of men to tip the refuse overboard. It is scarcely necessary to say that the contractor did not carry any more refuse at that price, and it was decided in future to take only half a load, and the price was increased to 1s. 4d. per ton.

Enormous quantities of refuse are tipped daily on this system, and on no occasion has it ever been found that any of the floating matter has found its way back again to the shore.

COLLIERY DISTRICT EXPERIENCES.

The author then moved on to the heart of the coal-mining district of Northumberland, where, as you are perhaps aware, they are not noted for high-class sanitation. In these districts the houses have privies and very large ashpits. Each collier receives a load of small coal once a fortnight, together with 5 cwt. of grey coal, and this causes a very large quantity of ashes to be dealt with, these being always deposited on the land in the adjacent areas.

The chief difficulty met with in these districts is in the sewers and water mains. A main sewer may be laid to-day in a very accurate manner, the levels taken carefully, and a first-class gradient obtained, and the work carried out in a very efficient manner, but in the course of a few months it is often spoiled by colliery subsidences.

During this time the author was engaged upon the Spen and Derwent Haugh Railway for two years with the consulting engineer, Mr. W. G. Laws. He prepared the sections and surveys for the carrying out of the work, and had some rather interesting experiences with reference to ordnance bench marks as shown upon the ordnance sheets. In some cases it was found that the line of the road with the bench marks on

* Paper read on Wednesday evening at a meeting of the Institute of Sanitary Engineers.

walls and gateposts had settled to the extent of 2 ft., and great care had to be exercised in using the bench marks as shown on the Government survey.

In 1900 the author had a very interesting experience at Cambois Colliery, which is situated close to the cliffs on the North-East Coast, and bounded on the West by the river Blyth. The colliery stands upon an island, and it is necessary to cross the river Sleekburn to reach it. No bridge is erected at this point, and carts and carriages have to cross by means of a ford. The author's coachman on several occasions remarked that he thought the ford was deeper at high tide than it used to be, and ultimately it was not possible to cross the ford at certain times of the tide. A quay wall extended for about 200 yds. on the east side of the river Blyth, and a breach occurred very near the high-water mark. This wall was built with dry rubble backed up with earth. Someone had evidently noticed this, and a large hole was made in the wall during the night, and at the next high tide the river made its way through the wall and ran up the main road and flooded the whole of the houses in the colliery, the water being from 5 ft. to 6 ft. deep.

The author was at a loss to understand this sudden flooding, and took a section from Newbiggin Point to Blyth, two fixed points on the Ordnance Survey which were known to be permanent bench marks. The whole of the bench marks were picked up in passing Cambois Colliery, and the section plotted of the surface and inked in with blue lines. The Ordnance Survey had been recently revised in 1896, four years previously, and the surface of the ground at that time plotted in red. It was then shown beyond doubt that the whole of the houses and the land adjoining had sunk 3 ft., and this accounted for the extra depth of water at the ford. A meeting of the colliery engineers interested and the Blyth Harbour Commissioners was afterwards held, and it was doubted very much as to whether this was correct or not. The levels were checked, and it was found that the subsidence had taken place, and the colliery companies paid the cost of rebuilding the wall in a more substantial manner. The cause of the wall collapsing was owing to the colliery subsidence, which had shaken the wall and caused it partially to collapse.

The first thing that would strike a sanitary engineer might be that the levels of the sewers would be altered, but it was found that the sewer was still in a working condition, as the ground had gone down bodily over the whole of the area. There was, however, a difficulty with regard to the outlet of the sewer, as at high tide the water level was from 7 ft. to 8 ft. above the outlet of the sewer. A tide flap with a lead seat was fixed at the end of the pipe, but this was of no avail, as pieces of stick or straw got wedged in the seat of the pipe, and the water made its way up the pipes and out at the manholes on the main road.

Another chamber was built about 30 ft. from the wall, and another flap fixed, with the same result. The author then designed a new form of tide valve, and had an additional chamber built further inland in the form of a cradle hanging on a bell mouth with a ball 18 in. in diameter inside. This was made by Messrs. Glenfield & Kennedy, of Kilmarnock, and after this was fixed it acted fairly well for a time, but at the next spring tide the water came through both flaps, there not being sufficient pressure to keep the ball in position, and the water still ran up the sewer and came out of the manholes. We then had to have recourse to another system, and an additional chamber with a 12-in. screw-down sluice valve was built; a man was engaged by the colliery company, and it was his duty to screw down and open the valve twice a day.

In laying the sewers in these districts it was found that a cement joint was not suitable, as the flanges of the pipes were continually breaking and causing a defective sewer. The system which the author adopted was to make a clay joint and to bed the pipe in concrete for a depth of 4 in. in the bottom and haunch it up with concrete to the centre of the pipe. Under this system we had not nearly so many broken flanges, as the nipping in the top flange was obviated. There was also considerable trouble with the water mains, as it was necessary to make a rigid joint between the spigot and the flange with lead, and there was no giving; therefore, whenever the ground subsided, the flanges were nipped, and the break always took place at the joint.

These breakages on the sewer and water mains took place chiefly where the coal was worked on what is known as the pillar system—that is, leaving a certain amount of coal in the pit to hold up the ground which caused undulations on the surface. With reference to the pit at Cambois Colliery, which has been already mentioned, this was worked on what is called the long wall system, where the whole of the coal is taken out and the surface allowed to set evenly.

WORK IN THE EASTERN COUNTIES.

The author's next experience was at Chelmsford, in the Eastern Counties, and a few notes upon the water supply of these districts may be of interest.

The first work with which the author was connected was the construction of an underground reservoir to hold 1,000,000 gallons of water. The walls were constructed of concrete lined with Callander's bituminous sheeting with 6 in. of concrete laid on the face and rendered about with ¾ in. of neat cement. The roof was carried by piers 18 in. square, built of blue Staffordshire bricks, and carrying a concrete roof composed of steel joists and metallic lathing. The roof was 12 in. thick.

In carrying out this work a rather interesting circumstance took place as follows: After the gravel had been dug out for a depth of 14 ft. for the whole area the concrete walls were built each 6 ft. thick at the bottom, and the back of the walls were filled in with hard core. The walls were built in the winter time, and rather suddenly water began to spout out at the bottom of the wall in hundreds of places, and it was not possible to lay on the sheeting until these water spouts were stopped. Small holes were drilled in the walls and pieces of lead piping inserted so that the water would come through the pipes, and these were ultimately sealed. However, in a very short time the water burst out in new places, and continued to trickle down the wall. A close observation was kept to endeavour to find out where the water came from, and it was thought to be making its way from the back of the wall through the concrete. The author ultimately decided to excavate a trench round the back of the reservoir for the full distance, and laid in a 9-in. pipe and filled the back with hard core, an outlet being found into an adjoining pond. When this work was about completed the whole of the water spouts had stopped running, and preparations were made to lay on the sheeting. However, it rained very hard the night before the sheeting was to be laid, and when the work was inspected the next morning there were the same old weeping holes running as hard as ever.

The author then came to the conclusion that the water most certainly was not coming from the back, and it was found that the rain had fallen on the face of the wall, which was 14 ft. high with a batter of 2 in. to the foot, and was soaking, possibly for an inch or two, into the wall, and then ultimately finding its way out at the bottom of the wall. The concrete was made of ordinary ballast, not crushed, which made it rather open and porous. After that time we had a week of fine weather, and the whole of the weeping holes dried out, and the sheeting was laid on without any further difficulty.

During the course of this construction considerable difficulty was experienced with regard to the water supply, which was mainly derived from an 18-in. borehole into the chalk. The well was 680 ft. deep, and touched the chalk at 350 ft. The pump at that time was delivering 10,000 gallons an hour at a depth of 250 ft., and on other advice it was decided to take the pump out and lower to 350 ft. with a view to obtaining a greater supply of water, but it was found that by doing this the water was shut out altogether, and the pump had to be taken out again, shortened and put back at the original level, the water being obtained from the Thanet sand overlying the chalk, and not obtained from the chalk itself. Considerable difficulty was experienced in keeping up the supply to the town, which was only of an intermittent character, and had a service of six hours, from 6 a.m. to 12 noon, and all the cisterns were supposed to be filled and charged until the next day.

The author was of opinion that the water which was being pumped, equal to 20 gallons per head per day, should be sufficient to supply the population, provided that all the water reached the consumers. It was recommended that the town be split up into six sections, and a Deacon water-waste meter should be fixed at a point to command the whole of the different areas for the purpose of ascertaining the amount of waste that was taking place in the town. This work was proceeded with with all haste, and in less than twelve months, by a systematic inspec-

tion and close observation, the whole of the town was put on a constant service with the same amount of water which it had previously taken to give a six-hours' service.

The subsoil was of gravel, which lends itself very much to water waste, as it does not make any appearance on the surface; it had even been remarked by some of the old residents in the district that their own private wells never ran dry, and this was afterwards found to be owing to the waste that was taking place in the council's mains. The service pipes were all composed of galvanised iron, and the subsoil appears to eat very much into this class of pipe; corrosion takes place, and holes make their appearance.

WATER-WASTE DETECTION.

There were numerous interesting cases of private service waste water, one especially which might be related: One of the councillors, who is a very eminent engineer, lived in the town, and had a very nice ball alley, which is covered with 4-in. concrete, adjoining his house. A bad leak was taking place on this section, and nightly inspections had been made by turning off the different sections and watching the behaviour of the water-waste meter, and it was ultimately found that the waste was taking place in the service pipe of this house, as could easily be detected by the stethoscope. When it was mentioned to the gentleman that a leakage of 500 gallons an hour was taking place on his premises he was very much astonished, and stated that the whole of his fittings were perfectly tight and open for anyone to inspect. However, permission was obtained to find this waste, and the author had a trench opened right through the centre of the ball alley on the top of the pipe to trace the leakage, and in the centre of the yard a split pipe was found with a slit in it fully 18 in. long. The water had been running from this point for very many years. Some of the houses adjoining had damp floors, and it had been quite a difficulty with the owners for years to keep down the damp, and they had gone to considerable expense to do this.

This was only one of the many instances which shows the desirability of having a proper system of water-waste detection, as, in the author's opinion, in some districts there is more water wasted than used.

The author constructed a large open-air swimming bath 150 ft. long by 100 ft. wide, adjoining the river Chelmer. This was dug out of the London clay, which is found within 2 ft. of the surface, and made an admirable watertight tank without any puddling or artificial means. The sides were sloped 2 to 1, and covered with concrete, and the bottom was laid with concrete flags.

In excavating the bottom of this tank at the top end, which was 6 ft. deep, a number of fissures appeared and delivered a vast amount of water which evidently came direct from the river Chelmer—which was within 30 ft. If the tank was allowed to stand without pumping, the water level rose steadily until it reached the level of the river. The point which appeared to be necessary to get over was the possibility of the whole of the flags lifting with the pressure of water behind, and this would most certainly have happened. After looking carefully into the matter, the whole of the springs were noted by pieces of wood, which numbered between sixty and seventy at spaces about 3 ft apart. The author had flags cast with holes in the centre 4 in. square, and these flags were carefully laid over the top of the springs so that the water came up through the holes, which got over the difficulty of the pressure. When the work was completed the water came up and was lying on the top of the flags, the latter remaining quite stationary.

SEWAGE DISPOSAL AT EDMONTON.

The author next moved to Edmonton, in Middlesex, where some very interesting work is being carried out in connection with the sewage works. The sewage farm comprises an area of 235 acres, and the sewage is treated on the broad irrigation principle. The population dealt with is 100,000. At the time of the author's appointment considerable difficulty was experienced with the Lee Conservancy Board and the Middlesex County Council owing to the effluent not being up to a satisfactory standard.

The sewage is delivered to the farm into an underground reservoir of a capacity of 2,000,000 gallons, and is lifted into three subsiding tanks of a total capacity of 600,000 gallons. The sewage then flows over the northern portion of the farm for preliminary treatment, and is afterwards taken by carriers to a gravel pit of an area of 3½ acres for further purification, being again passed over the land before being allowed to pass down the effluent channel into the river Lee. The effluent is examined by the Lee Conservancy Board and the Middlesex County Council at regular intervals, and it is required to come up to a satisfactory standard before being allowed to flow into the river. Considerable difficulty had been experienced in producing a satisfactory effluent, owing to the land being sewage sick and the gravel pit having become ineffective. It is more than probable that the effluent from the land which was passed into the gravel pit for further treatment was actually reduced in quality rather than improved. When the author took up his duties two years ago, instructions were given to have the gravel pit emptied, and this was done after pumping for a fortnight. It was then found that a large quantity of sludge was deposited on the surface, and it was not found practicable to cart it away; the pumps were kept at work with a view to keeping down the level of the subsoil water, and it was left to dry and bake in the sun. After lying for six weeks it had practically evaporated by first breaking up into sections about 6 in. square, and then finally became fine powder.

The sludge difficulty having been got rid of, it was then decided to dig holes at various places to ascertain the nature of the subsoil, and it was found to consist of sharp sand mixed with clean gravel for a depth of 5 ft. This lent itself to the construction of an ideal filter for either water or sewage, and as the area was 3½ acres, and capable of dealing with a large quantity of sewage effluent for secondary treatment with practically no solids, it was decided to lay down a 15-in. pipe for a length of 462 ft., at a depth of 4 ft. through the centre of the beds for manholes for æration and inspection, together with 4,300 ft. of 4-in. agricultural tiles at a similar depth at a distance of 6 yds. apart at right angles to the main for the purpose of gathering the whole of the effluent into the 15-in. main to be delivered into the pump well of the 13-in. and 9-in. centrifugal pumps to be finally lifted into six 12-in. by 3-in. steel troughs which overflow and drop the effluent 9 ft. into the effluent channel.

The preliminary treated effluent is brought to the beds by a concrete carrier, and is passed through a fine screen composed of $\frac{3}{16}$th holes, and is then delivered into a concrete chamber 14 ft. above the level of the gravel beds from the concrete chamber. The effluent then drops a distance of 5 ft. into an adjoining chamber, and is conveyed by a 9-in. by 6-in. cast-iron pipe, and a 5-in. by 4-in. cast-iron pipe, the full length of the beds, at an average height of 9 ft., with concrete manholes 13 ft. high at each bend, together with seven arteries composed of 5-in. by 4-in. aqueducts running across the beds. The total length of the 9-in. by 6-in. aqueduct is 576 ft., and the total length of the 5-in. by 4-in. aqueducts 1,692 ft., the whole of the aqueducts being under a pressure of 5 ft. The aqueducts are pierced with 1,500 $\frac{3}{16}$th holes, 2 ft. 6 in. apart, which deliver water at a rate of 1¼ gallons each per minute, or 112,500 gallons per hour, which is equal to the dry-weather flow to the farm. Each jet is provided with a zinc shield which breaks up the water into a fine spray, and considerably helps to purify the effluent. At each end of the aqueducts a removal stopper is provided for cleansing.

Since this system, which is believed to be the only one of its kind in England, has been in operation, the effluent has been inspected numerous times by the Lee Conservancy Board and the Middlesex County Council, and the effluent samples analysed by the council's analytical chemist, Dr. Kenwood, on every occasion, and has always been reported upon as very satisfactory, and fit to be put into any part of the river Lee. The whole of the works have been carried out departmentally.

New Town-planning Schemes.—It is understood that the Local Government Board have given authority for the preparation of three further town-planning schemes under the Housing and Town-Planning Act, 1909. The schemes are authorised to be prepared by the Corporation of Sutton Coldfield and the Urban District Councils of Ellesmere Port and Whitby and Finchley, and are to relate to areas comprising about 6,400, 3,678, and 1,044 acres respectively. The Caerphilly Urban District Council have decided to take the necessary steps for promoting a town planning scheme.

Trials of Road Materials at Sidcup.

A REVIEW OF THE INTERIM REPORT.

Brief particulars of the materials and methods employed in making up the trial lengths of road surfacings and upper courses of road crusts at Sidcup have already been given in THE SURVEYOR (January 31st, p. 250), together with what seems, at the present stage of the trials, to be the chief results so far shown, and the most immediately important of the comments of the committee. The Road Board and its Advisory Committee are to be congratulated on the admirably fair and sportsmanlike manner in which they are conducting these important investigations, the results of which will, if their limitations be duly recognised, be of first importance.

The conditions of the site are known to most surveyors, and since the document is an interim report, it is not desirable at present to describe the conditions in detail, or to compare them with those in other parts of the country. Such a study may be left until more of the competitors have passed the post—on the "last shall be first" principle. For the same reason no attempt will be made at present to describe or discuss any differences which there may be in the local conditions affecting different trial lengths.

THE TRAFFIC ON THE ELTHAM-SIDCUP ROAD.

The nature and amount of the traffic may be judged from two censuses, one taken in September, 1910, and the other in August, 1912, and it may be remarked that the traffic on this road is probably much less subject to seasonal variations than that on the main roads of the country generally. At the same time, it is to be hoped that before the trials are concluded the figures for the traffic of other seasons will be available.

September, 1910.—For the fortnight from August 31 to September 13, 1910, the following, omitting unimportant decimals, are the averages per day of twenty-four hours: numbers of vehicles, grand total, including bicycles and animals, 2,691: Total of horse-drawn vehicles, 454: horses drawing these vehicles, 787; heavy one-horse vehicles, 19; heavy vehicles, two horses or more, including omnibuses, 247; total of motor vehicles and their trailers, and motor cycles, 322; motor omnibuses, 105; motor lorries with rubber tyres, 16·8; motor lorries with "steel" tyres, 8·7, and their trailers, 3·6; motor cars and cabs and covered vans, 131; motor cycles, 40; ordinary cycles, 1,107: traction engines 1·5. Estimated tonnage per yard width per day, 360.

August, 1912.—For the week from August 15 to 21, 1912, the following are the averages per day of twenty-four hours; number of vehicles per day of twenty-four hours: Grand total, including bicycles and animals, 2,292. Total of horse-drawn vehicles, 387; horses drawing these vehicles, 478; heavy one-horse vehicles, 183; heavy vehicles, two horses or more, 84; total of motor vehicles and their trailers and motor cycles, 638; motor omnibuses, 331; motor lorries, rubber tyres, 24·4; motor lorries, "steel" tyres, 8·7, and their trailers, 5·8; motor vans, covered, 21; motor cars and cabs, 171; motor cycles, 53; ordinary cycles, 750; traction engines, 3·1. Estimated total tonnage per yard width per day, 506.

As far as the two periods chosen provide a sound basis for comparisons, they show a substantial increase in the number of motor cars and motor cycles, and a heavy decrease in ordinary cycles, as well as an important decrease in the total of horse-drawn vehicles. Leaving out motor cycles, animals, handcarts, &c., and counting only actual vehicles and trailers, we have the following totals per day; 1910, number 776; estimated tonnage per yard width, 288; 1912, number 1,025; estimated tonnage per yard width, 462. The estimated tonnages of motor vehicles alone per yard width per day were: In 1910, 174; in 1912, 392. This is, of course, largely due to the increase in the number of motor omnibuses, reckoned as 6-ton vehicles; the 105 in 1910 having increased to 331 in August, 1912.

CERTAIN ADVERSE CONDITIONS.

There were adverse conditions which affected some of the sections more than others. One such was the trenching work carried out by the water authority. It is unfortunate that this work could not have been done before the trial sections were put down, and it has no doubt been recognised by the committee that a site less liable to such disturbances, or to great changes in the nature and amount of the traffic, may be chosen for the next set of trials of this kind. The trenching is an especially unfortunate feature of the trials, since the effects of such work cannot be reckoned by the number of square yards of surface actually disturbed. Sometimes a considerable amount of earth is thrown on to the surface, seriously affecting results in some cases. Besides this, the jolting of vehicles, caused by the slight sinkage or humping of the surface, extends for some yards, especially in the case of vehicles intended for heavy loads, but travelling light and moving fast—an empty two-horse van going home late, for instance. In the case of one section, No. 15, the use of an adjoining field as a store for stone, and a standing ground for rollers during the whole of the operations, may have affected the results, although this section was one of the last to be finished. Another adverse condition which did not affect all sections equally was the starting and stopping of motor omnibuses. This not only affects a road surface directly, but may also have an indirect effect by causing a swerving of other traffic. Near a regular stopping place for omnibuses such swerving may somewhat increase the wear of the surface, an effect which may be observed in an extreme form at some turnings and bends on roads with much motor traffic.

CERTAIN LIMITATIONS OF THE TRIALS.

It must not be overlooked that the materials and methods were tested under conditions somewhat more favourable to some competitors than others apart from the nature and circumstances of the sites and the amount and kind of traffic. It was, however, necessary to limit the scope of the work to be done by the individual competitors in order to make it possible for all of them to compete under equal conditions. The trials were, accordingly, intended to test top courses, or carpet layers, and not whole crusts. Another factor which could not be foreseen was the unusual drought, the effect of which was necessarily greatest on those sections which were put down earliest, including, be it noted, the water-bound crust put down on June 15th, and the water-bound tarred crust put down on June 17th. It is unfortunate that the committee did not deem it necessary to make a full test of a water-bound crust, made and maintained with water only as a binder and dust-layer. The actual cost of specially watering such a small piece of road would not, of course, be charged against it, but only the due share of the cost of watering a length sufficient to keep a water crust fully employed during the dry season. The effect of calcium chloride may be better or worse than that of water, but it is not likely to be exactly the same.

Another limitation consists in the fact that capital expenditure and the cost of actual repairs do not tell the whole story. There are several trial sections for which, supposing them to be 5 miles long, any road surveyor, acting in a consulting capacity, would allot a considerable portion of the total annual cost in the form of the special kind of small, constant repair or daily attention suited to the particular kind of crust. The sections were, of course, fairly treated as regards scavenging, and due notice was no doubt given of incipient failure, and the very limitation here noticed furnishes lessons of some importance, since the Road Board would be glad to find a form of road surfacing which would require a minimum of attention when once it was down. The economic division of expenditure between capital outlay, repairs, and constant attention has, however, an importance which must to a large extent govern the methods to be employed.

GOOD FOOTHOLD.

The references to slipperiness are very significant, and, on the whole, bear out the opinions expressed in recent SURVEYOR articles. A road crust and its surface must "give" somehow if good foothold is to be provided. It may give by wearing, the slipping being prevented, moment by moment, by minute chipping or dinting of the surface; or it may give by slight horizontal shifting, absorbing the horizontal component of the energy of

impact in a movement of sufficient length to reduce the magnitude of the actual force to that which is not greater than the vertical force multiplied by the co-efficient of friction; or it may give, for the time being, plastically, and be afterwards restored to shape. These three effects may all be in play at once, or any two of them. On a water-bound road crust we usually have plastic movement, afterwards restored, or partly restored, and attrition; and the crust beneath the surface shifts a little elastically. These considerations profoundly affect the design of a road crust in competent hands, and it is because they are sometimes ignored that we hear of so many failures of various kinds of road crusts. With a rock asphalt carpet there is very little attrition, but there is plastic movement and some horizontal shift.

We find, accordingly, that the sections which are described in the report as providing good foothold did so in accordance with the basic principles briefly indicated above. Take, for instance, section No. 13, which "provided good foothold for horses." The wear in twelve months was considerable—0·40 in. It also gave plastically, since it became worn unevenly. Under happier circumstances restorative effects might have come into play; plastic deformation, sufficient to prevent slipperiness, does not necessarily lead to unevenness. Possibly, too, an upper course of this type (we are not specially considering the particular case) may be most economically designed when the cost of constant maintenance is a large proportion of the total annual cost. Consider section 17: The wear was small, only 0·06 in. in twelve months; but the surface was inclined to creep. The movement which absorbed the horizontal component of the shock of impact was plastic in a horizontal direction, and was accumulative in the absence of symmetrical average incidence of impact. The surfacing is a carpet layer on a concrete foundation course, and it may be suggested that if the necessary technical knowledge and skill were applied to the design of such carpet layers, they would have a wider range of application than they have at present.

No. 20 "affords good foothold," though the wear was only 0·08 in. in twelve months. In this case two of the three conditions for foothold come in, for the surface is described as "slightly wavy and somewhat sticky."

No. 22 "afforded good foothold," though the measurements showed practically no wear in twelve months. That some creep or plastic movement occurred is shown by the fact that it is slightly wavy, but in view of the report that it is "quite one of the best" of the sections, it is not pretended here that the good foothold is fully accounted for on the facts before us. It may be that the surface provides for plastic reception of impact with subsequent restoration of form without loss of material—small dints rolled out smooth afterwards.

No. 23, which has a 1-in. wearing surface, all materials in which pass a ½-in. mesh, also demands attention, since it "afforded good foothold." In this case there was 0·10 in. of wear in twelve months, and a slight waviness.

As regards some of these surfaces they are quite out of the range of economic expenditure for ordinary main roads, however well suited they may be for one of Greater London's main outlets.

"NOT SLIPPERY."

A number of sections are described as "not slippery," being evidently retained on the mesh which passes "good foothold." One of these, section No. 3, is a single pitch-grouted upper course 3 in. thick, and another section, No 4, is a 4½-in. crust double pitch-grouted. These were made by the Kent County Council to Road Board Specifications 3 and 4. Another similar crust was put down by one of the competing firms. The first two are described as "not slippery," and the third as giving no trouble as regards foothold"; but whether this means no trouble to the highway authorities or no trouble to anyone is left to the interpretation of the reader. Pitch-grouting, as a number of surveyors are aware, usually gives a better foothold than tar-macadam made by mixing, and this is borne out by the results of these trials. A possible reason for this is that the grout continues to sink while the surface is being finished off, and afterwards, with the result that the part of the crust near the surface is not so dense as in the case of tar-macadam, but includes some air spaces which allow of a sufficient range of elastic movement to absorb impact. Possibly the advantage is partly due to there being, as a rule, less tar near the surface and more gritty material, the grains of which are also somewhat larger.

Section No. 18 is also described as giving "no trouble from want of foothold." In this case the nature of the materials accounts for that result, allowing of a sufficient amount of wear, 0·18 in.; and there was also some creep.

NOT "UNDULY" SLIPPERY.

The phrase "not unduly slippery" is used with reference to the surfaces of a number of the trial sections, and it is significant that most of these are made with tar-macadam proper—No. 8 with Kentish rag, Nos. 9, 10 and 11 with blast furnace slag, No. 12 with elvan and diabase, No. 14 with blue Guernsey stone, and No. 16 with diabase.

The twelve months' wear of No. 8 was recorded as 0·66 in., but a part of this was due to trenching work. On No. 9 the twelve months' wear was 0·25 in., and on No. 10 0·31 in. No. 11 wore 0·27 in., No. 12 0·14 in., and No. 16 0·17 in. On No. 14 the wear was only 0·06 in., and the section is described as "one of the best." From the present point of view, therefore, and on the facts before us, the only interpretation of the results would lie in a somewhat sinister significance being given to the words "not unduly."

Most of these sections stood up well to the traffic, but although the several costs need not be considered at present, it may be pointed out that a first cost of 4s. per square yard, not allowing for any subsequent repairs, amounts to over £2,000 a mile for an 18-ft. carriageway.

SLIPPERY SURFACES.

With respect to Section No. 6, "complaints of slipperiness were received during October, 1911." The Kent county surveyor describes this section as "a little on the hard side," and notes that "during sudden changes of temperature, with a deposit of heavy dew, it affords little or no foothold."

In this case the wear in twelve months was only 0·06., and the section "supported the traffic with only small signs of distress." Section No. 7 gave rise to complaints of slipperiness in the autumn and early winter. In this case the wear was ample—0·29 in.—and the slipperiness does not seem to have been due to hardness or excessive rigidity. The first cost was low, and the best way of using the materials was, perhaps, not realised in time, for the nature of the materials employed and the amount of wear do not point to slipperiness.

In conclusion it may be pointed out that the expression "quite one of the best" is applied in the report to lengths ranging in first cost from 3s. 8½d. to 7s. 6d. per square yard. Even at the present stage the trials have furnished very valuable lessons as to the behaviour of materials, the results being all the more useful from the excellent way in which they are presented in the report.

The Mid-Lothian Surveyorship.—At a special meeting of the Mid-Lothian County Council held lately the chairman, Colonel Trotter, of Colinton, made sympathetic reference to the late Mr. John Robb, the county road surveyor, and enumerated the appointments he had held, and many of the important schemes he had carried through. It was agreed to make a record of the council's regret, and to send an excerpt to the relatives of the deceased. Following upon this, Lord Stair asked if it was necessary to fill up this post at present, and the chairman replied that it was very necessary. Mr. William Crichton, Aikendean, stated at this stage that he had a strong feeling that this appointment ought not to be filled up at present, as he thought it might be possible to continue the work of the county without a road surveyor. The council might remit the whole matter to a small committee to go into the whole matter and report. Mr. J. Leslie Leckie, Corstorphine, held the view that the district surveyors were quite competent to do all the work that was necessary, and that the post of road surveyor to the county of Mid-Lothian was a mere sinecure. He moved that they do not fill up the post. Mr. James Cormack, Colinton, said that other and larger counties than Mid-Lothian were taking the step of dispensing with the office of head surveyor, so that district surveyors had to undertake the work. Mr. M Hutchen Dobbie, vice-chairman of the county, suggested that it would be rash that day to vote either for or against a proposal to dispense with a county surveyor, and moved that it be remitted to a committee to report. Mr. John Thin, Stowe, seconded, and the amendment was agreed to.

Purification of Swimming Baths Water.

ROYAL SANITARY INSTITUTE COMMITTEE'S REPORT.

[We make the subjoined extracts from a recently prepared report of a committee of the Royal Sanitary Institute, consisting of Dr. Louis C. Parkes, chairman; Dr. Philip Boobbyer, Colonel J. Lane Notter, Dr. S. Rideal, F.I.C., Mr. A. Saxon Snell, F.R.I.B.A., Mr. H. D. Searles-Wood, F.R.I.B.A., and Mr. W. C. Tyndale, M.Inst.C.E. The report in question appears in the February number of the Institute Journal.]

The water of swimming ponds which are frequented daily by many bathers becomes highly charged with bacterial organisms as a result of such use. Thus it has been found that a fresh-water pond containing 100,000 gallons in use for one day only, but which had been used by 380 bathers, contained 342,400 bacteria per cubic centimetre of water at the end of the day, the average number of bacteria in the clean water used to fill the pond being less than 500 per cubic centimetre.

No doubt the great majority of such bacteria, which must have been in large part derived from the bodies of bathers, are harmless non-pathogenic organisms. But there will always be a certain residuum of organisms which have disease-producing powers when placed in an environment suitable to their growth and development. . . . There can also be little doubt that not all the bacteria derived from the bodies of bathers are likely to be distributed evenly through the bulk of the pond water.

That some of the bacterial impurity of the pond water is suspended in solid matters is evident from the formation of scum in water which has been bathed in, the scum floating on the surface of the water. Slimy sediment and slimy deposits are also to be found on the side walls and floor of the pond at its deeper end, the slimy ingredient being probably the mucus and epithelium from the bodies of the bathers. The water, too, becomes opaque, the opacity being due to minute particles of organic matter with their associated bacteria. The water loses its fresh smell, and in time will develop the distinctive odour of humanity.

The warmth of the water (70 deg. Fahr. in winter) is very favourable to the multiplication of bacteria, and this possibly accounts for the large numbers found in the water of a pond which has been in use for some days. As a result of these changes in the water, apart altogether from the question of infection, an unpleasant smell becomes noticeable in the air over a swimming pond, and this, with the associated warmth of the bath and the general absence of efficient ventilation, causes the lassitude and weariness so often complained of as following a swim in a public bath.

The rapidity with which swimming pond water will become polluted must naturally depend not only on the numbers, but also on the class of people who make use of it. A pond which is bathed in by persons who never have a bath at home, and who spit and urinate in the bath water, will much more rapidly deteriorate in quality than the first-class pond which is used only by cleanly persons. There can be no doubt that where a pond is extensively used by uncleanly persons the water should be changed daily, and the walls and floor of the pond freed from sedimentary collections. Ponds used by girls and women, for reasons which need not be particularised, require to have the water changed more frequently than where males only are accommodated. In no case during the summer bathing season, when large numbers are using the baths, should the pond water be changed less frequently than every other day.

This constant change of water implies heavy costs, and various systems have been recommended and practically applied for submitting the water to some purifying process so as to obviate the expense involved in frequent changes of water.

CONTINUOUS AËRATION AND FILTRATION PLANTS.

From the evidence collected by the Committee it would appear that the continuous aëration and filtration plants,* now so largely adopted, are effective to a certain extent in preventing the gross pollution that results where a pond water is in continuous daily use without change. The higher grades of bacterial pollution are prevented, and the water is maintained comparatively clear and free from odour, but there is nothing approaching sterilisation of the water, nor is the latter free from turbidity. It is evident that the comparatively small amount of aëration the water of a pond can be submitted to by this process, and the limited capacity of the filters through which the water is strained, can have no very great effect if restoration of the water to its original state of purity is the object aimed at. That these continuous aëration and filtration plants have a very considerable effect is undoubted, and they enable a swimming pond to be used without any apparent bad effects for a considerable time without a complete change of water; but it must not be supposed that the water is necessarily of so good a quality as that which comes in from the mains of a town; and it must also be remembered that, if the water of a pond is changed only at long intervals, there will be a considerable accretion of slimy matters on the walls and floors, which is a very undesirable adjunct of a swimming bath.

* At Belfast, at the public baths, continuous aëration and filtration is combined with a precipitant, the solution of the latter being added to the water on its way to the filter. The bacteriological results from the use of this system are reported to be good, *B. coli* being invariably absent in the filtered water.

ELECTROLYTIC FLUID TREATMENT AT POPLAR.

The committee has also investigated the treatment of bath water by electrolytic fluid, which is in use at the Poplar baths, and was very much impressed with the good results obtained. By the addition of hypochlorite of magnesia solution to the pond water in amount sufficient to give 1 part of free chlorine to every 1,000,000 or 2,000,000 parts of water, not only is the water sterilised or deprived of all organised living molecules, but it is kept sweet and free from odour, and there is no tendency in the water to the deposition of slimy sediments on the floor of the pond. A certain amount of slimy matter collects on the walls of the pond at the line where the surface of the water is in continual movement from the undulatory motions induced by the movements of bathers, but this is readily removed with a swab by an attendant.

At Poplar the hypochlorite of magnesia solution is prepared by the electrolysis of Water Board water containing certain definite proportions of sodium chloride and magnesium chloride. An elaborate plant has been erected, as the electrolysis fluid is largely used in the borough of Poplar as a disinfectant. Sea water would serve equally well for the manufacture of hypochlorite solution, as its chief constituents are the chlorides of sodium and of magnesium. It is quite unnecessary, however, to erect a plant for the manufacture of hypochlorite solutions, as these can be obtained as commercial products from the manufacturers of chlorinated disinfectants.

It should be said that the electrolytic fluid in the Poplar baths is not used with the idea of rendering unnecessary periodic changes of the pond water, but to keep the water in the pond fresh and free from harmful organisms all the time it is in use. The class of persons who use the swimming ponds in Poplar is always likely to contain uncleanly or infected individuals, and it is to guard against danger from the latter that the fluid finds its chief application.

At Poplar the electrolytic fluid costs in its preparation about £2 per 1,000 gallons, or a little less than ½d. per gallon. Thirty gallons are added to a swimming pond of 85,000 gallons capacity on first filling, and subsequent additions are made as required at intervals of two or three days. The bath is emptied weekly or every ten days.

Swansea Main Drainage.—The Mayor of Swansea, the town clerk, and Alderman Corker (chairman of the Water and Sewers Committee) have had a conference with Mr. Midgley Taylor, M.INST.C.E., and Mr. Hutchinson, K.C., respecting the adoption of a new scheme for main drainage in substitution for that rejected by Parliament last year. They will report in due course to the committee, who are anxious to take up the question without delay.

The Settlement of Solids in Water and its Bearing on Concrete Work.*

By Dr. J. S. OWENS, Assoc.M.Inst.C.E., M.R.San.I., F.G.S.

I propose to deal with one of the physical characteristics of stones and shingle, sand and mud, which lead to their separation into these distinct classes by Nature. Practically all the sorting is done by the agency of flowing water, and the chief factor governing the position of any deposit is the ability, or otherwise, of the water to hold the material in suspension. Very finely divided matter remains long suspended, and therefore, if in a current, passes over the place where coarser matter is being deposited, and settles in less disturbed water.

We cannot go into all the details of the process to-night, but the more important factors governing the grading will be considered. Seeing, therefore, that the ability of water to hold in suspension is important we will deal with that aspect of the problem first.

I may premise my further remarks by the statement that, with the exception to be referred to later, a heavy solid can only be supported in suspension in water by an upward thrust equal in intensity to that which would result from a current of water of the same velocity as the body would settle at in still water. This means: (*a*) It is to the resultant upward thrust due to eddies and disturbances that suspension in water is due; and (*b*) a measure of the rate of fall of a body through water will be useful as measuring its resistance to suspension.

A solid body which is of higher specific gravity than water will sink in the latter at a definite rate. Starting from rest, it will have two distinct stages in its fall:—

(1) An accelerating stage, during which the force operating on the body to pull it down is greater than the retarding force, due to friction and the impact of the water particles on the under surface of the body.

(2) A stage of uniform motion which is attained when there is an equilibrium between the downward and upward acting forces.

In practical work the first or accelerating stage is so very short as to be negligible, except for very large bodies; in the case of sand, and even pebbles up to ½-in. diameter, it is only by the most delicate measurement that the existence of an accelerating stage can be detected.

The chief factors governing the rate at which a body will settle through water are: (1) Its size, (2) shape, (3) specific gravity, (4) the temperature of the water, or any cause affecting the viscosity of the liquid, (5) the quantity of suspended matter present in the water.

SIZE.

If v represents velocity of fall in foot seconds, d diameter of body in feet, s specific gravity of body, and k a constant depending on the shape of the body (equal to about 9·35 for spheres, 6·12 for irregular grains of sand, according to my latest experiments), the velocity of fall in water for bodies over $\frac{1}{10}$ in. in diameter will be given with fair accuracy by the expression:—

$$v = k \sqrt{d\,(s - 1)}.$$

It will thus be seen that the rate of fall varies directly at the square root of the diameter.

SHAPE OF BODY.

I found that a curious law governs the position a body of irregular shape takes up in falling through water. We are accustomed to apply the law of "least resistance" to explain many phenomena in Nature. If we apply it in the present case, it would seem to indicate that a body such as a disc will settle through water edgewise, a rod endwise, and so on; but the contrary is the case; a disc always settles on the flat, a rod with its greatest length horizontal. I have established this fact beyond question, and it would appear that a body chooses that position which offers the greatest resistance to its fall. For this reason a sphere settles more rapidly than any other shape, and flat, thin bodies, such as slates, settle very slowly indeed.

SPECIFIC GRAVITY.

Referring to the formula given above, it will be seen that the velocity of settlement varies directly as the square root of the specific gravity of the body minus that of the liquid in which it settles.

WATER TEMPERATURE.

This has a profound effect on the rate of fall of fine matter in water, due, no doubt, to its influence on viscosity. A rise in temperature of the water produces an increased rapidity of settlement, which is most marked with the more finely divided materials. The rate of settlement of silicious sand of $\frac{1}{1000}$ in. diameter is doubled if the temperature be raised 80 deg. Fahr.

AMOUNT OF SUSPENDED MATTER PRESENT.

It can be shown experimentally that the greater the load of suspended matter, the slower its rate of settlement. Finely divided solid matter held in suspension in water has practically the same effect on the specific gravity of the mixture, measured by a floating hydrometer, as if it were in solution.

It is reasonable under the circumstances to suspect that the amount of heavy matter suspended in a liquid will influence its rate of settlement in the same way as an alteration in the specific gravity of the liquid itself; and this is found to be the case.

PRACTICAL APPLICATION OF RESULTS.

We now come to the practical application of the results above referred to. We may first consider how we are to define the meaning of the words "stone" or "shingle," "sand" and "mud." It is obvious that any definition to be of use must be based directly or indirectly upon size of grain.

There appear to be two distinct sizes of particle to which further attention must be given. It will be observed that the application of the formula given above is stated to be limited to sizes over $\frac{1}{10}$ in. diameter. The reason for this is as follows: In experimenting on the rate of settlement of different grades of material I found that the value of k in the formula referred to was fairly constant over $\frac{1}{10}$-in. diameter; but for grains of smaller size it fell off rapidly in value, thus showing that some factor was operating in the smaller grades which was not taken into account in the expression given. That this factor was the viscosity of the liquid I have no doubt, and its preponderating effect in the smaller grades may be due to the rapid increase in the ratio of surface to volume or weight, as the size is reduced, or to the passing of a critical point in the velocity such as that shown by Osborn Reynolds to divide stream-line flow from eddying-flow.

While it is not strictly correct to speak of a critical diameter at which this effect commences to appear, I found on plotting values of the constant k referred to that at about $\frac{1}{10}$ in. diameter the curve bent rapidly downward, whereas above this it was practically horizontal.

It would seem that we have here a natural dividing line between sand and shingle. Any grade of material having grains over $\frac{1}{10}$ in. diameter would, on this basis, rank as shingle, while grades finer than this would rank as sand.

It must, however, be understood that there is really a shading off of shingle into sand, and a range of sizes of from, say, $\frac{1}{20}$ in. to $\frac{1}{10}$ in. diameter, which might be ranked either as coarse sand or fine shingle with equal accuracy; but it would simplify matters to fix the line more or less arbitrarily at $\frac{1}{10}$ in. diameter, and neglect the gradations referred to.

Again, mud particles sometimes approach in size the limits of microscopic vision; so that we have clearly a considerable range of size to choose from in defining mud as distinct from sand. If we decided to take all below the critical diameter referred to as being mud, we have to consider how it is that particles of such a size as to be permanently suspended in water ever reach the bottom to form mud. This is not such a serious difficulty as might appear, for it is well known that certain physico-chemical actions often tend to hurry the precipitation by pro-

* Extracts from paper read at the last meeting of the Concrete Institute.

ducing flocculation of very fine matter, whereby collections or groups of particles are formed which operate as single bodies, and thus settle much more rapidly than would otherwise be the case. This is one of the causes of the formation of bars and deltas, as the sea water tends to thus precipitate mud coming down rivers.

Ordinary deposits classified as clays or muds contain varying proportions of silica and alumina in a more or less comminuted state, and their properties vary with the proportions present. The greater the percentage of alumina present the more plastic and "mud-like" in the ordinary sense does a sample become; so that the distinction between sand and mud is partly chemical, partly physical. From our point of view, however, it does not appear desirable to base a distinction between mud and sand on composition; and it is upon the size of a grain that we, in practice, rely to distinguish them.

To define mud or dust by the *diameter* of its grain is not, however, of much practical use to the engineer, who cannot examine doubtful samples with a microscope and micrometer. A method of definition is therefore required which will be practically applicable, and I would suggest that we consider as mud or dust any particles which, when stirred up in water in a glass vessel 12 in. high, cause a discoloration by suspension, which does not clear immediately—that is, within, say, a minute. This will cover all grades from about $\frac{1}{1000}$ in. diameter down, and include clay proper, which, when present in the aggregate as a coating on the stones, is very prejudicial to the strength of the concrete, owing to the interference with proper adhesion between the cement and the aggregate.

CONCRETE WORK UNDER WATER.

When concrete is allowed to settle through water, the effect is to bring about an analysis into coarse and fine strata. The larger particles—stones, gravel, &c.—settle more rapidly than the finer sand and cement; with the result that they reach the bottom first and form a layer over which the sand and cement settle, also in separate strata—the cement on top, the sand underneath it. The separation is not quite complete, because the larger particles always carry down in their wake some of the smaller, and for other reasons which we need not go into. Even when allowed to fall through only a foot or so of water the fine cement is washed out and, to a great extent, remains suspended, owing to the disturbance of the water. This is such a well-known fact that it does not call for further attention here.

EXCESS OF WATER IN CONCRETE.

When fine and coarse particles are suspended in a liquid the coarse, by virtue of their greater weight compared with their surface, tend to work towards the bottom, displacing the fine matter upwards; for it must be remembered that a body falling through a liquid always generates an upward current to fill the space which it occupied, and this is sufficient to keep very fine particles suspended. The case of immediate interest is that of concrete mixed with too much water; in such, when kept in a state of disturbance by ramming, there is a tendency for the coarse part of the aggregate to work towards the bottom, the finer sand and cement towards the top giving a deceptive appearance to the concrete of having been thoroughly consolidated.

CONCRETE MIXING.

It is not uncommon to meet with a so-called concrete mixer which, when closely watched, is found in some cases to separate the fine from the coarse parts of the aggregate. I have already indicated that permanent suspension of solids in water results from a continuous disturbance of the water, also that while a very slight disturbance is sufficient to suspend fine matter, this is not the case with the coarser grains. It is, therefore, easy to see that with sufficiently liquid concrete a badly designed mixer may produce sufficient agitation to suspend the sand and cement, but not the coarser part of the aggregate, which consequently gradually separates out as a bottom layer. This is, of course, an exaggerated case, and implies an excess of water; but while a mixer may not be so bad as to operate as a separator, it may be delayed greatly in its mixing operation by the above cause. Of the two chief types of mixer now in use, one depends on revolving arms operating in a fixed vessel, and this is the type most likely to be affected by the cause described, unless very carefully designed with proper provision for a positive mingling of the different parts of the concrete as distinct from mere agitation. The other type, in which mixing is effected in a revolving vessel fitted with shelves, is more likely to produce good concrete, as its action depends on repeated shifting of parts of the mass from one place to another—for example, from bottom to top and sides to middle.

TEST OF CONCRETE MIXING.

I hold very strongly the view that sufficient attention has not been given to the proper mixing of concrete. It is a process which has a perfectly definite point of completion, which is, however, not always attained to. Concrete may be said to be thoroughly mixed when all the ingredients are as uniformly distributed as possible throughout the mass. If we accept this as a definition of proper mixing, then samples taken from different parts of a heap of concrete should contain the same proportion of stone, sand and cement. The different rates of settlement of these three afford the engineer a simple method of measuring the relative proportions in any part of a heap of concrete. If, for instance, a small quantity of concrete be placed in a tall glass vessel full of water, shaken up, and allowed to settle, three distinct layers of sediment are formed. The stones or gravel settle immediately, then follows the sand, and after a much longer period—about ten minutes in a vessel 12 in. high—the cement forms another well-defined layer. The depth of these layers varies as the amount of the respective materials present; hence, a simple measurement of the depths in two samples enables us to compare the relative quantities of the different ingredients at any two parts of the heap.

In practice the application of this test may be simplified thus: Excluding the case of concrete, which is semi-liquid, and in which the coarse matter may therefore have separated from the fine, we may safely assume that if the sand and cement be properly mixed the coarser parts will also be mixed, since the time required to mix uniformly increases as the grain becomes finer. I have therefore found it advisable to take account only of the distribution of the cement through the sand, as this permits the test to be made with much smaller samples of concrete than if the coarse aggregate were also included.

INSPECTION AS TEST OF MIXING.

There were two special tests made, to which attention should be drawn. The first was directed towards determining what was the true value of inspection alone as a test of concrete mixing. For this purpose a sample of mortar of the proportions cement 1, sand 2, was made; beside this was placed another having cement 1, sand 2½, but no difference could be detected by eye. The result was the same with cement 1, sand 3, and it was only with cement 1, sand 3½, that any difference in appearance could with certainty be detected. On applying the sedimentation test to these samples, the difference in strength between 1 in 2 and 1 in 2½ was easily observed. It is therefore quite clear that inspection alone—the test which is ordinarily applied—is not sufficient to determine whether concrete is properly mixed or not.

HAND MIXING.

The second test I should like to draw attention to is one of hand-mixed concrete, turned twice dry, twice wet, on a London works of a reputable contractor.

Seven tests were made of different batches, and uniformity found in one only. The following figures show the percentage variation in the amount of cement in different parts of each batch:—

	Per cent.
Batch No 1	4
,, No. 2	7
,, No. 3	15
,, No. 4	0
,, No. 5	24
,, No 6	15
,, No. 7	17

All batches, except No. 5, were mixed in my presence, or that of the foreman or engineer; No. 5 was mixed by the men alone, without supervision. It would therefore seem that when concrete is mixed by hand it may not be of uniform strength, and that to bring the weakest parts up to the strength required an excess of concrete must be used equal to at least 10 per cent more than if uniformity of mixing could be assured. It is hardly necessary to say that on even a small work using, say, 1,000 tons of cement, a saving of 10 per cent of this would be well worth making. By the use of a proper mixing machine, effectively used, this saving can be made. I do not say that it is impossible to get uniformity by hand

mixing, but that the amount of supervision required makes it *practically* impossible.

I am aware, however, that mixing machines vary greatly in their ability to mix, and also require supervision in their working as well as hand mixing. I have found the test just described very useful in determining for any particular mixer the time or number of revolutions required to give a uniform concrete. It enables the engineer to say when mixing is complete with any particular aggregate or proportions, and thus to avoid either improperly mixed concrete or the unnecessary curtailment of the output of a machine due to over-mixing.

ROAD MAINTENANCE IN RURAL DISTRICTS.*

By L. Caplen,
Surveyor to the Yeovil Rural District Council.

At the time when the writer is drafting these few notes rain is descending in torrents, and has been doing so for days past; "potholes" are therefore very much in evidence, to say nothing of mud upon the roads.

Just now highway surveyors are not exactly being blessed by the general public, but it has often struck me how little people realise the difficulties that beset the rural road surveyor, especially one who has charge of a big mileage of highways spread over a large area. In the first place it is often the custom for posts to be advertised at barely a living wage, which makes it impossible for the official in charge of the roads to be able to give the proper amount of time and supervision to his work. In addition to his outdoor duties he has often to do the whole of the clerical work of his office, which, as time goes on, certainly does not diminish, but, on the other hand, greatly increases.

The class of roadman that the rural surveyor usually has in his employ is certainly not of the best, unless his district is a favoured one where he can obtain good men at a good wage. Having regard to this, the more personal supervision that is exercised the better the results will be, but this cannot be done unless the official receives such remuneration as will enable him to provide and maintain proper means of locomotion.

The cry is often raised that the rates are going up and the cost of road maintenance increasing, but some people fail to realise that what answered very well twenty years ago for traffic will certainly not answer now. The present requirements of the general public on country roads are far more exacting, a state of affairs to a large extent brought on by the use of the motor-car, which, although doing damage to the highways, has brought about a better state of affairs as regards system of repairs and maintenance, and those of the general public who are not users of motors have benefited inasmuch that they have far better country roads now than would have been the case had the motor car not made its appearance.

Touching on the damage done by cars, much of this could be done away with if drivers would only use more discretion than they do. Given a clear road in the country the car is generally kept right in the middle, and the result is that the surface gets badly "tracked," although the whole of the rest of the road remains good. This applies especially to flint and gravel surfaces, and to the road that is highly cambered. For highways that have to take motor traffic to any great extent I have found flint a poor material for surfacing, although in wet weather it forms a fairly clean road, providing there is a passable foundation or old crust existing.

It is not often in rural districts that one is fortunate enough to have to maintain roads which have anything that can be termed "foundations" to them. The practice is to substitute granite or other hard material in the place of flints or local stone in order to cope with the increased and varied traffic of the present day, and it often happens that a good stone is spoilt by the way it is sent out by the firms supplying, insufficient attention having been given to the breaking and screening; to my mind there is room for a lot of improvement in this direction.

Opinions differ a good bit as regards the size of macadam to be used for surfacing, but personally I prefer a stone from 2-in. to 2¼-in. gauge. When coating the object aimed at is to get the material consolidated into a compact mass which will afford the greatest amount of resistance to crushing and disintegration, and with the ordinary water-bound road it seems that if stone of a large size is used this result cannot be obtained owing to "voids" left after rolling.

I have alluded to the highly cambered road, which is a source of great trouble and expense to rural surveyors. One cannot often scarify down the centre and utilise the surplus material therefrom, as in nine cases out of ten there is no foundation, and the crust is not strong enough to allow of this being done. It is therefore often necessary to ballast up the quarters with local stone so as to allow for a proper camber when resurfacing, and for this purpose, and also when coating in the ordinary way, the roadman, when spreading, is very much helped if he has the use of a road level cut to the required camber. For the ordinary water-bound road I am using cambered levels, giving a run of ¼ in. to 1 ft. The level is made 9 ft. long out of 9 in. by 1 in. timber, with spirit level in centre, and is shod with iron.

As to the rutted road with fairly low quarters but with the centre good, a saving of material may sometimes be effected by scarifying from the inside edge of the ruts, drawing back the old material to the quarters, rolling it and spreading the new stone from the inside edge of the ruts right out to the quarters. Providing the new material is properly spread, a good job can be made if the road is strong enough in the centre to hold up under the big wheel of the roller when rolling from the quarter to the centre.

I think it is now generally regarded that better results are to be obtained in repairing roads by concentrating the materials in as long lengths as possible, and paying attention to patching and rutting such portions as cannot be coated during the current year. I find it is somewhat difficult to get one's men to realise how important this is. Although complaints may sometimes be received as to the lengths that have to be left owing to lack of material, it is better to have to put up with such complaints, but at the same time be able to say that on the same road there are stretches which have been made up well and will last than to try and make a ton of stone do twice the area that it should, and in the end have an indifferent road from start to finish.

* Paper read at the annual meeting of the Association of Somerset Surveyors held at Bridgwater on the 25th ult. See The Surveyor, January 31st, p 265.

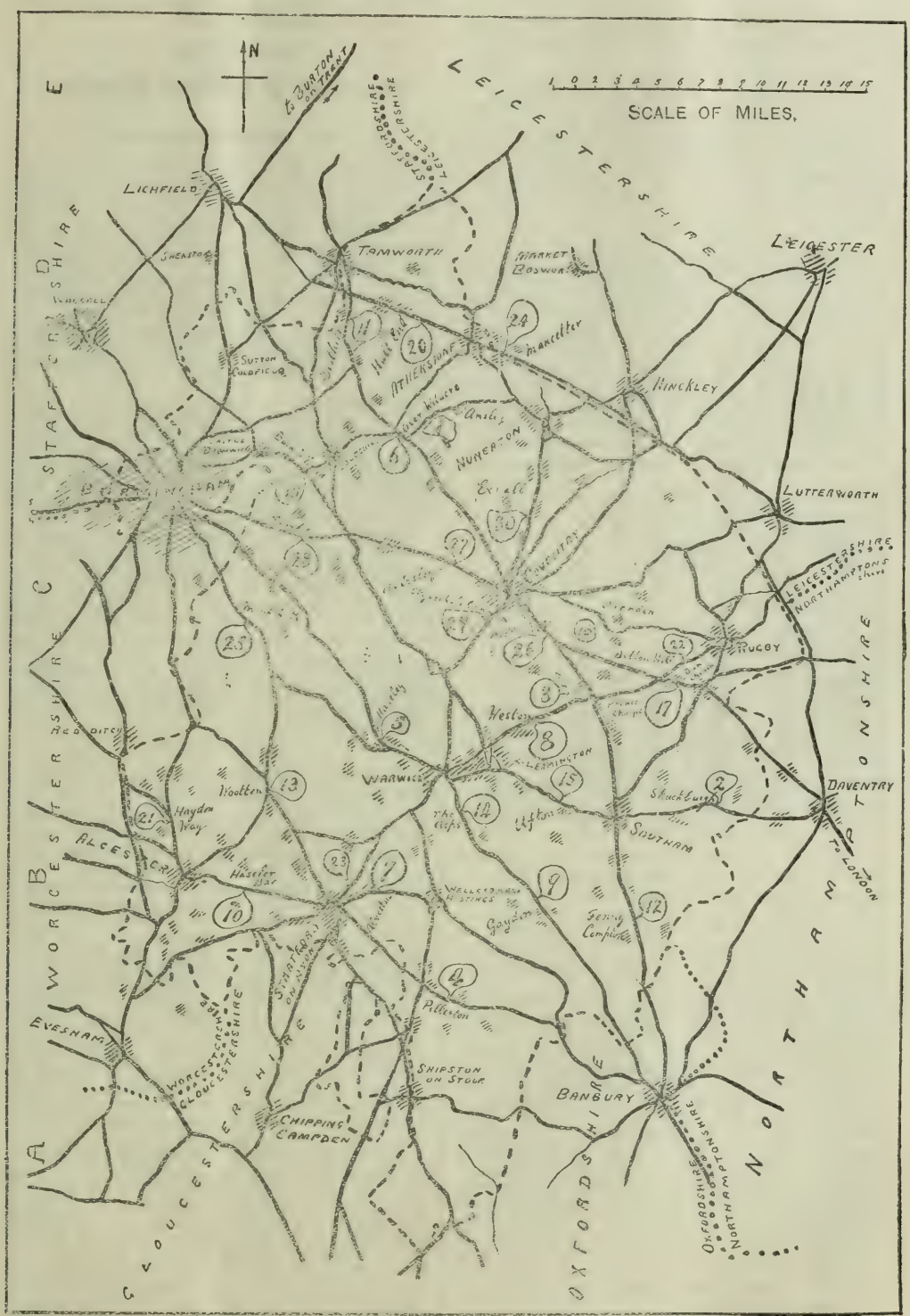
Roads Improvement Association.—The Select Committee on Motor Traffic have intimated that they will be pleased to hear representatives from the Roads Improvement Association, and a special meeting of the council will shortly be held to settle the evidence to be given. Among the main points to be dealt with by the association are the necessity for (1) A London Traffic Board to obtain unity in the administration of the highways in the Metropolitan area; (2) the more efficient regulation of all traffic in order that the traffic capacity of the streets may be utilised to the fullest extent; (3) the education of the general public as to the proper method of negotiating traffic when crossing a thoroughfare or alighting from a vehicle; (4) the alteration of the rule of the footpath to the same as that of the road; and (5) the level of the carriageway in a number of London streets being lowered, having regard to the height of the kerb and the footpath.

The Cost of Road Tarring.—The borough surveyor of Bury, Mr. G. G. Buckley, in a report on the subject of road maintenance, writes: "The gas engineer informs me that the price of tar will be increased from 2d. to 2½d. per gallon, and offers to supply 30,000 gallons to the corporation at the latter price. I have carefully considered the offer, and would recommend you to accept it for the present year, as, owing to the demand, there is no possibility of purchasing it at a lower figure, but at the same time I desire to state that, in my opinion, surface tarring cannot be adopted economically in this borough if any further increase be made. Even at 2½d. per gallon I am not prepared to advise you to continue its use year by year, and am convinced that the time has arrived for adopting methods of road construction which will obviate to a great extent the necessity of surface tarring." In calling attention to this, the borough surveyor remarked that he thought the council would be doing the proper thing in adopting some of the more modern methods of road making, having regard to the fact that tar was now becoming so expensive. It was a matter on which he hoped to report more fully at a later date.

TRAFFIC ON WARWICKSHIRE MAIN ROADS.

CENSUS FIGURES FOR A WEEK IN AUGUST.

Below is given a sketch map of Warwickshire which has been specially prepared for THE SURVEYOR in order that readers may be provided with a ready means of studying the traffic return—which we reproduce on the next page—relating to seven consecutive days in last August, from 6 a.m. to 10 p.m. every day. The names of the census points and of the roads on which they are taken have been omitted from the table; but the name of each place will be found on the map near the reference number, in letters ordinarily used in writing. The names of the towns are marked in square lettering, their positions being shown by hatching. The other patches of hatching mark the positions of villages or of railway



SKETCH MAP OF WARWICKSHIRE.

(This shows the principal roads and the stations at which a traffic census was taken for the seven consecutive days, August 12th to August 18th, 1912, from 6 a.m. to 10 p.m. every day.)

stations, not generally over the whole area, but only where villages or stations are near census points and likely to affect the amount of traffic. The roads shown are those usually marked as main roads on maps provided for cyclists and motorists, a few other roads being shown, in thinner lines, where they seem to be of importance. There is usually a considerable network of secondary or by-roads near those census points which as shown by the hatchings, are more or less surrounded by villages or groups of hamlets; but for the sake of clearness these are not shown on the map. The census points are all at places on county main roads. Each reference number is surrounded by a ring drawn to a point at or near the spot where the census was taken. The boundary of the county is shown by a thick dashed line, the lines of large dots running outward from it marking roughly the boundaries between counties bordering on Warwickshire, but without regard to outlying portions of these counties.

Traffic Statistics

on the Warwickshire Main Roads from a census taken at 30 point, on seven consecutive days, from the 12th to the 18th August, 1912, from 6 a.m. to 10 p.m. each day.

Census point.	Average width of road.	Average weight in tons per day (computed as per Road Board scale).	No. of ordinary cycles per day.	No. of all vehicles, excluding ordinary cycles, per day.	No of motor vehicles, including trailers, traction engines and motor cycles per day.	Percentage of motor vehicles, including trailers, traction engines and motor cycles, to total of all vehicles—col. 5.
	Ft. in.	Tons.	No.	No.	No.	Per cent.
1	18 0	109	55	80	32	40
2	18 0	127	69	70	32	45
3	16 6	130	119	96	64	67
4	16 0	137	64	78	35	45
5	18 0	169	148	118	75	64
6	17 6	172	164	119	55	46
7	16 0	177	145	120	45	37
8	17 6	178	172	112	56	50
9	15 0	185	88	105	57	54
10	18 0	202	121	160	131	82
11	17 6	205	99	95	38	40
12	15 0	217	83	160	84	52
13	21 0	239	164	196	134	68
14	17 0	242	103	147	69	47
15	18 0	254	164	160	91	57
16	17 0	262	513	154	69	45
17	20 0	284	197	219	154	70
18	17 0	308	489	228	164	72
19	20 0	314	388	237	130	55
20	22 0	339	342	212	63	30
21	21 0	347	423	263	184	70
22	17 6	386	431	249	91	36
23	18 6	388	236	261	205	79
24	22 0	392	448	268	98	36
25	21 0	451	435	344	205	60
26	20 0	609	703	479	351	73
27	24 0	727	547	465	361	77
28	24 0	734	588	480	319	66
29	20 6	736	1,029	598	426	71
30	22 3	797	823	384	130	34
Averages...		326	312	222	161	59

The position of Warwickshire is such that the greater part of the area, which may be regarded as normally populated, lies between a densely populated area on the west and north-west and the ordinary pastoral and agricultural lands of Leicestershire and Northamptonshire to the north-east and east, and those of Oxfordshire and Gloucestershire on the south and south-east. The densely peopled Black Country lies partly in the county—Birmingham and places near it—but mainly outside, to the west of CD, as marked on the margin of the map. Beyond DE the country is thickly peopled, but not so thickly as in the Black Country. The area to the west of BC is also thickly populated, while to the west of AB the population is somewhat thicker than in the districts to the south and east. The amount of motor traffic is, no doubt, affected by the presence of Coventry, Warwick and Stratford-on-Avon to an extent greater than that due to their populations. The sketch map should be studied with the aid of a map of England and a ½-in. map of a good class; the latter being sufficient to show the minor network of roads. The main sources or "magnets" of traffic within the county are, probably, Birmingham and Coventry, Warwick with Leamington, and Stratford-on-Avon. Leicester lies some way beyond the north-east border, Banbury near the south-eastern border, and Evesham a little to the south-west. The stations marked "17" and "26" are designated as lying in the road from Coventry to London, "2" and "15" on the road from Warwick to Northampton, the others being indicated as lying between places in the county or near the border. The stations have not been concentrated on a few routes to show the relative importance of local and of through traffic, but a study of the map furnishes some suggestions in this matter, particularly on the route including the numbers 11, 6, 26, 3 and 12, and that including 5, 14 and 9, the predominating influence of the towns being suggested by the figures for these and some other stations.

INSTITUTION OF MUNICIPAL ENGINEERS.

VISIT TO WOOLWICH ARSENAL.

The members of the Southern and South-Eastern Districts of the Institution of Municipal Engineers paid a visit to Woolwich Arsenal on Thursday of last week. The programme had been arranged by Mr. Arthur Palmer, hon. secretary of the Southern District, and over sixty members and friends assembled at the main gates of the Arsenal, Beresford-square, at 2 o'clock. Among the members present were the following: Messrs. E. A. Stickland (Windsor), A. J. Webb (Long Crendon), J. W. Riggs (Hertford), Walter F. Taylor (Surbiton), S. B. Hasell (Hambledon), E. C. Pearcy (Milton), H. Cooper (Wandsworth), W. Louis Carr (Ruislip-Northwood), J. Lewis (Yiewsley), N. R. Verma (London), T. Mundy (Woolwich), P. J. May (Wealdstone), A. N. Hudswell (Woolwich), H. J. Higgins (Lewisham), F. E. Ennals (Billericay), J. Chittendon (Faversham), W. J. Coleman (Maidenhead), H. A. Scott (Esher and the Dittons), H. W. Lovelock (Godstone), Arthur Palmer (hon. district secretary), and B. Wyand (secretary of the institution). Many members arrived after the roll had been called, and their names could not be recorded.

The party—split up into four sections, each under the conduct of a special guide—left the main gates at 2.15, and the round of visits comprised the main machine shop, wood working shop and wheel factory of the Royal Carriage Department; the boring mill, radial crane, heavy turnery shop and West forge (with the notable 3,000-ton press) of the Royal Gun Factory; the shell foundry, cartridge factory, brass foundry, bullet factory and main factory. In every department the fullest information was given, the processes being carefully explained and special demonstrations occasionally provided.

The Concrete Institute.—The total membership of this body is now 955. We understand that when the number reaches 1,000 an entrance fee, which at present is not demanded, will be imposed.

Proposed Road Widening in North London.—The Improvements Committee of the London County Council asked the Road Board whether it is prepared to consider an application for a grant of £50,000 towards the cost of the widening of Old-street and Kingsland-road. In reply, the secretary of the board (Mr. W. Rees Jeffreys) has written stating that if the council would intimate their acquiescence in the principle that the other improvement schemes towards which they intend to ask for a grant should be schemes not dealing with an urban area congested with local traffic, but having for their object the improvement of some main outlet of London, especially in the outskirts, the board would seek the sanction of the Treasury to their making an immediate grant. The committee remark that, having regard to the special conditions prevailing in London, they do not see their way to advise the council to give a definite assurance as desired by the Road Board, but that in preparing schemes for submission to the board they are giving careful consideration to the views expressed. In view of the urgency of the Old-street and Kingsland-road scheme, they consider that the submission of an application in respect of this proposal should not be delayed until a decision shall have been arrived at as to the other schemes to be put forward, and they suggest that the board should now be approached with a view to its granting £50,000 towards the cost of the proposed improvement. At a meeting of the council on Tuesday last Mr. Whitaker Thompson's motion, making formal application for the grant of £50,000, was agreed to, an amendment by Sir John Benn that a scheme or schemes as suggested by the Road Board should be submitted at the same time being rejected by 42 votes against 18.

Office Conversations.

MORE OR LESS IMAGINARY.

[*Contributed.*]

IV.—A Vacant Appointment.

Am I going to put in for Walson-on-Stoke? Well, I've thought about it, Mr. Smith; but—— Oh, that's how the land lies, is it? You're thinking of having a cut at it yourself, only you don't wish to —— Don't worry in the least about me, Mr. Smith. We've all got to do our little best, and good luck to you if you pull it off. You've the pull of me naturally, because I'm only a chief. Don't see the force of my remark? Why, my dear fellow, it's plain as Mrs. Rhumboid's face. What's the popular conception of the relative attainments of the chief and the deputy? Why, that any fool can be a chief, but that the deputy must be a smart man. The chief sits in his chair all day and gives orders, while the deputy carries them out. It's the same in newspaper offices, I'm told. The editor smokes fat cigars and talks while the subs. run the paper; and while the most incompetent bletherer that ever wasted ink could edit the largest London daily, only a man of vast ability could sub-edit the smallest.

* * * *

All rot? Possibly; but there's in the statements the spice of truth that carries a mighty unpleasant sting. Now, how will you word your application, Mr. Smith? Won't you give a list of the works that have been carried out here under your personal supervision, and won't this list include all the work that has been carried out since you came here? One moment, Mr. Smith; let me finish. Won't you have been in sole charge of the highways and the sewerage works, and the lighting station and the building department? And the drawing office—who will have bossed that but you? No, don't colour up, Mr. Smith; I'd do—nay, I've done—just the same. But it does come a bit hard on the chief, doesn't it? I can just picture the Walson-on-Stoke committee going through the applications. "Colin Stockforth—Walter Smith!" remarks a councillor; "why, they're both from the same office. Hum—Smith seems an excellent all-round man. Why, he does everything—runs the whole concern, manages all the departments, supervises the men, prepares the drawings and specifications. Stockforth? Oh, he's only the chief, Mr. Chairman; seems as though he does nothing. We know the kind of man. Sits in the office all day and leaves everything to his deputy. I propose that Mr. Smith be asked to attend before the council." No; on second thoughts I won't court disaster. I'm not very keen on the job, and I'm very comfortable where I am. You have a shot for it, Mr. Smith, and good luck, and what I can do for you I will.

* * * *

You won't apply for it if I don't? Oh, yes, you will—you've more sense than to lose the chance of a chief appointment where you can sit down all day and twiddle your thumbs while the deputy—— There, it's only my joke, Mr. Smith; don't be offended. Really, I don't want to put in for the job. The salary's better certainly, and another £100 a year is always acceptable; but there's peace of mind to consider. I have no doubt that the Walson-on-Stoke councillors are an estimable set of men; but there's just the chance that they are not. Here I rub along comfortably. I know my council and they know me, and £100 a year 'd be poor compensation if I found myself in a perfect hotbed. It 'd be just as bad for you? No, it wouldn't. Your rise would be nearer £300 a year, and you'd obtain a chief appointment. Why, there 're hundreds of men that stick as deputies or chief assistants all their lives. Once a chief, always a chief; don't forget that! And don't forget another thing. Directly you get your new appointment—oh, yes, I know it's in the clouds at present—look out for something else. Don't let a day slip by. You're young, and there's plenty of time for rusting later. Experience is what you want, and you can't have too much. I've been here nearly ten years now, and that's at least seven too many.

* * * *

No, I've nothing special this morning, Mr. Smith. You might just see how Wiltons are getting on, and mind and keep a sharp eye on Brown. He'll be shoving in all manner of rubbish if you don't. And oh! just a moment. I want the plans ready for the committee before lunch, so that we can go through them together. I suppose your report's all in order? That's good. And oh! Mr. Smith—sorry to call you back—but you'll remember Robinson's application; just give a look to what he's done. By-the-bye, I declare I was nearly forgetting it. Clarkson's men are coming over to-day to fit those new valves. It won't do to leave them alone; and while you're about it you might see Winstables—you'll pass their place on the way—about those brooms they sent us. Why, they'll be as bald as a badger in a month! Yes, I think that's about all, unless you can give Cheale a hand with those details. He's very slow on the board, and hasn't the ghost of a notion how to control a staff. You'll be back at half-past twelve, won't you? And oh!——

* * * *

Hang it! There're at least half a dozen things I want to tell him about. Just like him—off in a flash. And then they throw it in your face that the deputy does everything! Hallo! Yes, show him in. Good morning, Mr. Marrion—up to my neck in it, as usual, you see. Important matter? Sit down, please; I'm all attention. The Walson-on-Stoke appointment—am I entering for it? Well, really, Mr. Marrion, I scarcely know what to say. I suppose that you have a right, as chairman of the council, to ask me the question; but—— Oh, no; I'm not offended; because you see I'm not bound to commit myself; but there, there's no reason why I shouldn't be open with you—with *you*, you understand, and quite unofficially. Yes, I have thought of going in for it. It's a clear gain so far as salary goes. It 'd be a more important position than the one I hold here—and—and—— I may speak plainly? Well, then, I'm none too comfortable here; I—— Surprised? Well, of course, I've no complaint against you, Mr. Marrion, or against the majority of the council, but there are certain members—no, I'd sooner not mention names [I'm afraid I couldn't if I tried]—who are not quite fair in their treatment of me. It isn't that I wish to leave the place. I have many excellent friends here; I have (taking the members all round) one of the best councils in England; I——

* * * *

Would I be prepared to remain if—if—— Well, of course, that'd put a different complexion on the affair at once. It's really highly flattering to think that the council values my services so highly. Yes, it *would* be awkward if I went now with all those matters unfinished, and I'd be the last to leave you in the lurch. But, of course, you understand my position. I've got to look after myself. We surveyors aren't like the Poor-law officers, with their security of tenure and their comfortable pension, and all that sort of thing. We are dependent solely upon our salaries, and if we can see the chance of a lift up—why, we shouldn't be acting fairly to our families if we allowed it to go by. Yes, the Walson-on-Stoke salary is £100 more than I get here. If the council gave me a rise of £50, with two successive annual rises of £25 each, would I withdraw my application? To tell the truth, Mr. Marrion, it hasn't exactly gone in yet, but I—er—I—er—I have the draft ready and—— Yes, I'll take the offer, and am really pleased to have had the opportunity of considering it. I don't believe in changes. They unsettle one and all that sort of thing. Thanks very much, Mr. Marrion; it is more than kind of you. Good-bye.

* * * *

Whew! Thank goodness that's over. The unexpected with a vengeance! I wonder how he heard that I was thinking of putting in for the job. Still, it's done no harm, and anyway, whatever I might have done, there's no chance now of my entering the lists with Smith. Come in! Oh, that you, Mr. Cheale? I was just talking to Mr. Smith about those detail drawings you're on. They've been a long time about, you know, and I asked him to lend a hand, if necessary. Not

satisfied with you? Well, I don't exactly say that, but I should like things expedited a bit. Your hand's not firm enough, Mr. Cheale, and you allow your staff just a bit too much latitude. You must keep their backs bent to it. Oh, yes, I'll give you a reference right enough—you needn't fear about that—but, if I may ask—— Going to leave us? You may be? Got a better job, eh? *Where?* Walson-on-Stoke? What, are you putting in for it? Well, there's nothing like trying, and I wish you luck, only—— No, to speak plainly, I don't think it's the kind of post that 'd suit you. Of course, apply if you like—it's not my business—and I'll do what I can in the way of a testimonial. You'll have a lot of responsibility, you know. Look at the salary? Oh, yes, I grant that; but there, I mustn't stand talking here. Good luck to you.

* * * *

Mrs. Rhumboid? Now, whatever can she want at this time of day? Good morning, Mrs. Rhumboid; and what's your special trouble? You're thinking of leaving? Come, I'm sorry to hear that—something better, I hope, although I should think the caretaking here wasn't so bad a job after all. Too much charing and too many masters? I'm afraid you'll have to put up with both wherever you go. Still, you know your own business best. And when are you leaving us? Not quite settled yet—only just applying for another place? *Where?* Walson-on-Stoke? Heavens! you're not going in for the surveyorship, are you? Caretaker's job vacant there, is it? Oh, I didn't know that, though I shouldn't have been surprised if you'd been going to have a run for the other. Every one seems on it in this place. Oh, yes, I'll give you the best of references. Only too pleased—too pleased. Good-day, Mrs. Rhumboid, good-day. Come in! Oh, it's you, Wilson! Now, before we go any further, just tell me—are you going in for the Walson-on-Stoke appointment? I've had fifteen in about it in the last ten minutes, and Mrs. Rhumboid is—— No, you needn't look startled—*she* won't be on the selected list. You're not in for it then? That's all right, and you can fire away and tell me what you want in the fewest possible words.

"CAMARCO" PAVEMENT IN BERKSHIRE.

Some time ago we visited a section of "Camarco" pavement laid by the Berkshire County Council on the main Bath road between Reading and Twyford. Our subsequent reference to the work was most favourable, and we now have much pleasure in being able to reaffirm our observations as a result of a visit to the same road on Wednesday of last week.

It seems that "Camarco" had given such satisfaction

"CAMARCO" ON THE BATH ROAD—BOTTOM LAYER IN FOREGROUND.

to the county council that they had decided—wisely, we think—to make up a further section of the road with this first-class bitumen. The method they decided upon was the same as that used before with "Camarco"—viz., machine coating the dry and heated metal before laying and consolidating. The machine used was the same as before—viz., the "Acme" Mixer, supplied by the Durable Roads, Limited, of Westminster Palace-gardens. When the work was partially finished, the suppliers of "Camarco," the Canadian Mineral Rubber Company, Limited, of 32 Victoria-street, were kind enough to invite us, with a number of well-known surveyors, to visit the site and inspect the pavement, both finished and in course of construction. We found the work in full swing.

The "Acme" Mixer was run by a small kerosene engine, and was turning out the coated metal at the rate of from 35 tons to 40 tons per day. This meant about 300 super yds. of finished road per day, which, it will be admitted, is very satisfactory progress for a country main road. The Durable Roads representatives assured us that if necessary they could speed the machine up so as to turn out from 50 to 60 tons per day, and from what we saw this appeared to be no exaggeration.

The metal used in the construction was Welling-

VIEW OF ROAD SHOWING FINISHED SURFACE IN FOREGROUND.

borough slag of two sizes—viz., 2½ in. for the bottom and 1½ in. for the top. The specification was to lay one course of large material 2½ in. thick and consolidate with the steam roller. On top of this was laid 2½ in. of 1½-in. slag, and this was then consolidated with the roller. All the metal was of course previously coated with "Camarco" in the machine. Following this final consolidation liquid "Camarco" was lightly spread over the surface by hand, and was then covered with ¼-in. granite chips, and the road was finished with light rolling.

The result appeared to be excellent. The "Camarco"-slag crust was quite firm enough to stand up under the exceedingly heavy lorry and trailer traffic which frequently passes over it; it was not at all slippery to horses nor to rubber tyres, and seemed to possess remarkable resiliency and life. The representative of the Canadian Mineral Rubber Company, Limited, explained that this was due to the great inherent elasticity of "Camarco." Finally, what perhaps most impressed us was the fact that it was raining the whole time we were there, and had, we were told, been raining practically ever since the job was started. Yet the work went on without delay.

The Canadian Mineral Rubber Company, Limited, suppliers of "Camarco," and the Durable Roads, Limited, suppliers of the "Acme" Mixer, will be pleased to answer all inquiries both as to above section laid by the county council last June and the one the construction of which we have just witnessed. We would certainly recommend our readers who are interested to inspect these sections, and we are asked to say that the suppliers of "Camarco" will be pleased to send their representative, Mr. C. O. Seymour, to accompany any surveyors who may wish to make the inspection.

Prestwich Town Planning.—Mr. S. H. Morgan, ASSOC.M.INST.C.E., the council's engineer and surveyor, gave evidence at the inquiry held recently before Mr. T. Adams, Local Government Board inspector, in respect of an application by the Prestwich Urban District Council to prepare a town planning scheme. He has prepared the plans for the scheme, and insisted that it is absolutely necessary, if the district is to have proper development, that the town-planning scheme should be sanctioned. The council should be able to control the laying-out of estates and provide for the future as well as the present.

MOTOR TIP WAGONS.

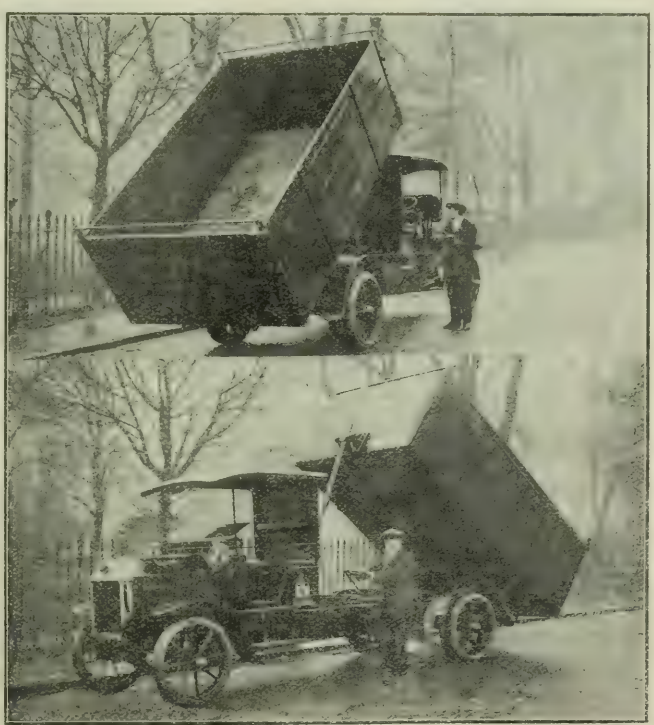
THE LACRE COMPANY'S VEHICLES.

We have received from the Lacre Motor Car Company, Limited, whose London offices are at 78 York-road, King's Cross, N., some particulars of a tip wagon which they have recently supplied to the Glasgow Corporation.

The vehicle is one of the firm's 30-horse power 3-ton types, fitted with a body of large capacity, which is fitted with a double-acting telescopic screw, capable of tipping the body to an angle of 45 deg.

In order to facilitate loading, small doors are fitted to the sides of the vehicle, and the rear part is designed on the type of the well-known Scotch carts, being detachable. A special feature of this body is the substantial iron channel runners and cross members which form the under-frame of this body, these enabling the weight of the body when loaded to be equally distributed over the frame of the chassis. This vehicle has a curved dash and fixed canopy over the driver's seat, giving ample protection against inclement weather.

Three-ton Lacre Tipping Wagon for Glasgow.



Front and Rear Views of Lacre Wagon, showing Vehicle Tipped.

NEWCASTLE-ON-TYNE TOWN HALL.

PROPOSED EXTENSIONS.

A few weeks ago the corporation received from Mr. Beresford Pite a report dealing with proposed alterations to the town hall. Mr. Pite suggested retaining the corn exchange on the ground floor, making a small hall to accommodate 500, and devoting the remaining space to municipal offices. The committee having charge of the matter referred the report back for a new one, from which the corn exchange should be eliminated, and a concert hall shown accommodating 2,000 to 3,000 people. Mr. Pite has now replied that the larger scheme is almost impracticable without resorting to complete rebuilding, which would cost approximately £100,000.

Trafalgar-square Subways.—It was stated at last Tuesday's meeting of the London County Council that proposals are under consideration for the provision of subways in Trafalgar-square.

Institution of Mechanical Engineers.—The sixty-sixth annual general meeting will be held in the meeting hall of the institution on Friday evening, the 14th inst., at eight o'clock. In the course of the proceedings the annual report of the council will be presented, and the result of the ballot for the annual election of the president, vice-presidents, and members of council announced.

Ancient Roads in Hertfordshire.—On Monday last the Herts County Council had before them the question of the desirability of the council taking over ancient roads, under "The Ancient Monuments Protection Acts, 1882 and 1900." At the November meeting the county surveyor, Mr. Urban A. Smith, presented a detailed report on such roads. The subject was then referred to the Highways Committee, and the council on Monday, in accordance with the report of the committee, resolved that no further action be taken at present.

Junior Institution of Engineers.—The annual dinner will take place on the 15th inst. at the Hotel Cecil.

CORRESPONDENCE.

For every ill beneath the sun
There is some remedy or none:
If there be one, resolve to find it;
If not, submit, and never mind it.
—Anon., *circa* 1843.

CAPITAL EXPENDITURE AND ROAD MAINTENANCE.

To the Editor of The Surveyor.

Sir,—Referring to the interesting article in your issue of December 6th last, and taking the financial aspect, it appears that we have some 29,200 miles costing annually £3,695,666, which averages about £126 per mile. Upon your basis of allowing £500 for every £20 per mile saved, it would need an expenditure of about £55,700,000 to reduce the cost of maintenance to £50 per mile, or to effect a saving of about £2,200,000 per annum, but when will the authorities "take the bull by the horns"? Is it not reasonable to contend that if we are up to date in road construction we must be in finance also? Taking the results you publish on the 17th inst. of the trials between New Eltham and Sidcup, it will need a considerably larger expenditure supposing the twenty-three methods on their merits come within consideration for economical uniformity.

As the rural districts show a further increased cost in maintenance—viz., 5·3 per cent—and have the largest mileage, it seems significant that those roads costing the most with the least mileage should be dealt with first from an economical point of view, as to deal with some other roads first would take less capital and effect a great saving. For instance, take the non-county boroughs.

Present cost per mile £227, an outlay of £5,500,275 should reduce the cost of maintenance on 1,243 miles, and save more than 4 per cent on the outlay, and a still greater saving if only the centre were armoured at the point of attrition for heavy and fast traffic, with a regulation compelling such traffic to use only that part of the road except when meeting or overtaking similar vehicles of less speed.—Yours, &c.,

Thomas Jones.

Hampden-in-Arden.
January 21, 1913.

[Mr. Jones's figure, 29,200, is about the mileage of all urban roads outside London, and his £3,695,666 about the annual cost of maintenance of these roads, not including loan charges. Certainly the proper financing of road work is a matter that ought to be taken up seriously, but there is much more in it than finding capital to wipe off annual expenditure. Sometimes more money should be spent on renewals, to reduce the cost of repairs, and the whole cost; in other cases more should be spent on small constant repair, to reduce the cost of renewals, and the whole cost. As regards the £500 capital and the £20 a year maintenance, our point was that at least £20 a year must be knocked off the cost of maintenance in order to pay for the capital. We did not mean that £500 capital will never reduce maintenance by more than £20 a year, nor that it always reduces it by so much. The purpose and effect of spending capital on roads may come under any of three heads: (1) To reduce the whole cost, with or without improvements for traffic, the interest on the capital and the new cost of maintenance being together less than the old cost of maintenance; (2) to effect improvements for traffic without making any difference in the whole expense, the cost of maintenance being reduced by an amount equal to the annual cost of the capital; (3) to improve the road for traffic, or to develop it into a road of greater importance than before, the cost of maintenance being reduced by an amount less than the annual cost of the capital, or being actually increased, the total cost being much increased in some cases. The third head, of course, covers a wide range of improvement work. The mileage of roads capable of being brought under the first of these heads is probably greater than is usually supposed, and it is to be hoped that the Road Board will undertake, or encourage the undertaking, of test works in favourable cases, without introducing improvements primarily intended to advantage the public, the work being done purely as a matter of highway economics in the narrower sense. If money is spent for other than economic purposes, it will naturally produce other than economic results. Crust improvement is, for instance, sometimes a luxury rather than an economy. We understand that Mr. Jones, accepting our proportion, contemplates a reduction of maintenance costs from £126 a mile to £50 as a possibility in some cases. We had not in view a radical change of this kind, but rather a reduction of maintenance cost limited to some moderate percentage of the whole cost, and limited also to some maximum as an actual sum, the maximum varying with the kind of road regarded as a work rather than with its class from the traffic point of view. That in some districts important economies are possible we do, however, believe. It is important to realise the difficulty of undertaking direct economic improvements without at the same time providing other kinds of improvement, and even for luxuries, which wipe up all the direct economic advantage. To some extent this is necessary, and we should be the last to suggest that any effort should be spared to develop the internal resources of the country, and especially agriculture and village industries. At the same time, we do suggest that the Road Board may devote some time and money to the purely economic side of the matter from the point of view of the ratepayers and their surveyors. We believe that suitable roads for test work of this kind could easily be found. We do not follow Mr. Jones in his suggestion as regards a formal division of the highway. A reference to our special roads article will show that, while we recognise the importance of the physical distinction, in cases where it is applicable, we would not hamper natural developments by making a new rule of the road. We are obliged to Mr. Jones for his interesting contribution to the study of the subject, and hope that any other of our readers, having views of his own as regards capital expenditure, will not hesitate to put them forward in our ever-open pages.—Ed. The Surveyor.]

TRAFFIC-RECORDING METHODS.

To the Editor of The Surveyor.

Sir,—The writer was greatly interested in your admirable editorial remarks on January 10, 1913, concerning the paper by Colonel J. W. Howard entitled "Traffic-Recording Methods." Two years ago the writer submitted to you a paper on the same general subject which you kindly published and noted editorially in your issue of March 10, 1911.

In both cases the editorials were probably of greater value than the papers, excellent as Colonel Howard's paper is; but it seems to the writer that in all the publications sufficient emphasis, perhaps, has not been given to one factor in the problem—that is, the speed of motors.

The writer considered this factor in his earlier paper. Colonel Howard seems to have ignored it. Possibly the difference in point of view furnishes an explanation, for at the time the writer prepared his paper his attention was mainly given to country roads, whereas Colonel Howard seems to have considered mainly, if not wholly, city streets or their like. It may be admitted that with pavements and with the usual limits to speed over such, the speed factor is of far less importance than on macadam roads or similar road crusts in open country. Nevertheless, it would be desirable for many reasons in establishing standards for the purpose of comparing travel records to have such standards applicable to both roads and streets. When is a street not a street? The answer is not yet agreed on. Therefore, in the further efforts along this line suggested by the closing paragraph of your editorial, the writer hopes proper consideration may be given to the matter of speed.

The December (1912) Bulletin of the Permanent International Association of Road Congresses has an interesting report (p. 298) in this connection.—Yours, &c.,

W. W. Crosby.

Baltimore, Maryland.
January 23, 1913.

[Mr. Crosby draws attention to a very important point. The damage and wear factor, represented by the nominal "weights" assigned to vehicles of different classes in our own Road Board traffic census forms, might well be made to include a recognition of speed. The matter has not been overlooked in our own pages, and in one of our issues of 1907 the following will be found: ". . . the best policy is to keep the motor car within bounds, both as regards speed alone and as regards size and weight in relation to speed." The idea is that a speed of, say, 30 miles an hour is more damaging per unit of weight in the case of a motor car weighing 1½ tons than with a car weighing 15 cwt., and so on.—Ed. The Surveyor.]

STRUCTURAL ECONOMY.

To the Editor of The Surveyor.

Sir,—After seeing your notice on December 20, 1912, of Mr. E. A. Slater's new book, "Structural Economy," I have been reading it for myself, and am so much impressed with its value to engineers, architects in general and my municipal brethren in particular, that I feel it a duty to direct their attention to it. If not contrary to your regulations, I should be glad if you will include this letter in your next issue.—Yours, &c.,

Arthur E. Collins,
City Engineer.

Norwich.
February 5, 1913.

[The book referred to by Mr. Collins is published by the St. Bride's Press, Limited, 24 Bride-lane, E.C., price 6s. nett.—Ed. The Surveyor.]

INSTITUTE OF SANITARY ENGINEERS.

ANNUAL DINNER.

At the Holborn Restaurant, on Monday evening last, Mr. H. Percy Boulnois, M.Inst.C.E., the president, occupied the chair at the annual dinner of the Institute of Sanitary Engineers, among others present being Sir Melvill Beachcroft, Sir Henry Tanner, Sir John Cockburn, Sir Wm. J. Collins, Prof. Henry Adams, Dr. A. Wynter Blyth, Dr. H. R. Kenwood, Messrs. A. J. Martin (past-president), R. J. Thomas, county surveyor, Buckinghamshire, and Thomas Cole (president and secretary respectively of the Institution of Municipal and County Engineers), E. White Wallis (secretary of the Royal Sanitary Institute), J. W. D. Bradley, W. Whitaker, W. H. Grieves, engineer and surveyor to the Sutton (Surrey) Urban District Council, E. T. Hall, W. J. Dibdin, C. Chambers-Smith, E. R. Palmer, G. W. Chilvers, F. W. Mason, O. E. Butcher and G. Hasluck (secretary).

Proposing the toast of "Our Public Health Authorities," Sir Melvill Beachcroft said he was prompted sometimes to go back to his earliest recollections of London. That was in 1855, when none of the important bodies which now controlled the health of the metropolis had any existence. The sewage passed straight into the Thames, and everything connected with sanitation was in a state of chaos; in fact, had it not been that the House of Commons was so affected by the smell which came from the sewers, they would not have had the Metropolitan Board of Works, the authority which preceded the present county council. At present they had such extraordinary means at their disposal that the only question was whether they were used to the best advantage. How was it, he asked, when they had 125,000 paupers in London today, disease had more to do with pauperism than anything else? How was it that in Shoreditch a man of twenty-one had but half the chance of a man in Hampstead of living to the age of 45? He should like to see the coming county council elections fought, not on the point as to whether the old corporation of London should give way to the county council, but as to what could be done to make the poorer members of the community healthier and stronger.

Sir John Cockburn, in responding, pointed out that local government owed its existence to the demands of public health. The Englishman's house was no longer his castle; instead, there was one continual surrender to the health officer, and yet there had been no serious complaint as to the ever-increasing powers with which local authorities were invested.

"The Institute of Sanitary Engineers" was given by Sir Wm. Collins. The view he had always taken had been that there were only two practical professions in this world—that of the surgeon, who operated on man, and that of the engineer, who operated on Nature. The engineer had a wide range of knowledge, theoretical as well as practical, but the sanitary engineer required more knowledge of public health laws and a wider range of science than the ordinary engineer. Medical doctrines were no doubt somewhat embarassing to the sanitary engineer, but he had no doubt that the doctrine and practice of the sanitary engineer were based on a surer and sounder foundation than these passing theories, and it was because the members of that institute represented the highest and best of their profession and had in their president one of the first and foremost engineers of the day, and one who commanded the highest respect and esteem of his colleagues, that he asked them to drink that toast. While healthy sanitary doctrines were familiar to all experts, they were not so well known to the public as, perhaps, they ought to be, and the Trust that bore the name of that early sanitarian Edwin Chadwick had decided to devote a great deal of its funds this year to a series of public lectures dealing with various aspects of sanitary engineering and public health. The first of these lectures were to be delivered by their president, Mr. Boulnois, and the opening lecture would take place that week at the Royal Sanitary Institute.

The President, in reply, expressed regret at the absence of Mrs. Boulnois, who had looked forward to being present that evening, but had been prevented by illness. One of the objects of their annual dinner was to bring to the knowledge of the general public the fact that they existed, that they had certain duties to perform, and that they tried to carry out those duties to the best of their ability. Founded some eighteen years ago, they had branches in Manchester, Birmingham and Northampton, and one of their aims was to promote honourable practices among their members. That might convey nothing to the lay mind, but in all professions, unfortunately, there were black sheep, and they had combined with a view of curing anything that might be regarded as discreditable. Another object was to settle disputed points of professional usage and courtesy, while members were afforded opportunities of intercourse and the exchange of ideas at the meetings which they held periodically. Last, but not least, they endeavoured to protect the mutual interests of their members. Referring to the difficulties which at times confronted public officials, the president reminded the company that he himself had been a municipal engineer all his life, and his experience had been that there existed in many councils a party whose one idea was to save the rates, who hampered progress, and who were continually finding fault with their officers when the latter were trying to do their duty. Local government was all right on paper, but in practice it often failed. Reforms in municipal representation seemed to him to be required; he had a doubt, for instance, whether builders should be allowed to serve on public bodies. As an old municipal officer he felt there were really many points in which reform was desirable, and he hoped to see the day when these would be carried out.

Mr. A. J. Martin, chairman of council and immediate past-president, proposed the toast of "Kindred Institutions." He did not think it was properly realised how much they owed to those kindred bodies. If they went back to earlier times and recalled the lack of everything that made life tolerable in those days, they would be able to appreciate the marvellous changes which had taken place. It was not, however, the politician whom they had to thank for that advancement; it was the hard, slogging, unremitting work of engineers, architects, sanitarians and medical men—in short, the members of the profession embraced by his toast—to whom they were indebted, and it was to them they looked for progress in the future.

Mr. R. J. Thomas, president of the Institution of Municipal and County Engineers, in response, said it was true that very great progress had been made in recent years in connection with sanitation, but something he saw a few months ago pointed to the fact that their ancestors were not such fools as they might have thought them to be. An old Roman villa had been discovered in Buckinghamshire, and in that he had seen a complete installation for the supply of hot air, and a system of flues all round the dwelling, the bathroom of which, too, was fitted with a lead waste. In some concluding observations Mr. Thomas suggested that the nearer one kept to Nature and assisted it to carry out its work, the more likely they were, whether in making roads, laying sewers, or in heating and ventilating their buildings, to achieve success.

Mr. William Whitaker, who also replied, said the toast proposed by Mr. Martin was a very proper one, because it was a mistake for any society or institution to think it could act independently of others. In the complicated state of society that existed they were dependent on each other, and it was only by the combined action of these kindred institutions, working in different directions, that any real benefit could result to their fellow creatures.

Submitting the toast of "The Visitors," Prof. Henry Adams referred to the great work accompanied by English sanitarians, and, commenting on the reduction in the death rate which had been effected as a consequence of the labours of the past 100 years, said it must follow from this that the enjoyment of life must have been increased owing to the improved health of the nation.

Mr. J. O. Neumann briefly replied, and the proceedings shortly afterwards terminated.

Assistants' and Students' Section.

CONDUCTED BY SYDNEY G. TURNER, ASSOC.M.INST.C.E.

All communications in regard to this page must be addressed to The Editor, St. Bride's House, 24 Bride-lane, Fleet-street, E.C. *Envelopes must be marked "Assistants' Section" in the top left-hand corner. Correspondents are invited to submit questions for consideration and answers to the questions which appear. For the contributions considered to be the most meritorious, one or more premiums in books will be awarded monthly. Diagrams must be drawn to scale on separate sheets, ready for reproduction.*

THE MONTHLY PREMIUM.

The premium for January is awarded to

Mr. H. M. WEBB,
City Engineer's Office,
Guildhall,
Worcester,

whose contributions have, in the opinion of the adjudicators, been the best received during the month.

QUESTIONS.

This week answers are invited to the following questions:—

300. Retaining Wall.—A retaining wall is required to support a roadway having no footpath, and consequently heavy vehicles such as steam rollers, &c., will seriously surcharge the wall. The height of the roadway above the adjoining ground is 8 ft., and the filling will be good clay. Design a suitable wall in mass concrete, and show calculations. (D. G. B., *Darlington.*)

303. Reinforced Concrete.—Give sketches of the usual forms of falsework for reinforced-concrete construction, showing how the moulding is arranged at the junctions, such as between the column and principal rafter, a column and cambered roof, &c. (T. H., *Leicester.*)

304. Geodesy.—What is meant by reducing a horizontal measurement to mean sea level? (Perplexed.)

305. Mechanics.—A machine is driven from a pulley 4 ft. in diameter by means of a belt. If the difference of pull in the two sides of the belt be 20 lb., and the pulley makes 150 revolutions per minute, what is the horse power transmitted by the belt? (T. R.)

306. Building Materials.—What are "encaustic" tiles, and how are they made? (Pup.)

[The Editor is at all times glad to hear from readers who desire to submit questions regarding matters of general interest, points of daily practice, &c., for insertion in the "Assistants' and Students' Section." Questions which are published are taken into consideration, as well as other matter, in awarding the Monthly Premium.]

REPLIES TO QUESTIONS.

301. Waterworks.—Two pumping engines deliver water at the rates respectively of 1,620 and 1,150 gallons per minute together into three pumping mains 10 in., 11 in. and 14 in. diameter. What is the velocity in and the discharge of each main? (D. G. B., *Darlington.*)

As the conditions stated are very vague, it is necessary to make one or two assumptions before proceeding with the calculations.

No lengths or lifts being included in the data, it is assumed that these are the same for each main, as might be the case if they all served to supply the same reservoir.

The mains are all supplied from the same pumps, so that the velocities in the pipes will adjust themselves until the total head (that is, the actual lift +loss due to friction+all other losses) is the same at the entrance to each main.

The loss due to friction in a length of pipe

$$= \frac{4fl}{d} \cdot \frac{v^2}{2g}$$

where l = length in feet
v = velocity in feet per second
d = diameter in feet
and f = coefficient of friction.

Let the 10-in., 11-in. and 14-in. mains be numbered 1, 2 and 3 respectively.

Neglecting all losses except those due to friction, and assuming that the actual lift, the length and the coefficient of friction are the same for each main,

then $\frac{v_1^2}{d_1} = \frac{v_2^2}{d_2} = \frac{v_3^2}{d_3}$

$$\therefore \underline{v_2} = v_1\sqrt{\frac{11}{10}} = \underline{1{\cdot}048\ v_1}$$

$$\text{and } \underline{v_3} = v_1\sqrt{\frac{14}{10}} = \underline{1{\cdot}184\ v_1}$$

Total discharge = 1620 + 1150 gallons per minute
= 2770 × $\frac{4}{25}$ cub. ft. per minute
= 433·20 cub. ft. per minute
= 7·387 cub. ft. per second.

Area of 10″ main = 78·540 sq. ins. = ·545 sq. ft.
,, 11″ ,, = 95·033 ,, = ·660 ,,
,, 14″ ,, = 153·938 ,, = 1·069 ,,

So that $\cdot545v_1 + \cdot660 \times 1{\cdot}048v_1 + 1{\cdot}069 \times 1{\cdot}184v_1 = 7{\cdot}3866$
$\therefore \cdot545v_1 + \cdot6917v_1 + 1{\cdot}2657v_1 = 7{\cdot}3866$
$\because 2{\cdot}502\ v_1 = 7{\cdot}3866$
$\therefore \underline{v_1 = 2{\cdot}951 \text{ ft. per second.}}$

$v_2 = 2{\cdot}951 \times 1{\cdot}048 = \underline{3{\cdot}093 \text{ ft. per second}}$
$v_3 = 2{\cdot}951 \times 1{\cdot}184 = \underline{3{\cdot}494 \text{ ft. per second}}$

$Q_1 = \cdot545 \times 2{\cdot}951 = 1{\cdot}609$ cub. ft. per second.
$Q_2 = \cdot660 \times 3{\cdot}093 = 2{\cdot}042$,, ,,
$Q_3 = 1{\cdot}069 \times 3{\cdot}494 = 3{\cdot}735$,, ,,
$7{\cdot}386$,, ,,

So that the 10-in. main discharges 1·609 cub. ft. per second with a velocity of 2·951 ft. per second; the 11-in. main discharges 2·042 cub. ft. per second with a velocity of 3·093 ft. per second; and the 14-in. main discharges 3·735 cub. ft. per second with a velocity of 3·494 ft. per second. (H. M. W., *Worcester.*)

302. Hydraulics.—By fixing a short tube to the orifice in the side of a vessel, a considerable increase in the discharge is obtained. Explain why this is so, and give the comparative "coefficients of contraction" with and without the tube. (E. S. M., *Luton.*)

When water flows from a vessel through a vertical plane, plate or partition which is not thicker than the diameter of the opening, the effluent stream will not pass out with *full flow*, but, owing to the converging currents, will assume a conical shape, form-

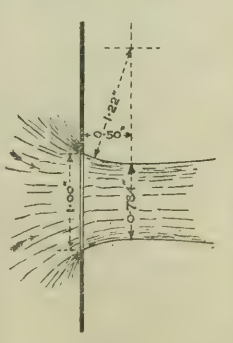


FIG. 1.

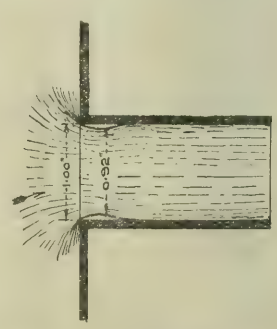


FIG. 2.

ing just outside the opening what is called the *vena contracta*, or contracted vein. In order that the contraction may take place to its fullest extent the inner sharp edges of the opening must not approach either the surface of the water or the bottom or sides of the vessel nearer than about 1½ times the diameter of the opening. The contracted vein occurs at a distance of about half the diameter of the orifice from the orifice itself; and ordinarily its area is about ·62, or nearly two-thirds that of the orifice (its

The Surveyor
And Municipal and County Engineer.

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diameter being ·784 of the orifice), and hence the actual discharge is but ·62 of the theoretical discharge.

When water flows from a vessel through a tube, the length of which is about 2½ or 3 times its diameter, the effluent stream will run with practically a full bore, and will discharge more water in a given time than if the tube was materially longer or shorter. For if longer than three times its diameter the additional friction against its sides begins appreciably to lessen the velocity and discharge; and if shorter than about twice its diameter the water will not flow in a full stream, but in a contracted one, as previously explained.

If the tube projects partly inside the vessel, the discharge will be diminished by about ¼th part.

The discharge through such openings may be increased to nearly the theoretical discharge by merely rounding off neatly the entrance end or mouth.

As much as ·92 or ·94 may be obtained by widening the opening toward its outer mouth, making the divergence about 5 deg.; or by widening it towards its inner mouth, but increasing the angle of divergence to from 11 deg. to 16 deg. In all cases the small end would be taken as the opening whose area must be multiplied by the velocity to obtain the discharge.

From the foregoing notes it will be observed that the coefficient of contraction for the discharge through an orifice in a thin plate is ·784; and that for the discharge through a short tube, not less than twice and not exceeding three times its diameter, is ·92. Figs. 1 and 2 show the section of the issuing stream in each case. (E. J. P., *Fareham.*)

Road Board Grant to Leeds.—It was announced at the meeting of the Leeds Town Council on Wednesday last that the Road Board had decided to make a grant of £9,000 for road improvement purposes.

Tramway-Car Tyres.—British firms being too busy to be able to guarantee delivery in six months, a contract for tramway-car steel tyres, it was reported at this week's meeting of the London County Council, has been sent abroad.

RIVERS BOARDS AND SEWAGE DISPOSAL.

THE FIXING OF A STANDARD.

In connection with the Yorkshire section of the Society of Chemical Industry, a meeting was held on Monday night last at the Queen's Hotel, Leeds, at which Dr. H. T. Calvert, of the West Riding Rivers Board, Wakefield, opened a discussion on the eighth report of the Royal Commission on Sewage Disposal. Mr. George Ward, chairman of the section, presided.

Dr. Calvert said this report was the most important yet issued by the Royal Commission, so far as it concerned the work of the Rivers Board. At present, he said, there was no statutory standard or limit of impurity for sewage discharges by compliance with which a sanitary authority was relieved of liability to prosecution under the Rivers Pollution Prevention Acts. The law only laid it down that the authorities must use the best practicable and available means to render their sewage harmless. Until now, therefore, the officers of the rivers authorities had adopted certain standards of comparison of their own, all being of opinion that a statutory standard was impracticable, although they believed that the various standards should have been brought into line with one another. In spite of the adverse opinion of many witnesses, however, the commission had come to the conclusion that a legal standard could be fixed, and had set forth tests to be carried out. All the former tests fell short of perfection, but those now recommended were no nearer the ideal. In some cases the commission recommended that the standards they were setting might be relaxed, but they were encountered by the obvious difficulties of a system requiring in effect a different standard of purity for the sewage or effluent of each place, and it would be readily understood that the multiplication of standards multiplied the difficulties of administering them, thus leading to an increased pollution of the rivers. If the views of the commission were adopted by the Legislature the work of the Rivers Board would be greatly increased, and an increased staff and laboratory accommodation would be necessary. In any case, the recommendation would add greatly to the difficulties of the board's work and to the delays of sanitary authorities in carrying out schemes of sewage disposal.

In conclusion (the *Yorkshire Post* reports), Dr. Calvert mentioned several concrete instances in the West Riding to show how unequal would be the effect of the recommendations. Wakefield, he said, contained two sewage works, the main one on one side of the river, and the second on the other bank, almost directly opposite. The volume of sewage at the former works was about 2,000,000 gallons a day, and at the latter about 15,000 gallons. The effluent in each case was practically the same, yet the standard for the larger works would be altogether more stringent than that for the latter, because, each considered apart, the available dilution was very much greater in the latter case, although, as a matter of fact, it would be practically the same in both cases. In the case of Leeds, Sheffield, and Horsforth there would also be difficult, and even ridiculous, propositions to decide.

"The Surveyor's" Coming-of-Age.—Mr. Hugh Stowell, chief engineering inspector of the Rivers Mersey and Irwell Joint Committee, writes: "May I congratulate you on the excellent and highly interesting number for January 17th, which I have read with much appreciation?"

Bromborough New Council Offices.—The new offices of the Bromborough Urban District Council were opened on Monday last. The buildings, which were designed by the council's surveyor, Mr. John Clarke, have a frontage to Allport-lane of 120 ft. and are set back from the old boundary line of the road some 20 ft., and bordering the land is a dwarf wall of red pressed brick with a stone coping and ornamental wrought-iron railing on top. The offices are faced on the ground floor storey with Ruabon red pressed brick and stone dressings, the upper storey with oak half-timbered work filled in with Keene's cementing, and the appearance of the building is pleasing and effective. Accommodation is provided for the clerk's and surveyor's staffs, with a spacious board-room for council and committee meetings. There are also a house for the assistant surveyor, and storehouses.

LOCAL GOVERNMENT BOARD INQUIRIES.

The Editor invites the co-operation of Surveyor readers with a view to making the information given under this head as complete and accurate as possible.

INQUIRIES HELD.

Baildon (Yorks) U.D.C. (January 31st. Mr. A. A. G. Malet.)—£893 for the extension of the sewage works.—Mr. J. N. Nicholson (of Messrs. Paterson and Nicholson, engineers, Bradford) stated that the instructions to his firm from the council were to make the present system of sewage treatment efficient at as small an outlay as possible. Dr. Wilson (of the West Riding Rivers Board), after asking several questions, said that the Royal Commission held that the fouler the river the higher the standard of purification required, and he agreed that the River Aire was very foul. Mr. Nicholson: The Royal Commission report is very contradictory, and you can read almost anything you like into it. Mr. Malet: That is the advantage of it.

Barkisland U.D.C. (January 15th. Mr. W. O. E. Meade-King)—£3,200 to provide a public water supply.—Dr. J. Hoyle medical officer of health, stated that many places in the district were without water three or four months of the year. Mr. W. Holmes, county council inspector, said that the county council had been urging for the scheme to be dealt with since 1897. He hoped the matter would be pushed ahead as quickly as possible.

Bournemouth T.C. (January 16th. Mr. F. H. Tulloch).—£2,150 for works of surface-water drainage in the Springbourne district.—It was stated by the clerk and the borough engineer, Mr. F. G. Lacey, that surface-water drainage had been the subject of previous inquiries, and sanction had been given for various works. The work it was proposed to carry out with the loan now asked for was merely an extension of the work in this particular district. It was rendered necessary through the overcharging of the sewers in the district. There had been a number of complaints from residents of the locality of flooding during the recent rains, and the work proposed would obviate these difficulties in the future.

Dublin T.C. (January 24th. Mr. P. C. Cowan).—£6,000 for the purpose of widening and improving Tara-street and George's Quay.—Mr. Patrick Tobin, secretary to the Paving Committee, stated that when the question of the improvement arose it was referred to the Paving Committee, and that committee requested the late city engineer (Mr. O'Sullivan) to confer with Sir John Griffiths, the port and docks engineer, and to submit a report and plans of the proposed widening of Tara-street. Two plans for the widening of Tara-street were afterwards submitted to the committee, and the estimated cost of the street-widening scheme was £6,000, which included the constructional street work, as well as the acquisition of the necessary property.

Halifax T.C. (January 14th. Mr. R. H. Bicknell).—£11,587 for works of paving.—The borough engineer, Mr. J. Lord, stated that if the present application were granted the work would be carried out within a couple of years. The town clerk explained that the corporation wished to pave certain roads with granite because it had a longer life than local stone, but they could not afford to do that continually out of revenue. Granite setts would not be laid on any roads having any gradient greater than 1 in 15. The inspector: What kind of setts are you going to use—hard or soft? Mr. Lord: We are going to use hard granite setts—Cumberland or Leicestershire. The inspector: You haven't got any money out of the Road Board, have you? The town clerk: No, sir. The inspector: You have had a good try, I see.

Halstead R.D.C. (January 21st. Mr. W. O. E. Meade-King).—£7,500 for the purpose of providing a water supply for the parish of Earls Colne.—Mr. Harry Hall Sands, of Messrs. Sands and Walker, engineers, stated that the scheme included the sinking of a small pump-well, erection of engine-house and water-tower, and the laying of mains throughout the district. The borehole had already been sunk on the site sanctioned, and an ample supply of water obtained. The borehole was 10⅝ in. internal diameter, and was sunk to a depth of 180 ft. Chalk was struck at 165 ft., so that the bore was lined 15 ft. into the chalk. The water rises to within 7 in. of the surface. The yield of the borehole was tested by fourteen days' pumping. Mr. H. O. Cross, the council's surveyor, said that the private wells of the parish were for the most part shallow, and the average depth about 25 ft.

Hartlepool T.C. (January 30th. Mr. W. O. E. Meade-King).—£972 for purchasing and laying out as a pleasure ground a triangular piece of land known as Redheugh Close, in the Cliff residential district.—The Town Clerk (Mr. H. W. Bell) stated that the price of the land was £500, though the vendor a few years ago paid between £1,200 and £1,300 for it. A strip of land on the Cliff Walk side will be used to widen the roadway. There was no opposition.

Mirfield U.D.C. (January 30th. Mr. A. A. G. Malet).—£3,850 for purposes of sewage disposal, £94 for sewerage purposes in Hand Bank-lane, and £523 for improvements in Doctor-lane and Water Royd-lane.—The surveyor (Mr. E. Gill) stated that the existing sewage farm at Northorpe had become sewage sick, and it was imperative that the council should erect settling tanks and other apparatus. As to the intended improvement of Doctor-lane and Water Royd-lane, it was stated that a census of traffic was recently taken which showed that between October 7th and 13th, 1912, 4,750 vehicles and 11,739 pedestrians, and 2,706 vehicles and 10,542 pedestrians respectively had used these roads, both of which contain dangerous corners.

Ripley U.D.C. (January 23rd. Mr. A. A. G. Malet).—£2,781 for works of sewage disposal in the southern portion of the central ward—Green Hillocks.—Dr. Barwise said the county council had only agreed to let this matter stand over until now because the council had had some difficulties at their Northern Sewage Farm. Mr. Fermor (chairman of the council) said they looked upon the scheme as absolutely necessary, and they were compelled to carry it out.

Spalding U.D.C. (January 23rd. Mr. H. S. Stewart).—£6,200 for the purpose of erecting thirty-six houses in the town for the working classes on allotment land belonging to the town situate on the outskirts of the town.—It was stated that plans had been drawn by Mr. J. B. Corby, architect, of Stamford, the proposal being to build ten of the cottages in couples and the remainder in blocks of four, so as to give variety to the street which was to be formed. The cost of each cottage worked out at £144, and the total area of the allotment land proposed to be taken was about an acre. It was stated by the deputy clerk of the council, in presenting the scheme, that the provision of proper housing accommodation for the working classes was one of the greatest needs of the district. Wherever a cottage was to be let the landlord was inundated with applications. In many cases the present cottages included but two bedrooms, one of them merely a lean-to, and in many cases only one was a proper bedroom.

Wakefield T.C. (January 13th. Mr. R. H. Bicknell).—£14,134 for works of street improvement, and £1,238 for works for sewerage.—Details of the proposed works were explained by Mr. J. P. Wakeford, the city surveyor. In consequence of the constantly increasing heavy traffic in certain parts of the city it is proposed to substitute granite or whinstone paving for the present macadam or Yorkshire setts, and the estimated expenditure on this is a little over £14,000. The second loan asked for is in respect of proposed new sewers in Denby Dale-road, with a view to prevent flooding of cellars in the neighbourhood.

Warmley R.D.C. (January 23rd. Mr. F. O. Stanford).—£2,500 for works of sewerage for the parish of Siston (including the execution of works in the parish of Oldland), and also communication of the sewers with the sewers belonging to the urban district council of Kingswood to be provided for.—It was explained that a large chocolate factory was being established in the parish, near Mangotsfield, which would employ some eight hundred hands, and that number might increase later on. An agreement had been entered into with the owners of the factory in regard to the proposed drainage scheme, by which a substantial payment would be made to the district council by them. The estimate for the scheme was £4,000, and they only proposed to borrow £2,500. The surveyor to the council and engineer for the scheme, Mr. H. M. Bennett, said they had trouble at an early stage of the operation of the Warmley section of their sewerage scheme in regard to excessive surface water getting into sewers. That was about two or three years ago, and since then

they had searched out inlets and were getting rid of them. As a result they were diminishing that trouble.

Wombwell U.D.C. (January 15th.—Mr. R. H. Bicknell).—£7,400 for providing public swimming baths. The swimming baths are to be built in reinforced concrete, and lined throughout with white marble terrazzo, with black swimming lines, and also black border lines. The platforms around the baths are to be laid in green vitreous mosaic. The amphitheatre steps are to have wooden seats fixed thereto, and will be able to accommodate some 200 persons. A railing will be fixed along the top tier in front of the dressing boxes, and this will give standing room for another 100 persons. The swimming baths will be fitted with diving stages, spring boards, and water chute. Ample light and ventilation will be obtained from the windows in the side and end walls as well as from the large lantern lights in the roofs. The slipper baths throughout will be of porcelain fireclay, with roll edges, and each bath will have hot and cold water laid on through specially designed mixing valves. The council have accepted the designs of Mr. Harold Burgess, of Westminster, and that gentleman will be architect to the scheme.

APPLICATIONS FOR LOANS.

Brighouse T.C.—£1,101 for the purchase of land for a recreation ground and other purposes.

Colne T.C.—£1,386 for street improvement works.

Epsom U.D.C.—£1,807 for a wood-paving scheme.

Howden R.D.C.—£400 for further works of water boring.

Loughborough T.C.—£800 for the New-street improvement scheme.

Maidstone T.C.—£500 for the extension of the engine-house at the electricity works.

Pebworth R.D.C.—£4,284 towards the cost of a joint water supply scheme.

Redditch U.D.C.—£1,566 for the purchase of land for a housing scheme.

Rotherham R.D.C.—£9,311 for road improvements.

Southend T.C.—£739 for street improvement purposes, and £500 for the purchase of a site for a depot.

Torquay T.C.—£5,000 for fitting up the municipal buildings.

Thirsk R.D.C.—£508 for a sewerage scheme.

Worcester T.C.—£970 for street improvement purposes.

LOANS SANCTIONED.

Cheltenham T.C.—£4,000 for sewage disposal works.

Edmonton U.D.C.—£1,572 for culverting works.

Ilford U.D.C.—£12,700 for the construction of sewage disposal works.

Magherafelt R.D.C.—£1,600, supplemental loan for the completion of the improvement scheme.

Margate T.C.—£1,500 for the purchase of a site for a fire station, and £4,000 for work in connection with the pavilion and winter garden.

Pontefract R.D.C.—£978 for the purposes of the water supply.

Redditch U.D.C.—£3,334 for recreation ground, sewage disposal, and street improvement purposes.

Staffs C.C.—£10,500 for a school at Princes End.

Tilbury U.D.C.—£600 for street lighting purposes.

Wellingborough U.D.C.—£2,731 for street improvement purposes.

York T.C.—£990 for street improvement works, and £1,345 for sewerage and surface drainage works.

FORTHCOMING INQUIRIES.

FEBRUARY.

	£
10.—**Maidstone.** For burial ground purposes (Mr. R. H. Bicknell)	3,000
10.—**Merton.** For private street works (Mr. M. K. North)	490
11.—**Hove.** For the provision of underground conveniences (Mr. R. H. Bicknell) ...	2,480
11.—**Shrewsbury.** For the provision of working-class dwellings (Mr. H. A. Chapman)	12,000
11.—**Southport.** For sewage disposal purposes (Mr. A. G. Drury)	60,000
11.—**Stafford.** For new street purposes (Mr. A. A. G. Malet)	10,000
11.—**Wanstead.** For the erection of a fire station (Major J. Stewart)	1,250
12.—**Beckenham.** For private street works (Mr. F. H. Tulloch)	600
12.—**Birmingham.** For bridge reconstruction purposes (Mr. A. A. G. Malet)	7,500
12.—**Carshalton.** For the provision of a pleasure ground (Mr. Edgar Dudley) ...	6,000
12.—**Glastonbury.** For the purposes of the gas undertaking (Mr. W. O. E. Meade-King)	4,295
12.—**Mexborough.** For sewage disposal purposes (Mr. A. G. Drury)	7,370
12.—**St. Neots.** For works of water supply (Mr. R. G. Hetherington)	6,662
13.—**Exmouth.** For the purposes of the water undertaking (Mr. W. O. E. Meade-King)	1,200
13.—**Scarborough.** For the provision of lavatories and shelters (Mr. A. G. Drury) ...	4,039
14.—**Kingsbridge.** For works of water supply (Mr. W. O. E. Meade-King)	400
14.—**Martley.** For sewage disposal purposes (Mr. A. A. G. Malet)	4,000

LOWER THAMES VALLEY DISTRICT SURVEYORS' ASSOCIATION.

MEETING AT TWICKENHAM.

An ordinary meeting of the above-named association was held at the Town Hall, Twickenham, on Saturday last, the president, Mr. H. F. Coales, Assoc.M.Inst.C.E., occupying the chair.

The association considered the question of Hill's motor vacuum road cleansing machine, and it is possible that a demonstration will be arranged at no very distant date, in the event of which due notice will be given.

The association further considered the Metropolitan Water Board Various Powers Bill, now before Parliament, which deals, among other things, with notice by the local authorities to be given to the Metropolitan Water Board in opening highways; the substitution of hydrants for fire plugs, and the disposal of water from excavations, &c., by pumping into watercourses, sewers, &c., and it was considered that local authorities affected by the Bill should strenuously oppose the special clauses referred to.

The association also considered the London and South-Western Railway Company's Bill, Clause 33, in which the company seek power in connection with, or in extension of, their railway system, to run road vehicles moved by animal, electrical or mechanical power, for the conveyance of goods or passengers in any district to which their system affords access. It was considered that, owing to the great amount of damage which may be caused to highways by any such rights being given to railway companies, and in the event of their making use of such rights, the local authorities should oppose the clause.

The association also considered the question of the election of the council of the Institution of Municipal and County Engineers, and it was unanimously decided that the members of the association should support the candidature of Mr. A. Gladwell, the engineer to the Eton Rural District Council, and obtain as much support from their friends as possible to secure his election on the council of the institution.

The association also had under consideration the question of testing the quality of gas supplied for public lighting.

SEA-COAST EROSION.—For a very complete and inexpensive library on the cause, prevention and repair of coast erosion the following three works are recommended: "Coast Erosion and Foreshore Protection," by John S. Owens, M.D., Assoc.M.Inst.C.E., F.R.C.S., and Gerald O. Case (price 7s. 6d., post free 7s. 10d.), with numerous illustrations and diagrams; "Sea-Coast Erosion and Remedial Works," by R. C. Allanson-Winn, M.Inst.C.E.I. (price 1s., post free 1s. 1d.); and "Erosion of the Coast and its Prevention," by F. W. S. Stanton, Assoc.M.Inst.C.E., F.S.I. (price 3s., post free 3s. 2d.), with numerous maps and other illustrations. The publishers are the St. Bride's Press, Limited, 24 Bride-lane, Fleet-street, London, E.C.

Municipal Work in Progress and Projected.

The Editor invites the co-operation of Surveyor readers with a view to making information given under this head as complete and accurate as possible.

The following are among the more important projected works of which particulars appear below: Buildings—Middlesex, Newbury £3,000, Omagh; housing and town planning—Cardiff; refuse collection and disposal—Nottingham; roads and materials—Cornwall £10,770, East Sussex £18,877, Rochdale £13,260, Westminster £24,425; sewerage and sewage disposal—Doncaster £125,000, Truro £19,972; water, gas and electricity—Bolton.—Particulars of other works projected will be found on our "Local Government Board Inquiries" pages.

BUILDINGS.

Dublin T.C.—A new district fire station erected in Thomas-street from the design of the city architect, Mr. Charles J. MacCarthy, has been formally opened. The cost of the scheme was £7,800.

East Ham T.C.—The tender of Mr. J. W. Jerram at £19,697 has been accepted for the erection of a school in Brampton-road.

Exeter T.C.—The surveyor, Mr. T. Moulding, has been instructed to prepare a plan for a shelter in St. Thomas's Recreation Ground.

Folkestone T.C.—It is proposed to purchase the Harvey Grammar-school premises for £2,000, and adapt them as a cookery centre at a cost of £250.

Gloucestershire C.C.—The tender of Mr. W. J. Halls, of Gloucester, at £680, has been accepted for carrying out alterations and additions at Child's Wickham school.

Middlesbrough T.C.—A tuberculosis dispensary and hospital is to be erected at an estimated cost of £3,000.

Middlesex C.C.—The council in May last approved of the appointment of Mr. J. S. Gibson as architect for the purposes of the fittings and furniture for the courts, council chamber, and principal rooms at the Guildhall, and the County Buildings Committee now reported that Mr. Gibson's estimate of the cost was £13,613. The committee had considered the question of the additional furniture required for the offices, &c., and estimated that a sum of £2,000 would probably cover this expenditure. It seemed desirable that application should be made to the Local Government Board for their consent to a loan of £16,613 made up thus:—Estimated cost of fittings and furniture for principal rooms, £13,613; architect's commission (estimated), £1,000; estimated cost of fittings and furniture for offices, &c., £2,000; total, £16,613. In the meantime, pending the issue of the sanction of the Local Government Board to the loan, the committee were of opinion that tenders should be obtained, and recommended accordingly. It was stated by a member that the estimate for furnishing the council chamber alone came to £3,000, that £1,000 was excessive for the ante-room, while something like £800 was to be spent on a committee-room and a similar sum on another such room. A commission of 7½ per cent to the architect was too much. The recommendation to obtain tenders was adopted.

Newbury T.C.—Alterations are to be effected at the Corn Exchange so as to make it available as a town hall, at an estimated cost of £3,000.

Newry U.D.C.—The tender of Mr. Isaac Copeland, of Belfast, at £3,300, has been accepted for the work of extension and improvement at the town hall.

Omagh U.D.C.—Sets of plans are being invited for the proposed enlargement of the town hall.

Southend T.C.—The borough surveyor, Mr. E. J. Elford, has received instructions to prepare plans for shelters at Southchurch.

Southport T.C.—A bandstand is to be erected in the Lord-street open space, at an estimated cost of £1,000.

Staffordshire C.C.—A site is to be bought for an infants' school at Brierley Hill.

Torquay T.C.—An outside approach to the roof promenade is to be constructed at an estimated cost of £100.

Woolwich B.C.—The tender of Messrs. Kirk and Randall, at £1,486, has been accepted for the work in connection with the steel superstructure for the new engine house at Globe-lane.

HOUSING AND TOWN PLANNING.

Cardiff T.C.—Several plans have been prepared by the city engineer, Mr. W. Harpur, for proposed workmen's cottages at Kitchener-road, Portman-road, and Victoria Park, and it has been decided as an experiment, subject to the sanction of the Local Government Board, to erect thirty cottages on the Kitchener-road ground, which has been secured from the Parks Committee. The council hope to erect these at a cost of less than £170 each, and let them out at 6s. 6d. per week. In connection with the scheme at Portman-road and Victoria Park the Health Committee have decided to visit the district before giving final instructions

Dudley T.C.—A special committee has been appointed to report on the housing question.

Finchley U.D.C.—The Town Planning Committee have received a notification from the Local Government Board that the next town-planning scheme to be submitted to them for approval should include all the undeveloped land in the district. Steps have been taken to carry out the suggestion. It is stated that about ten thousand houses will in time be added to the district.

Okehampton R.D.C.—A plot of land is to be purchased at Chagford for the erection of workmen's dwellings.

South Mimms R.D.C.—The surveyor, Mr. G. Simcox, has prepared plans of a scheme for the erection of cottages on land belonging to the council.

PARKS AND OPEN SPACES.

Edinburgh T.C.—Corstorphine Hill, west of Edinburgh, a haunt of Sir Walter Scott, from which one of the finest views of the district can be had, is to be bought by the town council for the purposes of zoological gardens. The purchase price is £17,000.

REFUSE COLLECTION AND DISPOSAL.

Aberdeen T.C.—A refuse disposal scheme is under consideration involving the purchase of Cairnery Quarry and the provision of the necessary equipment at an estimated cost of £9,000.

Nottingham T.C.—A sum of £5,000 is to be spent on the purchase of motor vehicles for street work and scavenging purposes.

ROADS AND MATERIALS.

Belfast T.C.—Negotiations have been completed for the purchase of several properties in Castle-street for the purposes of the widening scheme.

Billinge U.D.C.—The surveyor, Mr. A. Darlington, has prepared schemes for the widening of Main-street at an estimated cost of £275, and improving Claremont-brow at an estimated cost of £70. Application is to be made to the county council for a special county grant in aid of the improvements.

Birmingham T.C.—The Public Works Committee have been authorised to carry out the improvement of King's-road, Hay Mills, between Speedwell-road and the corporation depot, including the construction of a new bridge over the canal, at an estimated cost of £5,025, to which certain frontagers will contribute £293.

Blean R.D.C.—The county council have notified their approval of a proposed road improvement near Studd's farm on the Herne Bay and Whitstable road, and the plans will be forwarded to the Road Board with a request for a grant.

Cornwall C.C—It is proposed to expend £10,770 upon the resurfacing of the roads in the western division, and application is to be made to the Road Board for a grant of £5,000 towards the cost.

Doncaster T.C.—The sanitary committee have accepted the tender of Messrs. Pearce & Co., Morecambe, for paving a part of St. Sepulchregate with granite setts, the amount being £1,300.

Durham C.C.—The Road Board's combined grant and loan of £50,000 for the improvement of the main roads has been accepted by the council.

East Sussex C.C.—It has been agreed to carry out a scheme for strengthening and tarring main roads for the year ending March 31st, 1914, at a cost of £18,877, provided the Road Board make a grant of £8,877 towards the cost of the works. It has been further agreed to contribute three-fourths of the cost of tarring main roads in urban districts during the ensuing year where such work is done by the urban authorities, such cost not to exceed 1½d. per square yard, and to contribute three-fourths of the cost of tarring other sections of main roads on the application of local authorities or private individuals, provided the work is carried out by or to the satisfaction of the county surveyor, at an estimated cost of £1,500.

Finchley U.D.C.—The tender of the Praed Road Construction Syndicate, Ltd., estimated at £660, has been accepted for treating Fortis-green-road with bitumen asphalt.

Hammersmith B.C.—Property to the value of £2,393 is to be purchased for the purpose of the King-street improvement.

Kensington B.C.—The borough engineer, Mr. A. R. Finch, Assoc.M.Inst.C.E., has been instructed to prepare plans and specifications for renewing the wood paving in portions of the following roads, at the estimated costs mentioned:—Elgin-crescent, £1,484; Kensington-road, £3,740; Palace-gate and Gloucester-road, £3,506; King-street, £160; Young-street, £144. The advisability of substituting wood for the existing clinker block paving in portions of Kensington-square is under consideration. The estimated cost of the work is put at £785.

Knaresborough U.D.C.—Application is to be made to the Road Board for a grant towards the cost (estimated at £943) of remaking High-street from what is known as Parrs-corner to the cemetery gates.

Loughborough T.C.—A scheme for the improvement of New-street is to be carried out at an estimated cost of £800.

Middlesex C.C.—The Improvements Sub-Committee are to confer with the local authorities concerned in connection with the proposed Western Approach Road (as to which a report on an amended scheme has been prepared by Mr. H. T. Wakelam, the county surveyor), and as to the proposed variation of the route suggested by the Heston and Isleworth Urban District Council.—Reconsideration was last week asked for the system adopted by the Highways Committee of making deductions from the accounts of certain local authorities in respect of wages paid to workmen employed on the main roads and who receive over 26s. per week. It was contended that while that sum might be a fair amount to pay in remote parts of the county, it was inadequate for a workman with a family near London. The proposal for reconsideration was referred back.

Ormskirk U.D.C.—Derby-street is to be paved with granite setts at a cost of £850.

Richmond (Surrey) T.C.—The Improved Wood Pavement Company, Limited, have completed the wood-paving throughout the whole length of Kew-road and Kew Bridge Approach.

Rochdale T.C.—It is proposed to carry out improvements in Oldham-road, Milnrow-road, Whitworth-road, and Manchester-road, Castleton, at an estimated cost of £13,260. It is intended to put down granite setts in place of the macadam with which these roads in some parts are surfaced.

Rotherham R.D.C.—A horse sweeping machine is to be purchased for the removal of dust from roads previous to tar spraying, at an estimated cost of £30.

Westminster B.C.—The works committee have decided to invite tenders for paving nineteen streets or parts thereof with wood, asphalt, or other paving material, at an estimated total cost of £24,425. The selection of the material to be used in each case is to be deferred until after tenders for the work have been received. The approximate area to be paved amounts to 36,335 sq. yds.

SEWERAGE AND SEWAGE DISPOSAL.

Bowland (Yorks) R.D.C.—A communication has been received from the Local Government Board stating, with respect to the recent inquiry into the proposed sewage disposal scheme for Bolton-by-Bowland at an estimated cost of over £2,000, that the scheme ought to be remodelled and greatly reduced in extent, and that the hamlet of Holden, the sewage of which would cost nearly one-half the total estimate, ought to be left out for the present, and the remainder reduced in cost. The council have decided to have the plans revised, and a new estimate made for a modified scheme for submission to the Board.

Doncaster T.C.—The Sanitary Committee have passed a new sewage scheme to deal with a population of 75,000, including the adjoining townships—probably in the near future to be incorporated—at an estimated cost of £125,000.

Gloucester T.C.—The council have accepted the tender of Messrs. T. B. Cooper & Co., Bristol, for the reconstruction of parts of the northern and southern main sewer, and for constructing a new main outfall sewer at a cost of £6,952; and also the tender of Messrs. Thomas Wardle & Sons, Bristol, for constructing a tunnel under the river Severn, and syphon chambers at each end, with syphon pipes and incidental flushing arrangements, at a cost of £8,904. These works, entailing an expenditure, including engineers' fees, &c., of approximately £17,000, are undertaken in fulfilment of a promise given to the Local Government Board as a condition of the extension of the city in 1900.

Hartley Wintney R.D.C.—The scheme of sewerage and sewage disposal for Hartley Wintney prepared by Mr. T. J. Moss-Flower, C.E., of Westminster and Bristol, has been adopted, and application is to be made to the Local Government Board to borrow the money to carry out the work.

Holywell U.D.C.—The plans submitted by Mr. F. J. Commin, engineer, Westminster, of the proposed sewage disposal works have been accepted and forwarded to the Local Government Board. The estimated cost of the scheme is £2,783.

Ongar R.D.C.—The council are being pressed by the Local Government Board to prepare an adequate scheme of sewerage for High Ongar, a question that has been in abeyance for some years. The council have negatived proposals by the Sanitary Committee for dealing with the matter, and they have now invited the High Ongar Parish Council to bring forward an alternative plan.

Rochdale T.C.—The Paving and Sewering Committee have decided to schedule 101 more houses with separate sanitary accommodation for conversion to the water carriage system. Up to date the number scheduled is 1,865, and the number completed is 841.

Truro T.C.—The city surveyor, Mr. F. A. Barnes, has received instructions to prepare plans and specifications of a sewage disposal scheme for the city, at an estimated cost of £19,072.

WATER, GAS, AND ELECTRICITY.

Belfast T.C.—The new vertical retorts, coke handling plant, and spiral guided gasholder which have been erected at the gasworks were formally opened recently. The installation was supplied by West's Gas Improvement Company, Ltd., Manchester. The scheme included the removal of one of the existing gasholders and the substitution of it by a four-lift spiral-guided holder, which was supplied and erected by Messrs. Robert Dempster & Son, of Elland.

Bewdley T.C.—Negotiations are proceeding with a firm of electrical engineers for supplying electricity for the public lighting of the town.

Bexhill T.C.—A new switchboard is to be installed at the electricity works at a cost of between £500 and £600.

Bolton T.C.—For that purpose of providing a daily supply of 300,000 gallons of water for Darwen the Waterworks Committee are obtaining tenders for additional pumping plant and machinery,

Bourne R.D.C.—The council have adopted a water scheme for Baston, and the surveyor, Mr. T. Lake, has provided an estimate for a 3-in. bore, 3-in. main, and standpipes in the street, at a total estimated cost of £300.

Chelmsford T.C.—A report is being prepared on the condition of the street lighting service.

Derby T.C.—The council are recommended to introduce a 2,000-kw. turbine set and other equipment at the electricity works, at an estimated cost of £13,500.

Epsom U.D.C.—The tender of the Electric Consumption Company, Limited, at £368, has been accepted for the installation of a motor electrical pumping apparatus at the waterworks.

Evesham R.D.C.—An intimation has been received that the Joint Water Committee have adopted the scheme to connect up the springs at Stanway in accordance with the agreement for lease entered into by Evesham and Pebworth Rural District Councils and Lord Elcho. The estimated cost of the joint works is £11,180, which has been apportioned on assessable value between the two councils in respect of the parishes concerned.

Gloucester T.C.—With the object of increasing the supply of water, tests are about to be conducted upon a borehole at Ketford Bridge, about 11 miles west of the city. This borehole, which is 18¾ in. in diameter, was sunk last year into the new red sandstone under the superintendence of Mr. R. Read, the city surveyor. The hole is 350 ft. deep, and lined with a steel tube 15 in. in diameter. It is hoped to obtain an additional supply for the well and pumping station installed at Newent in 1896.

Haverfordwest T.C.—Tenders are being obtained for a new gasholder.

Hove T.C.—In the poll at Hove on the corporation's Bill to acquire the electricity undertaking of the local electric lighting company, at about £195,000, 1,384 votes were given for the Bill and 1,015 against.

Kensington B.C.—The new scheme for improving the street lighting has been carried out at a total cost of £3,737. The street lighting by gas in the borough now consists of 5,770 burners. Six lamps are fitted with four-light burners; 230 with three burners; 697 with two, and 3,662 with one burner. In the scheme provision was made for the conversion to the inverted burner system of a total of 5,525. The borough engineer, Mr. A. R. Finch, estimates that the saving in the consumption of gas by the adoption of the inverted burners is nearly 1 ft. per hour, and the average cost for gas per burner per annum £1 9s. 10d.

Kingston T.C.—The remaining fifty-eight public arc lamps are to be converted to groups of five high-candle power metal-filament lamps, the total cost of the work being £360, which includes the supplying and fixing of seventy-six automatic switches operated from the Central Station for the whole of the main-road lamps, and the supplying and fixing of four indicator switchboards, one for each of the main-road circuits. The estimated annual net saving of wages and coal consumption, owing to the increased efficiency of alternating-current supply compared with the use of small arc lighters, is £150.

Kirkcaldy T.C.—The gasworks are to be considerably extended, at an estimated cost of £45,000.

Maidstone T.C.—The Electricity Committee have made proposals for additional machinery at the electricity works, at an estimated cost of £5,600.

Marylebone B.C.—Additional plant is to be installed at the electricity works, at a cost of £25,000.

Milton R.D.C.—Improvements in the water supply are to be carried out at a cost of £600.

Shoreditch B.C.—A scheme for the improved lighting of the main streets has been adopted by the council, but will not come into operation until the close of the financial year. The illuminating power of the new flame lamps, which are to be adopted in Shoreditch High-street, Great Eastern-street, and Kingsland-road, will be equal to 2,500-c.p., as compared with 1,500-c.p. for the existing lamps. The consumption of electricity will be one-third less, the financial saving amounting to £476 per annum. It is also claimed that the new lamps will have a better fog-penetrating effect, an important element in view of the increase of traffic, and the fact that the streets included in the scheme are important Metropolitan main roads carrying a lot of through traffic. Being of the magazine type, the new lamps can be charged with a larger number of carbons, and will burn from seventy to eighty hours, as against about twenty-two hours with the present type, and obviously they will require much less frequent trimming.

Sunderland T.C.—The estimated net profit of the electricity undertaking for last year is £6,723. It is proposed to set aside £1,200 for renewing mains.

Teignmouth U.D.C.—An agreement is to be entered into with the Candy Filter Company, Limited, to supply two additional filters at the Mylor waterworks on the hire system, with the option of purchase.

Ware R.D.C.—The surveyor, Mr. H. J. Jackson, has been authorised to erect a water-level indicator at the reservoir, with electric communication with the pumping station.

Wednesbury T.C.—The Electricity Committee recommend an expenditure of £3,000 on additional mains and connections.

Weymouth R.D.C.—Plans and specifications are being prepared for a water supply and scheme for the parish of Upwey.

Wishaw T.C.—A new gasometer is to be erected at a cost of £8,000.

MISCELLANEOUS.

Wimbledon T.C.—Among the schemes contemplated for carrying out in Wimbledon during the present year is the erection of an additional scarlet fever block for convalescent patients, partly on the open-air principle. The question of recreation-grounds is having considerable attention, and recently a Local Government Board inquiry was held with regard to a proposed loan of £10,000 for the purchase of a section of Coombe Farm for the extension of Wimbledon Common. This purchase is on the understanding that the promoters of the Common Extension purchase that portion of the farm situate between the common and the road proposed by the Road Board which is to act as a by-pass road, so that traffic going west can avoid passing through Kingston and Surbiton; the extension of Wimbledon Common will allow the proposed road to skirt the common for 1½ miles, and so give a view of woodland scenery. The land lately purchased between the Wandle and Garfield-road will no doubt be laid out during the year, part as a recreation-ground and part as a site for an elementary school. This is an addition to the open spaces acquired since the Wandle Open Spaces Association was established. There is no doubt that Wimbledon has gained very considerable benefit from open spaces, which appear to be one of the chief reasons why the rateable value of the large houses in the district has been maintained, and in consequence the rates have not increased in the same proportion as in other districts. The average district rate for the past four years is 3s. 4½d. in the pound. An addition to the cemetery is being made. In this a large proportion of space is allotted to shrubs, in order to mitigate the view of monuments. In Wandle Park it is intended to erect an extensive swimming-bath, which will receive its supply from the Mill Pond, with an almost constant flow.—The two new motor fire engines just delivered were publicly christened on Saturday, among those present being Councillor Allen (chairman of the Watch Committee), Lieutenant Sladen, R.N. (chief officer of the London Fire Brigade), and Mr. E. R. Capon, surveyor to the Epsom Urban District Council. The tests made were quite satisfactory.

FOR OTHER ADVERTISEMENTS

See End of Paper.

HAMPTON URBAN DISTRICT COUNCIL.

SUPPLY OF MATERIALS, &c.

The above Council hereby invite Tenders for the Supply of:—

(1) Hand-broken Granite.
(2) Granite Chippings.
(3) Broken Kentish Brown Flints.
(4) Derbyshire Limestone Marble Tar-paving Material.
(5) Forage.
(6) House Coal and Coke.
(7) 18 doz. (more or less) Best Scavengers' Bass Brooms.

Forms of Tender, Conditions, and all particulars may be obtained at the Offices of the Council, Hampton, Middlesex, where Tenders must be delivered, sealed and endorsed "Tender for ——," not later than 5 p.m. on Thursday, the 27th day of February, 1913.

Dated this 5th day of February, 1913.

By Order,
SIDNEY H. CHAMBERS,
Surveyor to the Council.

Public Offices,
Hampton, Middlesex.

CITY OF WESTMINSTER.
PAINTING, &c., WORKS.

The Westminster City Council invite Tenders for internal and external painting, &c., works at the Public Baths, Great Smith-street, and minor works at the Buckingham Palace-road and Marshall-street Baths.

Forms of Tender and specifications can be obtained on application to the Town Clerk's Office, Westminster City Hall, Charing Cross-road, W.C., between the hours of 10 a.m. to 4 p.m. (Saturdays 10 a.m. to 12 noon).

Each Tender, on the Official Form supplied, is to be enclosed in a sealed cover addressed to the Town Clerk, Westminster City Hall, Charing Cross-road, W.C., and marked "Tender for Painting, &c., Works at Baths," and is to be forwarded to the Town Clerk so as to be delivered at the City Hall not later than 11 a.m. on Wednesday, the 19th February, 1913. No Tender will be received after that time. Tenders may be placed by or on behalf of tenderers in a locked box at the City Hall provided for the purpose.

The Contractor will be bound by the Contract in the case of all workmen employed by him to pay wages at rates not less, and to observe hours of labour not greater than, the rates and hours recognised by the associations of employers and employees, and in practice obtained in the district where the work is to be executed.

Tenderers are prohibited from directly or indirectly canvassing members or officials of the council in reference to any Tender, and the Tender of any person who does so canvass will be rejected.

The Council do not bind themselves to accept the lowest or any Tender.

JOHN HUNT,
Town Clerk.

Westminster City Hall,
Charing Cross-road,
London, W.C.
February 5, 1913.

BARRY URBAN DISTRICT COUNCIL.

The above Council have about 300 second-hand 6-ft. 6-in. W.I. Treeguards to dispose of, in good condition. Each Treeguard weighs, approximately, 100 lb.

Offers for same to be sent to the undersigned on or before 10 a.m. on Friday, the 21st day of February, 1913.

The Treeguards may be seen at any time on application to the Surveyor's Office, Public Offices, Barry.

The highest or any Tender not necessarily accepted.

J. C. PARDOE, ASSOC.M.INST.C.E.,
Surveyor.

SURBITON URBAN DISTRICT COUNCIL.
MANAGER OF SEWAGE WORKS AND DESTRUCTOR.

Applications are invited for the appointment of Manager of the New Sewage Works and Refuse Destructor of the above-named Council.

Salary £3 10s. per week (payable monthly), together with house and light.

The works consist of low-level pumping station with steam-raising plant worked by destructor; chemical precipitation tanks, percolating filters, and sludge-pressing machinery for a population of 20,000, rising to 30,000.

Applicants must be between 30 and 45 years of age, have had actual experience in the management of works of a similar character, and must have a sound knowledge of mechanical and electrical appliances.

Applications, on forms to be obtained from the undersigned stating age, qualifications, and previous experience, together with copies of three recent testimonials, to be sent in to me not later than 12 noon on Monday, the 24th February.

Canvassing is strictly prohibited.

FREDERICK W. WOOD,
Clerk and Solicitor to the Council.

Council Offices,
Ewell-road,
Surbiton.
February 6, 1913.

PERSONAL.

Mr. C. R. Fortune, city surveyor of Bath, has been granted an increase of salary of £50 a year.

Mr. Thomas S. Picton, borough surveyor of Eccles, has been granted an increase of salary from £300 to £325 per annum.

Mr. Richard Waring, highways superintendent, has been unanimously voted an increase of salary by the Withington Committee of the Manchester Corporation.

Mr. R. S. Scott, surveyor to the Bishop's Stortford Urban District Council, has been voted £31 for extra services in connection with the Hockerill water and the Thorley sewerage and water schemes.

Mr. A. E. Shapley, who is at present engaged in the surveying department of the Whickham Urban District Council, has been appointed surveying assistant on town-planning under the Manchester Corporation.

Mr. F. Hargreaves has been appointed surveyor and inspector of nuisances to the Consett Urban District Council at a salary of £175 per annum, and Mr. F. Stringfellow assistant-surveyor to the same council.

Mr. R. W. Smith-Saville, borough engineer of Darwen, and joint engineer-manager of the corporation tramways, has been presented by the members of the staff with a silver rose-bowl upon his retirement from tramway management.

Mr. L. J. West, of Reading, has been appointed district surveyor of main roads for the west district of East Sussex at a salary of £160, rising to £200 in £5 yearly increments with an allowance of £79 per annum travelling expenses.

Mr. A. E. Nichols, borough engineer and surveyor of Folkestone, has resigned his position of chief officer of the corporation fire brigade, and Mr. H. O. Jones, deputy borough engineer, has been appointed in his place, at an additional salary of £50 per year.

Mr. Matthew Algernon Piercy, chief assistant surveyor for the county borough of Stoke-on-Trent, has been unanimously recommended by a special committee to the General Purposes Committee for appointment as deputy borough surveyor of Warrington, at a salary of £200 per annum.

Mr R. K. Wortley, Lewes, formerly of the borough surveyor's office, Hove, has been appointed junior engineering assistant under the Worthing corporation. The applications received for the post numbered 118, and the selected candidates included Messrs. A. G. Davies, borough surveyor's office, Richmond; W. H. Dobson, borough surveyor's office, Gillingham, Kent; and H. St. G. Tolputt, borough surveyor's office, Folkestone.

Messrs. W. E. Bush, city engineer, Auckland, New Zealand; W. Calder, city engineer, Prahran, Victoria; C. H. Roberts, water engineer, Aberdeen; W. J. Steele, city engineer, Newcastle-on-Tyne; Hugh Stowell, chief engineering inspector, Mersey and Irwell Joint Committee; and O. E. Winter, borough engineer, Hampstead, have been transferred from the class of associate member to that of member of the Institution of Civil Engineers. Mr. H. Cranage, borough engineer's office, Leicester, has been elected an associate member of the institution.

Mr. J. W. H. Mason, who died, we regret to learn, quite suddenly at his home at Norbury last week, in his 84th year, was the father of Mr. C. S. Mason and Mr. Horace Mason, who have been for many years associated with THE SURVEYOR. They desire to acknowledge gratefully many kind letters of condolence received on the occasion. The deceased gentleman's name recalls the famous *Trent* case in the American Civil War of 1861-65. The over-zealous action of a naval officer who took the Confederate envoys (Messrs. Mason and Slidell) out of a British mail steamer sailing between two neutral ports, almost brought about a collision between the United States and Great Britain. The American precedents were, however, all against the United States, and the envoys were given up.

Modern Hospitals.—At a meeting of the Royal Institute of British Architects, to be held on Monday, the 17th inst., Messrs. A. Saxon Snell and W. Milburn will introduce a discussion on this subject.

Legislation and Legal Precedents, 1892—1913.

(*Conclusion.*)

[The opening instalments of this article appeared in our issues of the 17th and 31st ult.]

ADMINISTRATION.

Important changes with respect to highway administration were made by the Local Government Act, 1894. Under the Public Health Act, 1875, urban authorities were made the highway authorities for their respective districts. But outside urban districts the highways remained under the control of the highway boards where highway districts had been formed, and of the highway surveyors in parishes not comprised in any highway district. The Act of 1894 abolished highway boards, highway districts, and highway parishes, and transferred the powers, duties and liabilities of highway authorities in rural districts to the rural district councils. It has been pointed out that the operation of the Act in this respect has produced an anomaly. Those rural district councils which are successors to a highway board have all the powers given by the Highway Acts of 1835, 1862, and 1864; but those which are successors to highway surveyors are limited to the powers given by the Act of 1835 alone.

Another outstanding feature of the Act of 1894, as it affects highway administration in rural districts, consists in the powers conferred upon parish councils and parish meetings. Parish councils are empowered to acquire rights of way, and their consent is necessary to the stopping or diversion of public rights of way, or to a declaration that a highway in a rural parish is unnecessary and not repairable at the public expense. These councils are also authorised (subject to restrictions on expenditure) to undertake the repair of footpaths other than those at the side of public roads. In the opinion of the Local Government Board this provision authorises the necessary repair of stiles or gates in public footpaths, and the substitution (with the consent of the owner of the soil) of gates for stiles. Parish councils may also complain to the county council of the failure of the rural district council to repair any highway. The county council, if satisfied as to the default, may assume the duties and powers of the district council for the purpose of the matter complained of, or may appoint a person to perform the duty. A parish council may also complain to the district council of any unlawful stoppage or obstruction of a public right of way, or encroachment on a road side waste, and the district council is bound to take the necessary proceedings (unless satisfied that the allegations are incorrect), failing which the parish council may petition the county council, who may take upon themselves the powers and duties of the district council.

In rural parishes not having a separate parish council the parish meeting is substituted for the purpose of the foregoing provisions as to diversion, &c., of highways, and complaint to the county council of the failure of the district council to repair a highway.

The Act also make it the duty of district councils to protect public rights of way, and prevent obstructions and encroachments, and gives them power to institute or defend any legal proceedings with this object.

There is also a very useful provision for enforcing the repair of highways repairable *ratione tenuræ*. If such a highway appears on the report of a competent surveyor not to be in proper repair, and the person liable fails to repair when requested by the district council, they may report and recover the expenses from him.

The highway expenses of rural district councils are to be defrayed as general expenses, and district councils have the same power to charge highway expenses under exceptional circumstances in contributory places as highway boards had in respect of any area under sec. 7 of the Highways, &c., Act, 1878.

Rural district and parish councils may appoint committees and authorise them to institute any proceeding, or do any act which the council might have instituted or done for any purpose of the Public Health or Highway Acts, except the raising of loans or the making of rates or contracts.

The following point of highway law and practice have been decided under this Act: A rural district councillor who lets for hire a team to be used in the repair of highways does not incur the penalties imposed on a highway surveyor so doing by sec. 46 of the Highway Act, 1835 (*Buckley* v. *Hanson*, 1898, 62 J.P., 119).

Where the duty of cleansing a watercourse is imposed upon the surveyor of highways for the time being by an inclosure award that duty is transferred by the Act to the rural district council (*Attorney-General* v. *Tamworth Rural District Council*, 1901, 85 L.T., 190).

When a surveyor of highways has contracted under the Highways and Bridges Act, 1891, to contribute by instalments to the cost of constructing a bridge, the liability to pay the future instalments passes to the rural district council (*Herts County Council* v. *Barnet Rural District Council*, 1902, 2 K.B., 48).

The Act does not convert a surface-water drain laid under a road by a highway board into a "sewer" within the meaning of the Public Health Act, 1875 (*Williamson* v. *Durham Rural District Council*, 1906, W.N., 102).

The remedy given by the Act for non-repair of a *ratione tenuræ* highway is exercisable against the occupier only of the land, and not against the owner (*Cuckfield Rural District Council* v. *Goring*, 1898, 1 Q.B., 865).

It would appear that a district council may, for the purpose of testing a question of public right, direct their officers to do some overt act, such as driving over a road alleged to be a public highway (*Greenwell* v. *Howell*, 1900, 1 Q.B., 535).

A district council may contribute to the costs of the defence of an action brought against a private individual who removes an obstruction to assert an alleged public right of way (*Rex* v. *Norfolk County Council*, 1901, 2 K.B., 268).

An entirely new highway authority—the Road Board—has been constituted by the Development and Roads Improvement Funds Act, 1909, for the purpose of improving the facilities for road traffic, and of the administration of the road improvement grant (subsequently provided by the Finance (1909-10) Act, 1910, as amended by the Revenue Act, 1911), being a sum equal to the nett proceeds of the duties on motor spirit and on motor car and carriage licences.

The board, with the approval of the Treasury, have power to make advances to highway authorities in respect of the construction of new or the improvement of existing roads, and also themselves to construct and maintain new roads. When advances have been made to highway authorities for the construction of new roads the board may also contribute towards the maintenance of such roads. The advances may be either by way of grant or by way of loan, or partly in one way and partly in the other.

New roads when constructed by a county council become main roads, and when constructed by other highway authorities, or by the board, they become highways repairable by the inhabitants at large.

The board may contract with a highway authority for the maintenance by the latter of the portion within their district of any road made by the board; and for the purpose of maintenance and improvement of roads made by the board they are to have the same powers (except the power of levying a rate) that county councils have with respect to main roads. They may also exercise the powers of county councils for the repair of bridges, and the prevention and removal of obstructions.

The "improvement" of roads, for the purposes of this Act, includes widening, cutting off corners, levelling, dust mitigation, and any work beyond ordinary repairs essential to placing a road in a proper state of repair—and the term "roads" includes bridges, viaducts and subways.

Before the Treasury approve the construction of a new road by the board they must consult with the Local Government Board, and see that notice of the intended road has been sent to every highway authority in whose area the road will be situated, and consider any objections received from such authorities.

Land may be acquired by the board or a highway authority for a new road approved or authorised, and in the case of the board, additional land within 220 yds. from the middle of the proposed road may be acquired. If land cannot be got by agreement on reasonable terms, the Development Commissioners may, on application, make an order for compulsory purchase. With the approval of the Treasury the board may sell, lease and manage any surplus land.

There has been no statutory alteration in the law relating to the dedication of highways during the period under consideration, but there have been many judicial decisions illustrating the subject and clearing up dubious points. The question of dedication (which is always one of fact, or of presumption founded on fact) includes such questions as the width of the road dedicated and the respective rights of the public and of landowners with regard to roadside wastes and strips of greensward which frequently give rise to difficulties.

The following important points have been decided or affirmed since the year 1891: A tenant for life cannot dedicate a way as a highway as against the remaindee-man, unless the stringent requirements of the Settled Land Act, 1882, are complied with (*Eyre* v. *New Forest Highway Board*, 1892, 56 J.P., 517); and a lessee of land cannot dedicate it as a highway for the term of his lease (*Corsellis* v. *London County Council*, 1908, 1 Ch., 13).

Where there is a public footpath across land, and a certain amount of the surface of land lying across the course of the footpath is used by traffic, even though it be private traffic, there is a presumption that the whole of the surface so used has been dedicated to the public (*Attorney-General* v. *Esher Linoleum Company*, 1901, 2 Ch., 647).

Any consent given by a highway authority to an obstruction or encroachment is illegal. "Once a highway, always a highway," and the omission to use a highway for any length of time will not preclude the public from resuming the exercise of the right to use it (*Harvey* v. *Truro Rural District Council*, 1903, 19 T.L.R., 576). The permission of a landowner to the public to visit an ancient monument—*e.g.*, Stonehenge—does not indicate any intention on his part to dedicate a public highway (*Attorney-General* v. *Antrobus*, 1905, 2 Ch., 188).

In the case of a *cul-de-sac* mere acts of user alone are not sufficient evidence of dedication (*Whitehouse* v. *Hugh*, 1906, 2 Ch., 283); *London County Council* v. *Hughes*, 1911, 75 J.P., 239).

Where there is strong evidence to rebut the presumption of dedication evidence of user is immaterial (*Holloway* v. *Egham Urban District Council*, 1908, 72 J.P., 433).

Mere assertion of possession and activity to prevent encroachment of land, while permitting public user of the surface of the soil, will not rebut the presumption of dedication (*Coates* v. *Herefordshire County Council*, 1909, 2 Ch., 579).

It is no answer for a person who has allowed the public to pass over his land to plead that it would have been inconvenient to exclude them. This is only equivalent to saying that it was not convenient to him to prevent the land becoming a highway (*Attorney-General* v. *Chandos Land, &c., Society*, 1910, 74 J.P., 401); but we shall see, when referring to cases as to the width of highways, that this principle must be understood *cum grano* in applying it to forecourts in towns.

It is not necessary, in order to establish dedication, to show by what particular owner a road has been dedicated (*Farquhar* v. *Newbury Rural District Council*, 1908, 25 T.L.R., 39; *Attorney-General* v. *Watford Rural District Council*, 1912, 1 Ch., 417).

A railway company cannot grant a perpetual right of way over their lines of rails, or over land intended to be used for lines of rails (*Great Central Railway Company* v. *Balby, &c., Urban District Council*, 1912, 28 T.L.R., 268).

Where the owner of a building estate laid out and threw open to the public a road running east and west, but only made up the southern half of its width, it was held that he intended to dedicate the whole width to public use, and could not prevent the owners of land on the north of the road from obtaining access to it from their land (*Tottenham Urban District Council* v. *Rowley*, 1912, 41 The Surveyor, 912).

Where a question arises whether a roadside ditch forms part of a highway, and its origin is unknown, the decision will turn upon evidence as to the use and control of the ditch in the past (*Regina* v. *Bradley*, 1894, 58 J.P., 199).

In a later case it was contended that a ditch cannot be dedicated as part of a highway, but the Court held that it can, the ditch being treated as an obstruction or excavation, subject to which the highway is dedicated, but the surface of which if filled up must be treated as part of the original highway (*Chorley Corporation* v. *Nightingale*, 1907, 2 K.B., 637). The ditch in this case was constructed for the passage of water, and was essential to the existence of the highway. In another case a dry ditch which was useless to the highway was held not to form part of the latter, but to belong to the adjoining landowner (*Chippendale* v. *Pontypool Rural District Council*, 1907, 71 J.P., 231).

When a road set out under an inclosure award is made of a greater width than that prescribed by the award the public may by user establish a right over the whole width (*Harris* v. *Northampton County Council*, 1897, 61 J.P., 599).

The presumption that strips of greensward form part of a dedicated highway may be rebutted by an entry on the Court Rolls of a manor that the greensward is manorial waste, and by showing that it has been dealt with as private property (*Friern Barnet Urban District Council* v. *Richardson*, 1898, 62 J.P., 547); or by showing that it was formerly part of the waste of a manor, and has been so dealt with (*Nedd* v. *Hendon Urban District Council*, 1899, 63 J.P., 724); or that the ground has at no time within living memory been used otherwise than as private property, no objection having ever been raised to such user (*Belmore* v. *Kent County Council*, 1901, 1 Ch., 873).

The following four cases have been decided with regard to forecourts in towns:—

In *Piggott* v. *Goldshaw* (1901, 84 L.T., 94) it was held that certain recesses paved as part of the footway had not been dedicated, and that new windows built over them were not an encroachment.

In *Hoare* v. *Lewisham Borough Council* (1901, 67 J.P., 20) it was held that the user of a "draw-up" in front of a public house by the customers of the house was no evidence of dedication to the public; and it was found as a fact that the "draw-up" never had been dedicated, and did not form part of the highway.

In *Hassell* v. *East Ham Urban District Council* (1903, Local Government Chronicle, p. 748) and *Carter* v. *Camberwell Borough Council* (1905, Local Government Chronicle, p. 714) injunctions were granted to restrain the councils from taking possession of open spaces between houses and pavement used by shopkeepers for deposit of goods.

REPAIR.

The provisions of the Public Health Acts Amendment Act, 1907, with respect to urgent repairs to private streets have already been noticed, as have also those clauses of the Development and Roads Improvement Act, 1909, which are relevant to the subject of repair.

There have been several decisions bearing on the subject which are of interest.

First, we will take cases relating to the liability to repair *ratione tenuræ*.

This liability rests primarily upon the occupier for the time being of the land, and not upon the owner, unless he is also the occupier (*Cuckfield Rural District Council* v. *Goring*, 1898 1 Q.B., 865; *Daventry District Council* v. *Parker*, 1900, 1 Q.B., 1). But the occupier can compel the owner to reimburse him (*Esher, &c., Urban District Council* v. Marks, 1902, 66 J.P., 243).

When the land is discharged from the liability, the occupier does not become liable to be rated for expenses of repair of the highway in question (*North-Eastern Railway Company* v. *Dalton*, 1900, A.C., 345).

Where a highway had been stopped up by Royal licence, in 1773, a landowner having undertaken to make and keep in repair a substituted road, it was held that the latter was repairable *ratione tenuræ* (*Esher, &c., Urban District Council* v. *Marks, ubi supra*).

A highway authority can take over a *ratione tenuræ* road in consideration of the payment of a lump sum (*Stamford and Warrington's Settled Estates*, 1911, 1 Ch., 648). But whether trustees are authorised to pay such a sum out of trust funds is doubtful (see *re Hodgson's Settled Estates*, 41 The Surveyor, 536).

As to the general liability of highway authorities for the repair of highways, it is, of course, elementary knowledge that there are highways for the repair of which no one is liable. If a district council repair such a highway without the consent of the owner of the soil they will be liable to an action for trespass (*Eyre* v. *New Forest Highway Board*, 1892, 33 J.P., 115).

When a new road has been substituted, after the passing of the Highway Act, 1835, for an old highway repairable by the inhabitants at large, and there is evidence of repair of the substituted road by the parish, it is open to the court, after a lapse of time, to presume that the formalities required by sec. 23 of the Act have been complied with (although there may be no evidence of this having been done), and to find that the new road is a highway repairable by the inhabitants at large (*Leigh Urban District Council* v. *King*, 1901, 1 K.B., 747).

If a highway repairable by the inhabitants at large is widened by an adjoining landowner, the highway authority are not liable to repair the added strip, unless it is formally dedicated under sec. 23 of the Act of 1835 (*Rex* v. *Crompton Urban District Council*, 1902, 66 J.P., 566).

Where a district council propose to take over a driftway, or a private carriage or occupation road, under sec. 36 of the Act of 1835, it is not necessary to obtain the consent of a person who has a mere right of way over the road, as he is not an "occupier" within the meaning of the section (*Rex* v. *Somers*, 1906, 1 K.B., 326).

STREET REGULATION AND CONTROL.

Some important provisions with respect to streets (in addition to those as to urgent repairs to private streets already noticed) are contained in the Public Health Acts Amendment Act, 1907; but these provisions are only in force in districts where they are applied by Order of the Local Government Board. In such districts the local authority may vary the intended position, direction or termination or level of intended new streets so far as is necessary to secure more direct, easier or more convenient means of communication with any other street, or an adequate opening at either end of the new street, or compliance with any enactment or by-law. They may also fix the points at which the new street is to be deemed to begin and end. These powers, however, are not to be exercisable if compliance with the requirements would entail upon the landowner the purchase of additional lands, or the execution of works on other land, and compensation is to be paid to anyone injuriously affected.

The provision of new means of access for vehicles, &c., to premises across the footway of the public street may be allowed by the authority subject to the conditions prescribed by the Act, which include the submission of the plan of the proposed works and their supervision by the authority.

If the footway of a public street is injured in consequence of excavations, &c., on adjoining land, the cost of the necessary repairs is recoverable from the landowner or other party responsible for the damage.

The name of a street may be altered with the consent of two-thirds in number and value of the ratepayers in the street, and the names of streets may be marked on buildings, a penalty being imposed on anyone obliterating or defacing such marks.

The authority may require corner buildings to be rounded off, compensating the owner for any loss.

The authority may remove and dispose of old materials existing in a street at the time of the execution of works unless the frontagers do so after forty-eight hours' notice. Reasonable value of the materials removed is to be allowed by the authority to the frontagers.

No building materials, rubbish, or other thing may be laid, nor any excavation made, in a public street without the written consent of the authority. When placed or made with such consent, the materials or excavation must be fenced and lighted by and at the expense of the person responsible, and removed or made good by him or by the authority at his expense.

The authority are empowered to enforce the repair, removal, protection or enclosure, by or at the expense of the landowner, of any dangerous building, wall, fence, steps, structure or other thing, well, excavation, reservoir, pond, stream, dam or bank in any situation fronting, adjoining or abutting on any street or public footpath. Also, after obtaining an Order of the Local Government Board the authority can enforce the fencing or repair of the fences of land adjoining a street which, owing to the absence or inadequacy of fences, is a source of danger or used for immoral or indecent purposes. Hoarding, &c., abutting on a street is to be securely fixed to the satisfaction of the authority.

The Housing, Town Planning, &c., Act, 1909, gives local authorities power to lay out and construct streets or roads on land acquired or appropriated for the purpose of Part III. of the Housing of the Working Classes Act, 1890, or to contribute towards the cost of the laying out and construction of streets or roads (to be dedicated to the public) by other persons. The Act of 1909 also enables an Improvement Scheme, under the Act of 1890, to provide for the closing and diversion of highways with a view to the improvement of the area or the general efficiency of the scheme, and authorises the Local Government Board to make regulations for this purpose.

This Act is more fully noticed below.

HOUSING OF THE WORKING CLASSES.

There have been four statutes dealing with this subject—viz., The Housing of the Working Classes Acts, 1894, 1900 and 1903, and the Housing and Town Planning Act, 1909 (Part I.).

The Act of 1894 enables a local authority to borrow for the purposes of a scheme of reconstruction under sec. 39 of the "principal Act"—*i.e.*, the Act of 1890.

The Act of 1900, so far as it is unrepealed by the Act of 1909, enables a council (other than a rural district council) who have adopted Part III. of the principal Act to establish or acquire lodging houses outside their district, and contains provisions as to the expenses of metropolitan borough councils who have adopted Part III., accounts and leases by local authorities (other than rural district councils) for building lodging houses.

The Act of 1903, so far as unrepealed by the Act of 1909, contains provisions as to the maximum term for repayment of loans, the transfer of powers and duties of the Secretary of State under the Acts to the Local Government Board, rehousing obligations when land is taken under statutory powers, the powers of the confirming authority in failure of the local authority to make a scheme, the inclusion of neighbouring lands in schemes of reconstruction, power to recover costs of demolition, recovery of possession from tenants in pursuance of closing orders, powers in connection with the provision of dwelling accommodation or lodging houses, and service of notices. Future contracts excluding the application of sec. 75 of the principal Act (implying the condition that a house is fit for habitation) are made void.

There are some special provisions applicable to London.

Part I. of the Act of 1909 made Part III. of the principal Act applicable, without adoption, in every urban or rural district or other place for which it had not previously been adopted. The Act contains provisions for authorising the compulsory purchase of land by local authorities for the purposes of Part III. of the principal Act by an Order submitted to and confirmed by the Local Government Board, no additional price being paid for compulsory purchase. If the scheme involves the acquisition of a common, open space or allotment, it must be confirmed by Parliament, except where an equal area is given in exchange—such area being certified to be equally advantageous by the Local Government Board after consultation with the Board of Agriculture. Notice of the proposed exchange must be given, and if necessary an inquiry must be held. Compulsory purchase is not to apply to the site of any ancient monument or other subject of archæological interest, or to land acquired for a railway, dock, canal, water or other public undertaking, or to land forming part of a park, garden, or pleasure ground, or otherwise acquired for the amenity or convenience of a dwelling house.

Local authorities may lay out and construct or contribute to the laying out and construction of public streets in connection with the exercise of their powers under Part III. of the principal Act.

The Public Works Loan Commissioners may grant loans for not more than eighty years for the purposes of the Act, and local authorities may accept donations of money or land for the same purposes.

On complaint (*a*) as to a rural district by the county council, a parish council or parish meeting, or four householders, (*b*) as to a county district not being a rural district, by the county council or four householders, and (*c*) as to other areas by four householders, the Local Government Board may, after inquiry, by order direct the local authority to carry out specified works, &c., in the exercise of their powers under Part II. or Part III. of the principal Act. Any such order is to be laid before Parliament.

Where it appears to the board that a local authority have failed (*a*) to carry out an improvement scheme under Part I. of the principal Act, (*b*) to give effect to an order as to an obstructive building or to a reconstruction scheme under Part II. of that Act, or (*c*) to have inspection made of their district as re-

quired by the present Act, the board may order them to remedy the default. Such an order may be enforced by mandamus.

On complaint by a parish council or parish meeting or four householders of the failure of a rural district council to exercise their powers, the county council, after an inquiry, may assume the powers of the district council under Part III of the principal Act; also where a county council think it expedient, they may obtain an Order of the board conferring on them any of the powers of a local authority in a rural district under Part III of the principal Act.

The condition imposed by sec. 75 of the principal Act (as to a house being fit for habitation) is to apply to houses let at rents not exceeding, in London, £40 a year in boroughs and urban districts of 50,000 inhabitants, £26 a year, and elsewhere £16 a year—unless the house is let for three years certain on the terms that the lessee is to make it fit for occupation. There is also to be implied the additional condition that the landlord will keep the house fit for habitation during the tenancy. Powers are given to the local authority to enforce these obligations, subject to the option given to the landlord to close the house or appeal to the board.

The duty is imposed upon all local authorities of causing to be made periodical inspections of their district with a view to ascertain whether there are any houses unfit for occupation.

Extended powers are given to the local authority for closing houses unfit for habitation, including power to pull down where a closing order has been in operation for three months and nothing has been done.

The Act contains various amendments of the principal Act with respect to improvement and reconstruction schemes and financial matters.

A power of entry on premises after twenty-four hours' notice to the occupier and owner (if known) is given to any person authorised in writing *ad hoc* by the local authority or the board for the purpose of survey or valuation in the case of proposed compulsory purchase, or where a closing order has been made or when necessary to determine whether any powers under the Housing Acts should be exercised.

Powers are also given to the board to obtain reports on crowded areas, to authorise joint action by local authorities, and to prescribe forms and dispense with advertisements.

The future erection of back-to-back houses intended to be used as working-class dwellings is prohibited, but this provision is not to apply to (*a*) a house containing several back-to-back tenements if the medical officer certifies that the tenements are effectively ventilated, or (*b*) houses abutting on streets the plans of which were approved by the local authority before May 1, 1909, in a borough or district whose by-laws permitted back-to-back houses.

Power is given to the board to revoke unreasonable by-laws.

COMMONS AND OPEN SPACES.

By Part I. of the Commons Act, 1899, power was given to urban and rural district councils to make schemes for the regulation and management of commons, subject to the approval of the Board of Agriculture. The management of any common regulated by such a scheme is vested in the district council, and rural district councils may delegate their powers of management to parish councils, the latter being empowered to contribute all or any part of the expenses incidental to schemes for the regulation of commons in their respective parishes. Compensation is to be paid for any rights injuriously affected by a scheme. A district council may acquire the freehold or any other interest in or rights over a regulated common by gift, purchase, or agreement.

The provisions as to by-laws in secs. 182 to 186 of the Public Health Act, 1875, are to apply to by-laws made in pursuance of a scheme under the Act of 1899.

The expenses of the Board of Agriculture in relation to a scheme are to be paid by the district council, and all expenses incurred by the latter are to be treated as incurred in the execution of the Public Health Acts; and they may borrow money for the purposes of the Act, subject to the same conditions as under the Public Health Acts.

Urban district councils may, with the approval of the Local Government Board, contribute towards the expense incurred by other councils in executing schemes.

The above provisions as to urban district councils apply also to county borough councils.

No scheme under the Act is to apply to commons to which the Metropolitan Commons Acts or other Acts are applicable.

Part II. of the Act contains provisions with respect to surplus rents from field, gardens, and recreation grounds, the modification by the Charity Commissioners at the instance of a district or parish council of existing provisions relating to recreation grounds, &c., and other miscellaneous matters.

The Open Spaces Act, 1906, was passed to consolidate enactments relating to open spaces. It repeals and consolidates, with amendments, the whole of the previous legislation on the subject, except so much of sec. 4 of the Open Spaces Act, 1887, as amends the Disused Burial Grounds Act, 1884.

METROPOLITAN WATER BOARD FINANCE.

Some remarkable facts appear in a memorandum issued by Mr. A. H. Tozer, chairman of the Finance Committee of the Metropolitan Water Board, dealing with the deficiency of £180,000 in the water fund of the board.

The cost of acquisition of the water companies' undertakings was over £49,000,000, which represents £46 per service, against £22 under the companies.

Water consumers pay less to the board than they did to the companies, the respective incomes per service being £2 11s. 1d. and £2 13s. 7d.

The rate of increase of water rental has fallen in five years from £28,438 to £18,248, owing, among other things, to depression in the building trade and the increase in the number of empty houses.

New houses erected yearly have fallen in numbers from 25,161 to 11,757, and new services from 22,672 to 10,377.

Population has ceased to grow at the same rapid rate, and the Budget of 1909-10 cost the board £17,000 as the result of the fall in value of licensed premises, while £29,000 a year was lost by the action of Parliament in their new Charges Bill.

Private wells in London deprive the board of £40,000 a year, while rates and taxes have increased by 24 per cent in eight years. In addition, the board is compelled to contribute double the amount the companies paid into their sinking fund.

All these things, it is pointed out, are beyond the power of the board to remedy, but in the matter of staff salaries the memorandum shows that a saving of no less than £18,913—equivalent to 9d. per service—has been effected since the transfer of the companies' undertakings.

"The Civic Engineer's Who's Who."—The first issue of "The Civic Engineer's Who's Who" (London: St. Bride's Press, Limited, 24 Bride-lane, E.C., 2s. 6d. nett) gives wonderfully complete lists of the engineering officials of England and Wales. For a first issue it is very creditable.—*Glasgow Herald.*

Scientific Destruction of Vermin.—From the earliest times rats have been regarded as natural enemies of mankind, and recently medical men have made a further charge against these pests as carriers of infectious diseases. Rats can only be completely and efficiently destroyed by making use of the knowledge which modern science has placed at our disposal. The old-fashioned methods of attempting to destroy rats by means of traps, gins, ferrets, &c., only tend slightly to reduce the number of rats in a large area. The use of poison—such as arsenic, phosphorus or strychnine—is obviously attended with danger, not only to domestic animals, but to human beings. For this reason, therefore, they cannot be widely employed with safety. It is a well-known fact that rats migrate in colonies, and that the healthy rats attack, kill and devour the weaklings. These circumstances suggested to bacteriologists that if some infectious disease fatal only to rats and mice could be discovered the rats themselves would act as carriers among their associates and spread the fatal infection. The bacteriologist (Neumann, of Copenhagen) was successful in discovering a bacillus which produces such a disease in rats and mice; this is known as the Ratin bacillus, from which the famous "Ratin" is manufactured. The Ratin Laboratory will be pleased to forward their booklet, entitled "Scientific Extermination of Rats and Mice," on receipt of a postcard, and will undertake the effectual clearance of any desired area at an inclusive price.

INSTITUTION OF MUNICIPAL AND COUNTY ENGINEERS.

President—Mr. R. J. THOMAS, M.INST.C.E., County Surveyor, Buckinghamshire.

EASTERN DISTRICT.

An Eastern District meeting is to be held at the New Middlesex County Council Buildings, Westminster, and Lyons' Victoria Mansions Restaurant, Victoria-street, Westminster, to-day (Friday).

PROGRAMME.

3 p.m.—Meet at the Middlesex County Council Offices (in course of construction) opposite Westminster Abbey, and inspect buildings under the guidance of Mr. H. T. Wakelam, M.INST.C.E.

4.30 p.m.—Meeting of the Eastern District Executive Committee at the offices of the institution, 11 Victoria-street, Westminster.

6.30 p.m.—Dinner of the institution at Lyons' Victoria Mansions Restaurant (Victoria-street, Westminster). Tickets, 3s. 6d. each.

7.30 p.m.—Paper on "Sterilisation," with special reference to the ultra-violet rays process, by Dr. Thresh, followed by a short discussion.

8.30 p.m.—Discussion on points of interest or difficulties arising in the ordinary course of practice, to be introduced briefly by members present at the meeting.

Members are requested to make a special effort to attend this meeting and, if convenient, the dinner. A cordial invitation is extended to members of the institution outside the Eastern District to attend the meeting and discussion.

E. J. ELFORD, *Hon. District Secretary*, Borough Engineer, Southend-on-Sea.

A. FIDLER, *District Chairman*, Borough Engineer, Northampton.

EAST MIDLAND DISTRICT.

The East Midland District meeting at Newark, fixed for Saturday, February 8th, has been altered to Saturday, February 15th

SOUTHERN DISTRICT MEETING.

A meeting of the Southern District will be held at Southampton on Saturday, February 22nd next.

NORTH-EASTERN DISTRICT.

A meeting of the members of the North-Eastern District will be held in Leeds on Saturday, March 8th.

A meeting of the institution will be held in the North-Eastern District at Newcastle-on-Tyne on May 2nd and 3rd next.

ANNUAL MEETING AND TOWN-PLANNING CONFERENCE.

The Fortieth Annual General Meeting and Conference with delegates from local authorities on Housing and Town Planning will be held at Great Yarmouth on July 23rd, 24th, 25th and 26th next. Those desirous of reading papers at either of these meetings are requested at once to communicate with me.

By order of the Council,
THOMAS COLE, *Secretary*.
11 Victoria-street, S.W.

INSTITUTION OF MUNICIPAL ENGINEERS.

President—Mr. FRANK LATHAM, M.INST.C.E.I., F.S.E., Borough Engineer and Surveyor, Penzance.

COUNCIL MEETINGS.

The following council meetings have been arranged: February 22nd, Newcastle-on-Tyne; March 26th, London; April 30th, London; May 31st, Manchester; June 28th, London; July 30th, London.

GENERAL MEETING.

A visit will be paid to the Building Exhibition at Olympia on April 12th, by kind permission of the promoters. Full particulars will be issued later.

NORTHERN DISTRICT.

A meeting of this district (of which particulars will be given later) will be held at Newcastle-on-Tyne on the date of the council meeting, February 22nd.

EXAMINATIONS.

The next examination will be held in London and other centres during the week ending May 17th next. Copies of syllabus and forms of application to sit may be obtained from the secretary. Intending entrants are requested to make early application.

B. WYAND, *Secretary*.
39 Victoria-street, S.W.

INSTITUTE OF SANITARY ENGINEERS.

President—Mr. H. PERCY BOULNOIS, M.INST.C.E., F.R.SAN.I.

SESSIONAL MEETINGS.

Sessional meetings of the Institute of Sanitary Engineers, to be held at Caxton Hall, Westminster, have been arranged as follows:—

February 17th.

"A Plea for Scientific Research in the Field of Sewage Purification," by Mr. A. J. Martin, M.INST.C.E., F.G.S.

March 17th.

"The Dwelling House," by Dr. S. C. Lawrence, medical officer of health, Edmonton Urban District Council.

April 2nd.

"Heating and Ventilation," by Mr. Arthur H. Barker, Lecturer on Heating and Ventilation to University College, London, and the London County Council. Mr. A. H. McFerran, chief engineer, H.M. Office of Works, in the chair.

April 21st.

"House Drainage on the Continent," by Mr. Frank R. Durham, ASSOC.M.INST.C.E.

May 19th.

"Micro-Organisms and Public Health," by Dr. H. R. Kenwood, Chadwick Professor of Hygiene and Public Health in the University of London, medical officer of health for the County of Bedford and for the Metropolitan Borough of Stoke Newington.

ROYAL SANITARY INSTITUTE.

A sessional meeting of the institute will be held at 90 Buckingham Palace-road on Tuesday next, the 11th inst., at 7.30 p.m., when a discussion will take place on "The Eighth Report of the Royal Commission on Sewage Disposal, on Standards and Tests for Sewage, and Sewage Effluents Discharging into Rivers and Streams," to be opened by Samuel Rideal, D.SC., F.I.C., J.P.

The following hope to be present and take part in the discussion: A. P. I. Cotterell, M.INST.C.E., Bristol; Gilbert J. Fowler, D.SC., F.I.C., Manchester; George A. Hart, Leeds; Prof. A. Bostock Hill, M.D., M.SC., Birmingham; Lieut-Colonel A S. Jones, V.C., M.INST.C.E., Finchampstead; W. Kaye-Parry, F.R.I.B.A., M.INST.C.E., Dublin; Baldwin Latham, M.INST.C.E., London; E. G. Mawbey, M.INST.C.E., Leicester; George Reid, M.D., D.P.H., Stafford; J. D. Watson, M.INST.C.E., Birmingham; H. MacLean Wilson, M.D., B.SC., Wakefield.

General discussion is invited.

The chair will be taken at 7.30 p.m. by Colonel T. Walter Harding, D.L., J.P., LL.D.

SOUTH AFRICAN BRANCH CONGRESS.

The second congress of the South African Branch of the Royal Sanitary Institute is to be held in Johannesburg from March 10th to 12th next.

E. WHITE WALLIS, *Secretary*.

THE SURVEYORS' INSTITUTION.

At the Surveyors' Institution on Monday next a paper on "Building By-laws and Regulations as Affecting the Housing of the Working Classes" will be read by Mr. Wm. Woodward, and one entitled "Some Urban Housing Problems" will be submitted by Mr. M. Price Holmes.

The chair will be taken at 8 p.m.

APPOINTMENTS VACANT.

Official and similar advertisements received up to 4.30 p.m. on Thursdays will be inserted in the following day's issue, *but those responsible for their despatch are recommended to arrange that they shall reach* **THE SURVEYOR** *office by noon on* **Wednesdays** *to ensure their inclusion in the weekly list of summaries. Such advertisements may, in cases of emergency only, be telephoned (No. 1369 Holborn), subject to later confirmation by letter.*

SURVEYOR'S JUNIOR ASSISTANT.—February 7th. —Weybridge Urban District Council. £50 per annum. —Mr. John S. Crawshaw, surveyor.

SURVEYOR OF HIGHWAYS AND INSPECTOR OF NUISANCES.—February 8th.—Skirlaugh Rural District Council. £250.—Mr. C. W. Hobson, clerk, Beverley.

ASSISTANT SANITARY INSPECTOR.—February 8th.—Corporation of Southport. £80—£100.—Mr. J. E. Jarratt, town clerk.

INSPECTOR OF NUISANCES.—February 8th.—Bradford Corporation. £85 per annum.—Mr. F. Stevens, town clerk.

INSPECTOR OF NUISANCES.—February 8th.—Failsworth Urban District Council. £135 per annum. —Mr. H. C. Broome, clerk.

INSPECTOR OF NUISANCES.—February 8th.—Cosford Rural District Council. £100 per annum.—Mr. A. Newman, clerk.

SURVEYOR.—February 8th.—For the borough of Clifton Dartmouth Hardness (Corporation of Dartmouth).—Mr. S. J. Pope, town clerk.

BOROUGH ENGINEER'S ASSISTANT.—February 10th.—Corporation of Accrington. £100 per annum.—Mr. William J. Newton, borough engineer.

QUANTITY SURVEYOR.—February 10th.—Beckenham Education Committee.—Mr. F. Stevens, clerk, Council Offices, Beckenham.

CLERK OF WORKS.—February 10th. Carlisle Rural District Council. Mr. J. Graham, engineer, 28 Castle-street, Carlisle.

INSPECTOR OF NUISANCES.—February 10th.—Corporation of Stoke-on-Trent. £80 per annum. Mr. E. B. Sharpley, town clerk.

BOROUGH ARCHITECT. - February 11th. Corporation of Swansea. £500 per annum. Mr. H. Lang Coath, town clerk.

INSPECTOR OF NUISANCES.—February 11th.—Shepshed Urban District Council. £60 per annum. —Mr. M. Smith, clerk.

INSPECTOR OF NUISANCES. February 11th.—Towcester Rural District Council. £80 per annum. —Mr. W. K. Higham, clerk.

ROAD FOREMEN (2).—February 12th.—Dorsetshire County Council. 25s. per week.—Mr. E. Archdall Ffooks, clerk, Dorchester.

CLERK OF WORKS.—February 13th.—Nantwich Rural District Council. £2 10s. per week.—Mr. H. G. Atkinson, clerk.

INSPECTOR OF MAIN ROADS.—February 15th.—Warwickshire County Council. £175—£210 per annum. —Mr. John Wilmot, county surveyor.

ASSISTANT SURVEYOR.—February 17th.—Worcestershire County Council £175 per annum. Mr. S. Thornley, clerk.

CLERK OF WORKS.—February 17th.—Corporation of Manchester. £3 3s. per week.—Mr. Thomas Hudson, town clerk.

OUTDOOR ENGINEERING ASSISTANT.—February 17th.—Corporation of Manchester. £200 per annum.—Mr. Thomas Hudson, town clerk.

ARCHITECTURAL ASSISTANT.—February 18th. —Corporation of Burnley. £2 15s. per week.—Mr. Peregrine Thomas, town clerk.

SANITARY SURVEYOR AND INSPECTOR OF NUISANCES.—February 18th.—St. Austell Rural District Council. £150—£200.—Mr. John Stephens, clerk.

ROAD SURVEYOR.—February 18th.—Teme Rural District Council.—£40 per annum.—Mr. E. H. Deacon, clerk.

ASSISTANT BOROUGH SURVEYOR.—February 19th.—Corporation of Richmond (Surrey). £250 per annum.—Mr. Henry Sagar, town clerk.

JUNIOR SURVEYOR AND DRAUGHTSMAN.—February 24th.—East Sussex County Council. £65 per annum.—Mr. F. J. Wood, county surveyor.

ARCHITECT.—February 25th.—Corporation of Swansea. £500 per annum.—Mr. H. Lang Coath, town clerk.

ASSISTANT ENGINEERS. — May 1st.—Indian Public Works and State Railway Departments.—Secretary, Public Works Department, India Office, London, S.W.

CLERK OF WORKS.—Wexford County Council.—Mr. W. F. Barry, county surveyor.

DRAUGHTSMAN.—Gold Coast Government. £250 a year and expenses.—Crown Agents for the Colonies, Whitehall-gardens, London, S.W. Quote M 5836 on left-hand top corner of application.

MUNICIPAL COMPETITIONS OPEN.

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LLANGOLLEN.—February 26th.—Designs for laying out a pleasure garden, for the Llangollen Urban District Council. A prize of 2 guineas is offered. —Mr. J. W. Hughes, surveyor.

RANGOON.—March 1st.—Designs for municipal buildings. Premiums are offered of £300, £200, and £100.—The Clerk to the Rangoon Municipality.

WINNIPEG.—March 1st.—Designs for city hall. Limited to British architects in Canada. Premiums are offered of 5,000 dols., 3,000 dols., and 2,000 dols.—The Clerk.

IPSWICH.—March 31st.—Designs for laying out 26 acres as a working-class suburb on the lines of a modified garden city. Premiums of 50 guineas, 30 guineas, and 20 guineas are offered. Mr. W. Bantoft, town clerk

BARNET.—April 29th.—Designs for schemes for the erection of new municipal offices, at a cost not exceeding £4,000, for the Barnet Urban District Council. Premiums of £25, £15, and £10 are offered. —Mr. H. W. Poole, clerk, 40 High-street, Barnet.

MUNICIPAL CONTRACTS OPEN.

Official and similar advertisements received up to 4.30 p.m. on Thursdays will be inserted in the following day's issue, *but those responsible for their despatch are recommended to arrange that they shall reach* **THE SURVEYOR** *office by noon on* **Wednesdays** *to ensure their inclusion in the weekly list of summaries. Such advertisements may, in cases of emergency only, be telephoned (No. 1369 Holborn), subject to later confirmation by letter.*

Buildings.

CLEETHORPES.—February 7th.—For building a shelter in reinforced concrete, for the urban district council.—Mr. B. Greaves, clerk.

MIDFORD.—February 8th.—For building fifty-two labourers' cottages, for the rural district council.—Mr. S. Watters, clerk.

RADCLIFFE.—February 8th.—For the construction of a footbridge, for the urban district council. Mr. S. Mills, clerk.

BOURNE.—February 8th.—For the erection of six workmen's dwellings, for the urban district council.—Mr. A. R. Agnew, surveyor.

MONMOUTH.—February 10th.—For the erection of stables and coach house, for the county council.—County Surveyor, Newport.

NEWPORT (Mon.).—February 10th.—For the erection of an electric car paint shop, for the corporation. —Mr. A. A. Newman, town clerk

ST. HELENS.—February 11th.—For the erection of a school, for the corporation.—Mr. Perceval Sharp, secretary for education.

EDINBURGH.—February 12th.—For the erection of wash-houses, for the corporation.—Mr. T. Hunter, town clerk.

ARBROATH.—February 12th.—For reconstructing the court-house, for the corporation.—Mr. W. K. Macdonald, town clerk.

HUDDERSFIELD.—February 12th.—For the erection of a tall chimney, for the corporation.—Mr. J. Henry Field, town clerk.

WIMBLEDON.—February 13th.—For the erection of a ward pavilion at the isolation hospital, for the corporation.—Chairman of the Public Health Committee.

CARNARVON.—February 17th.—For the erection of twenty-five artisans' dwellings, for the corporation.—Mr. E. Hall, borough surveyor.

BARROW-IN-FURNESS.—February 17th.—For the erection of an infants' school, for the corporation.—Borough Engineer and Surveyor.

BIRMINGHAM.—February 17th.—For the erection of weights and measures offices, for the corporation.—Mr. Henry E. Stilgoe, city engineer and surveyor.

BRADFORD.—February 18th.—For the erection of eight workmen's dwellings, for the corporation.—Mr. F. Stevens, town clerk.

BARKING.—February 18th.—For the erection of workmen's dwellings, for the urban district council.—Mr. H. Hargreaves, clerk.

BRITON FERRY.—February 22nd.—For the erection of sixty-two houses in rows of 9, 10, 11, 12 and 20 houses respectively, for the urban district council.—Mr. H. Alex. Clarke, architect and surveyor.

WEST RIDING.—February 22nd.—For the supply of masonry and steelwork affecting Glasburn Bridge, for the Highways Committee.—Mr. F. G. Carpenter, West Riding surveyor, County Hall, Wakefield.

RHONDDA.—February 25th.—For the erection of refuse destructor and electrical generating works, for the urban district council.—Mr. W. P. Nicholas, clerk.

WEXFORD.—February 26th.—For the erection of a reinforced concrete bridge at Deeps, for the county council.—Mr. W. F. Barry, county surveyor.

FALMOUTH.—March 5th.—For the erection of twenty-two houses, with alternative prices for forty-four, for the corporation.—Borough Engineer.

Iron and Steel.

SHEFFIELD.—February 8th.—For the supply of 1,000 tons of steel tram rails, for the corporation.—Mr. W. J. Hadfield, surveyor of highways.

PENRITH.—February 10th.—For laying and jointing cast-iron piping, with valve and hydrants, for the rural district council.—Mr. J. W. Smith, clerk.

CHARD.—February 10th.—For the supply and delivery of 5-in., 4-in., 3-in. and 2½-in. diameter cast-iron pipes, junctions, bends and other special castings, for the corporation.—Mr. J. A. Forward, town clerk.

CHARD.—February 10th.—For the supply and delivery of 4-in. and 3-in. sluice valves, fire hydrants, air valves, and other special castings, for the corporation.—Mr. J. A. Forward, town clerk.

CHARD.—February 10th.—For laying 5-in., 4-in., 3-in. and 2½-in. diameter water mains, with valves, hydrants, and other works, for the corporation.—Mr. J. A. Forward, town clerk.

SHOEBURYNESS.—February 11th.—For laying and jointing water mains, for the urban district council.—Mr. Frederic Gregson, clerk.

WINCANTON.—February 12th.—For laying cast-iron main, with valves and fittings, for the rural district council.—Mr. E. N. Martin, clerk.

BERWICK.—February 12th.—For laying 11 miles of water mains, for the corporation.—Mr. W. Weatherhead, clerk.

MACCLESFIELD.—February 21st.—For the supply of cast-iron pipes and connections for a water main, for the corporation.—Mr. F. R. Oldfield, town clerk.

BRADFORD.—February 22nd.—For the supply of tram rails and steel poles, for the corporation.—Mr. F. Stevens, town clerk.

CHEPPING WYCOMBE.—March 5th.—For the supply of cast-iron pipes, wrought-iron tubing, and brass fittings, for the corporation.—Mr. T. J. Rushbrooke, borough surveyor and water engineer.

BOMBAY.—March 25th.—For supplying and laying about 19 miles of 50-in. diameter steel main, for the municipality.—Mr. H. J. Trivess Smith, hydraulic engineer, Municipal Offices, Bombay.

Roads.

BANBURY.—February 8th.—For the supply of broken granite and grouse, for the rural district council.—Mr. E. L. Fisher, clerk.

HORNCASTLE.—February 8th.—For the supply of granite and slag, for the rural district council.—Mr. J. E. Chatterton, clerk.

CRICK.—February 8th.—For the supply of Hartshill granite, Mancetter or Mountsorrel stones, for the rural district council.—Mr. J. W. Pendred, clerk.

FORFAR.—February 8th—12th.—For the supply of highway materials, for the county council.—Mr. D. Ross, Brechin-road, Kirriemuir.

WELLINGBOROUGH.—February 8th.—For the supply of granite, for the rural district council.—Mr. W. Jackson, clerk.

LEES.—February 8th.—For making up part of Stamford-street, for the urban district council.—Mr. W. Ogden, clerk.

PENGE.—February 8th.—For the supply of granite-macadam, Kentish flints, Crayford shingle and sand, Croydon gravel, tar-paving, tar-macadam, and horse hire, for the urban district council.—Mr. A. E. Eves, town clerk.

REIGATE.—February 10th.—For the supply of road materials and team labour, for the rural district council.—Mr. E. C. Morrison, clerk.

SOUTHAM.—February 10th.—For the supply of granite, for the rural district council.—Mr. W. Wood, clerk.

BIRKENHEAD.—February 10th.—For the supply of horses and drivers for street watering, for the corporation.—Mr. J. Fearnley, town clerk.

BEVERLEY.—February 10th.—For the supply of 3,000 to 4,000 tons of stone for macadamising, for the rural district council.—Mr. F. G. Hudson, clerk.

BIRKENHEAD.—February 10th.—For the supply of granite and Rawtenstall kerbs and channels, Penmaenmawr breaking stone, natural flags, and creosoted red deal paving blocks, for the corporation.—Mr. J. Fearnley, town clerk.

ILFORD.—February 10th.—For making up certain roads, for the urban district council.—Mr. A. Partington, clerk.

WEETSLADE.—February 11th.—For work of paving, for the urban district council.—Mr. W. Webb, clerk.

MALDENS AND COOMBE.—February 11th.—For works of making up and paving with artificial stone, for the urban district council.—Mr. James W. Johnson, clerk.

TOWCESTER.—February 11th.—For the supply of granite and slag, for the rural district council.—Mr. W. K. Higham, clerk.

FORFAR.—February 12th.—For quarrying and carting road materials, for the Forfar District Committee. Mr. John P. Anderson, district clerk, Municipal Buildings, Forfar.

KINGSTON-UPON-THAMES.—February 12th.—For levelling, paving, metalling, flagging, channelling, sewering, and lighting Woodbines-avenue, for the corporation.—Mr. Harold A. Winser, town clerk.

EASINGWOLD.—February 12th.—For the supply of whinstone and slag, for the rural district council.—Mr. F. J. H. Robinson, clerk.

LUDDENDEN FOOT.—February 12th.—For works of excavating, concreting and granite paving, for the urban district council.—Mr. C. W. Moses, clerk.

ROCHDALE.—February 12th.—For levelling, paving, metalling and flagging, for the corporation.—Mr. W. H. Hickson, town clerk.

RYTON (Durham).—February 12th.—For making up certain streets, for the urban district council.—Mr. H. Dalton, clerk.

REIGATE.—February 12th.—For tar-washing 140,000 yds. super. of roads, for the corporation.—Mr. Alfred Smith, town clerk.

TODMORDEN.—February 12th.—For making up 6,000 yds. of granite-sett paving, for the corporation.—Mr. D. Sutcliffe, town clerk.

CORK.—February 13th.—For supplying and laying bituminous or other similar street-surfacing materials, for the county council.—Mr. F. W. McCarthy, town clerk.

CORK.—February 13th.—For laying certain streets with Trinidad Lake asphalt-macadam, similar to that laid for the London County Council on the Victoria Embankment, for the corporation.—Mr. F. W. McCarthy, town clerk.

CARDIFF.—February 13th.—For making up certain streets, for the corporation.—Town Clerk.

WOKING.—February 14th.—For the supply of 4,000 tons of broken granite, for the urban district council.—Mr. G. Wooldridge.

DURHAM.—February 14th.—For the supply of whinstone slag, tar-macadam, pitch, tar, creosote oil, and cartage, for the rural district council.—Mr. G. Gregson, surveyor.

LANARK.—February 14th.—For the supply of tar and tar-macadam, for the Middle Ward District.—Mr. W. E. Whyte, district clerk, Hamilton.

PRESTON.—February 14th.—For work of making good, for the corporation.—Borough Surveyor.

ACTON.—February 14th.—For making up certain roads, for the urban district council.—Mr. W. Hodson, clerk.

MAIDSTONE.—February 15th.—For the supply of road materials, for the rural district council.—Mr. R. Hoar, clerk.

ROTHERHAM.—February 15th.—For making up a certain street, for the corporation.—Mr. C. L. Des Forges, town clerk.

WORSLEY.—February 15th.—For making up certain streets, for the urban district council.—Mr. J. F. Monks, clerk.

WISBECH.—February 15th.—For the supply of granite, ironstone slag, gravel, ragstone and clunch, for the rural district council.—Mr. A. G. Catling, highway surveyor.

WIRRAL.—February 15th.—For making up certain roads, for the rural district council.—Mr. William Henry Churton, clerk.

SURBITON.—February 17th.—For the supply of road materials, brooms, and horse-sweeping brooms, for the urban district council.—The Clerk.

SEVENOAKS.—February 17th.—For the supply of 8,000 gallons of refined tar and 20,000 gallons of crude tar, for the urban district council.—Mr. P. Darbyshire, clerk.

WEST SUFFOLK.—February 17th.—For the supply of broken material, for the county council.—Mr. W. Lionel Jenkins, county surveyor, Bury.

CHERTSEY.—February 17th.—For making up certain streets, for the rural district council.—Mr. H. E. Paine, clerk.

FINCHLEY.—February 17th.—For the supply of 20,000 gallons of tar, for the urban district council.—Mr. E. H. Lister, clerk.

FORMBY.—February 17th.—For making-up certain streets, for the urban district council.—Mr. E. H. Bond, clerk.

LOUTH.—February 17th.—For the supply of granite and slag, for the rural district council.—Mr. F. C. Chard, clerk.

EAST SUFFOLK.—February 17th.—For work of steam rolling, for the county council.—Mr. A. Townshend Cobbold, clerk, Ipswich.

LONG SUTTON (Lincs).—February 18th.—For the supply of broken granite, broken slag, slag screenings and tar macadam, for the urban district council.—Mr. S. S. Mossop, clerk.

LEIGH-ON-SEA.—February 18th.—For making up several streets, for the urban district council.—Mr. E. P. Wheatley, clerk.

NEARNE.—February 18th.—For the supply of dross, screenings, granite and tar, for the rural district council.—The Clerk.

ELY.—February 18th.—For the supply of 4,210 tons of granite and 1,010 tons of gravel, for the rural district council.—Mr. E. B. Claxton, clerk.

MARGATE.—February 19th.—For the supply of Kent rag asphalt, hardcore, and pit flints, for the corporation.—Mr. E. Brooke, town clerk.

ARGYLL.—February 19th.—For road diversion, for the county council.—Mr. Richard Callen, road surveyor, Dunoon.

HORBURY.—February 20th.—For the supply of tarmac, granite, whinstone, limestone, dross, flags, kerbs, and setts, for the urban district council.—Mr. W. Sugars, engineer and surveyor.

THAKEHAM.—February 20th.—For the supply of road material, for the rural district council.—Mr. Percy Ayling, clerk, Council Offices, Storrington.

FLAXTON.—February 20th.—For the supply of whinstone and slag, for the rural district council.—The Clerk.

HODDESDON.—February 21st.—For watering the streets, for the urban district council.—Chairman of the Highways Committee.

PONTYPRIDD.—February 22nd.—For making up certain streets, for the urban district council.—Mr. J. Colenso Jones, clerk.

CLAYPOLE.—February 24th.—For the supply of granite and slag, for the rural district council.—Mr. A. J. Franks, clerk.

LITTLE HULTON.—February 24th.—For the supply of broken granite, grit setts, granite setts, granite and limestone chippings, and grit kerbs, for the urban district council.—Mr. J. H. Heyes, clerk.

EPSOM.—February 25th.—For making-up Woodcote Park-road, for the urban district council.—Mr. E. G. Wilson, clerk.

BELPER.—March 1st.—For the supply of highway materials, for the rural district council.—Mr. R. C. Cordon, engineer and surveyor, Duffield, near Derby.

CHERTSEY.—March 3rd.—For the supply of Guernsey and Leicester granite, Hungry Hill flints, Farnham shingle and gravel, Mendin stone, chalk and macadam, for the rural district council.—Mr. Herbert Benney, surveyor.

TANGIER.—April 10th.—For the construction of a sewer and a road, for the Special Committee of Public Works.—Commercial Intelligence Branch of the Board of Trade, 73 Basinghall-street, E.C.

Sanitary.

HORSFORTH.—February 10th.—For laying sewers and constructing manholes, for the urban district council.—Mr. J. Davidson, clerk.

GRIMSBY.—February 10th.—For the construction of a 15-in. glazed stoneware pipe sewer, half to be laid in concrete on piles varying from 8 ft. to 65 ft. in length, for the corporation.—Mr. H. Gilbert Whyatt, borough engineer and surveyor.

DERBY.—February 10th.—For laying earthenware and cast-iron sewers, for the corporation.—Town Clerk.

LISKEARD.—February 10th.—For the removal of house refuse, for the corporation.—Mr. H. Lyde Caunton, town clerk.

BISHOP AUCKLAND.—February 10th—March 3rd.—For the construction of sewage disposal works, for the rural district council.—Mr. S. Adams, clerk.

WATFORD.—February 11th.—For work of sewerage, for the rural district council.—Mr. H. M. Turner, clerk.

GRIMSBY.—February 11th.—For the construction of half a mile of sewers, for the rural district council.—The Surveyor.

AMBLESIDE.—February 11th.—For the construction of sewage disposal works, for the urban district council.—Mr. G. Gatey, clerk.

BLAYDON.—February 11th.—For the cleansing of ashpits, for the urban district council.—Mr. H. Dalton, clerk.

RUSHDEN.—February 12th.—For the construction of sewage disposal works, comprising alteration of existing works, new screening and detritus tanks, sedimentation tanks, storm-water tanks, humus tanks, percolating filters, culverts, drains, ejector house and plant, sludge-drying beds, laying out land, road making and incidental works, for the urban district council.—Mr. W. B. Madin, engineer and surveyor.

KILRUSH.—February 12th.—For the supply of engines and pumps for sewerage scheme, for the rural district council.—Mr. T. Kelly, clerk.

EXETER.—February 12th.—For works of sewerage, for the corporation.—Mr. T. Moulding, city engineer.

BIRMINGHAM.—February 12th.—For the reconstruction of Brockley Brook culvert, and construction of open brook course, for the corporation.—Mr. Henry E. Stilgoe, city engineer and surveyor.

HACKNEY.—February 13th.—For the removal of refuse, for the borough council.—Chairman of the Tenders Committee.

CHEADLE.—February 13th.—For the construction of sewers and manholes, for the urban district council.—Mr. A. Briggs, clerk.

GOSPORT AND ALVERSTOKE.—February 13th.—For providing and laying an extension of the sewage outfall, Stokes Bay, in 36-in. cast-iron pipes, for the urban district council.—Mr. E. Talbot Palmer, clerk.

NANTWICH.—February 13th.—For the construction of pipe sewer and manholes, for the rural district council.—Mr. H. G. Atkinson, clerk.

NORTHWICH.—February 13th.—For the removal of house refuse, for the rural district council.—The Clerk.

CHIPPENHAM.—February 14th.—For laying a drain and constructing a tank, for the Joint Hospital Committee.—Mr. Edmund M. Awdry, clerk.

WINDERMERE.—February 15th.—For laying and jointing stoneware pipe sewers and cast-iron pipe sewers, and constructing manholes, lampholes, sedi-

mentation tanks, bacteria beds, effluent tanks, sludge lagoons, engine-houses, pump wells and roads, for the urban district council.—Mr. J. T. Bownass, clerk.

GLASGOW.—February 15th.—For the erection of a public convenience, for the corporation.—Mr. J. Lindsay, town clerk.

COLCHESTER.—February 15th.—For cleansing the cattle market, for the corporation.—Mr. H. Goodyear, borough engineer and surveyor.

BALBY-WITH-HEXTHORPE. — February 17th.—For the construction of detritus tank, sewage tank, percolating filters, humus tanks, sand filters, and other works, for the urban district council.—Mr. Frank Allen, clerk.

MANCHESTER.—February 17th.—For the construction of main drainage work No. 8 new intercepting sewer, for the corporation.—Mr. Thomas Hudson, town clerk.

MACCLESFIELD.—February 17th. — For laying sewers, manholes, and flushing tanks, for the rural district council.—Mr. F. May, clerk.

NORTHWICH.—February 17th.—For the removal of nightsoil, for the urban district council.—Mr. J. A. Cowley, clerk.

PORTHCAWL.—February 17th.—For the construction of surface-water drain and manholes, for the urban district council.—Mr. A. S. Lilley, engineer and surveyor.

LANCHESTER.—February 17th.—For alterations to sewage disposal works, for the rural district council.—Mr. W. H. Ritson, clerk.

LIVERSEDGE.—February 19th.—For the construction of sewage disposal works, for the urban district council.—Mr. T. Mitcheson, clerk.

CROYDON.—February 20th.—For emptying cesspools, for the rural district council.—Mr. E. J. Gowen, clerk.

DUMFRIES.—February 21st.—For relaying section of main drain, for the corporation.—Mr. John Barker, burgh surveyor.

STAFFORD.—February 22nd.—For the construction of a sewer, for the corporation.—Mr. R. Battle, town clerk.

PORTSMOUTH.—February 26th.—For laying storm drains with manholes, for the corporation.—Mr. G. Hammond Etherton.

PORT SAID.—March 1st.—For the construction of drainage works, for the municipality.—Mr. A. L. Webb, C.M.G., Queen Anne's Chambers, Broadway, Westminster.

Stores.

STEPNEY.—February 8th.—For the supply of bricks, lime, fireclay, brooms, cast-iron work, colours, drainage materials, oilman's goods, Portland cement, pitch, tar, green oil, bitumen, timber, tools, wheelwright's materials, shoeing horses, squaring and redressing old paving materials, ballast, uniform clothing, boots, and disinfectants, for the borough council. Mr. Geo. W. Clarke, town clerk.

OSSETT.—February 8th.—For the supply of materials, stores and workmen's tools required in the highways, gas, lighting, water, sanitary and educational departments, for the corporation.—Mr. T. W. Wilson, town clerk.

BLACKBURN. February 8th. For the supply of miscellaneous materials and labour, for the corporation.—Mr. William Stubbs, borough and water engineer.

YORK.—February 8th.—For the supply of Portland cement, stoneware pipes, sludge press cloths, building and sewage lime, pitch and creosote oil, Yorkshire stone flags, kerbing, edging, whinstone, slag, and limestone chippings, for the corporation.—Mr. F. W. Spurr, city engineer.

LEIGH.—February 8th.—For the supply of grit setts, flags, kerbstones, macadam, sewerage pipes, castings, brushes, pitch, creosote oil, and tools, for the corporation.—Mr. W. H. Cowburn, town clerk.

FINSBURY.—February 11th.—For the supply of granite patent stone, horse and cart hire, Portland cement, lime, sand ballast, wood-paving blocks, York paving, blacksmith's work, carbolic acid, castings, chandlery, oils, stoneware goods, and timber, for the borough council.—Mr. George Whitehead Preston, town clerk.

FORFARSHIRE.—February 11th.—For the supply of ironmongery, drain pipes, cement, lime, coal, and gratings, for the Dundee District Committee.—Mr. H. A. Pattullo, district clerk, 1 Bank-street, Dundee.

EPSOM.—February 11th.—For the supply of sewerage ironwork, gulley gratings, shovels, picks, brooms, forks, disinfectants, Portland cement, stoneware pipes, kerbing, channelling, setts, broken granite, chippings, flints, limestone dust, tarred paving, tarred macadam, coal, coke, hay, corn, straw, bricks, paraffin, artificial stone paving, Thames ballast, veterinary surgeon's services, tar, pitch, and team labour, for the urban district council.—Mr. E. G. Wilson, clerk.

WOOLWICH. February 12th.—For the supply of ballast, sand, brooms, brushes, cement, chandlery, drain pipes, forage, granite kerb, harness, ironmongery, road material, sewer ironwork and timber, for the borough council.—Mr. Arthur B. Bryceson, town clerk.

BRADFORD. February 12th.—For the supply of road metal, gullies, earthenware pipes, timber for sewerage, cartage, and team labour, for the corporation.—Mr. Frederick Stevens, town clerk.

NEWPORT (Mon.).—February 12th.—For the supply of road materials, timber, slates, scavenging brooms, pitch, sanitary ironwork and pipes, for the corporation.—Mr. Albert Newman, town clerk.

BATTERSEA.—February 12th.—For the supply of veterinary attendance, horse hire, materials for carts and van covers, removal of old tins from depot, harness material, paints, painters' sundries, varnish, tools, ironmongery, granite-macadam, tarred slag-macadam, gravel, tar paving, York paving, Thames ballast, sand, stoneware pipes, timber, bricks, cement, lime, slates, iron castings, iron bars, disinfectants, coal, coke, soaps, and oils, for the borough council.—Mr. W. Marcus Wilkins, town clerk.

RAWTENSTALL.—February 13th.—For the supply of road metal, earthenware pipes, gullies, timber, pitch, creosote oil, disinfectants, Portland cement, iron castings, flags, setts, tools, brushes, horse-shoeing, and carting, for the corporation.—Mr. James Whalley, town clerk.

NORTHAMPTON.—February 15th.—For the supply of broken granite, granite kerb, setts, artificial stone paving, stoneware pipes, gullies, Portland cement, ironmongery, tar paving, tar-macadam, blue bricks, brooms, coal, iron castings, timber, and team labour, for the corporation.—Mr. Herbert Hankinson, town clerk.

HALIFAX.—February 17th.—For the supply of stores required in the electricity department, for the corporation.—Mr. Percy Saunders, town clerk.

RICHMOND (Surrey).—February 17th.—For the supply of ironfounder's work, brooms, forage, road materials, harness, and team labour, for the corporation.—Mr. Henry Sagar, town clerk.

LEEDS.—February 17th.—For the supply of requisites for the tramway department.—Mr. J. B. Hamilton, general manager.

FROME.—February 17th.—For the supply of scavenging brushes, cement, limestone, tools, kerbing, channelling, pennant and concrete flagging, for the urban district council.—Mr. H. E. Ames, clerk.

ECCLES.—February 18th.—For the supply of setts, flags, kerbs, broken rubble, granite and macadam chippings, prepared tar limestone, limestone cube chippings, gravel, cinders, castings, pitch, creosote, tar, Simpson's patent street gullies, stoneware-pipe gullies, stoneware pipes, bends, junctions, mortar, and channel stones, for the corporation.—Mr. Edwin Parkes, town clerk.

GOOLE.—February 19th.—For the supply of road metal (Guernsey granite and chippings), granite setts, slag, hardcore, concrete flags, York flags, kerb, channel, stoneware pipes, Portland cement, tar-macadam, brough gravel, coal and bricks, for the urban district council.—Mr. C. G. Bradley, engineer and surveyor.

LEEDS.—February 19th.—For the supply of requisites for the electricity department.—Mr. Robert E. Fox, town clerk.

LEEDS.—February 20th.—For the supply of cement, earthenware drain pipes, sewer ironwork, galvanised dirt-boxes, and sewer ventilating columns, for the corporation.—Mr. W. T. Lancashire, city engineer.

WESTMINSTER.—February 20th.—For the supply of ballast, sand, boots, bricks, brooms, road repairs, cement, lime, coal, disinfectants, drysaltery, flags, broken granite, setts, kerb, channels, stoneware gullies, iron castings, sewerage and drainage works, tarpaulin, and wood blocks, for the corporation.—Mr. John Hunt, town clerk.

CROYDON.—February 20th.—For the supply of road materials, Portland cement, cartage, brooms, and stoneware pipes, for the rural district council.—Mr. Ernest John Gowen, clerk.

CAMBRIDGE.—February 25th.—For the supply of timber, stoneware pipes, Portland cement, gravel, sand, brooms, paint, haulage, and horses, for the corporation.—Mr. J. E. L. Whitehead, town clerk.

SOUTHEND-ON-SEA.—February 26th.—For the supply of stoneware pipes, bends, flints, bricks, gravel, timber, ironmongery, paints, cement, team labour, forage, tar paving, tar-macadam, iron castings, granite kerb, channel, broken Guernsey granite, broken granite, pitch, harness, brooms, iron and steel, disinfectants, for the corporation.—Mr. H. J. Worwood, town clerk.

WINCHESTER.—February 27th.—For the supply of broken granite chippings, bass brooms, Portland cement, coal, coke, stoneware drain pipes, and concrete paving slabs, for the corporation.—Mr. Thomas Holt, town clerk.

GUILDFORD.—March 5th.—For the supply of broken granite, chippings, granite setts, Durax cubes, brooms, brushes, cast-iron pipes, flints, galvanised steam tubes, disinfectants, horse hire, cartage, iron castings, ironmongery, oils, pitch, tar, Portland cement, dias lime, stoneware pipes, and shoeing, for the corporation.—Mr. A. D. Jenkins, town clerk.

Miscellaneous.

LONDON.—February 17th.—For the cartage of import and export goods, and the supply of vans, carts, and trolleys, for the Port Authority.—Mr. F. Ayliffe, secretary, 109 Leadenhall-street, E.C.

TENDERS FOR MUNICIPAL WORKS OR SUPPLIES.

The Editor invites the co-operation of SURVEYOR readers with a view to making the information given under this head as complete and accurate as possible.

* Accepted. † Recommended for acceptance.

ABERGELE.—For work in connection with sanitary conveniences, shelter, jetty, pumping installation, sewerage works, and cast-iron surface-water drain, for the urban district council.—Mr. M. R. Jones, surveyor:—

G. P. Trentham, Birmingham	£2,596
G. Salt, Deganwy*	2,212
Jones & Pritchard, Abergele	1,914
B. Lumb, Old Colwyn	1,783

BERMONDSEY.—For a heating installation at the "Paragon," for the London County Council:—

F. Burkitt, Borough	£1,100
J. Yetton & Co., Limited, Limehouse	860
E. Deane & Beal, Limited, London-bridge	805
Tilley Brothers, Kingsland-road	797
Hayward Brothers & Eckstein, Limited, Borough*	751

CAMBERWELL.—For a heating installation at the School of Arts and Crafts, for the London County Council:—

Palowkar & Sons, Queen-street	£1,675
Arding & Dyne, Southwark	1,500
J. Yetton & Co., Limited, Limehouse	1,430
Tilley Brothers, Kingsland-road	1,295
J. & F. May, Lincoln's-inn	1,269
The Brightside Foundry & Engineering Company, Limited, Westminster	1,251
C. P. Kinnell & Co., Limited, Southwark	1,230
W. G. Cannon & Sons, Limited, Southwark	1,245
Cannon & Hefford, Peckham	1,223
G. & E. Bradley, Lever-street*	1,181

CAMBERWELL.—For a heating installation at Leipsic-road, for the London County Council:—

Palowkar & Sons, Queen-street	£1,152
J. Grundy, Limited, City-road	1,097
J. Yetton & Co., Limited, Limehouse	1,050
W. G. Cannon & Sons, Limited, Southwark	1,025
Hayward Brothers & Eckstein, Limited, Borough	982
J. & F. May, Lincoln's-inn	959
The Brightside Foundry & Engineering Company, Limited, Westminster	957
Cannon & Hefford, Peckham	947
Strode & Co., Osnaburgh-street	928
H. J. Cash & Co., Limited, Westminster*	924

HACKNEY.—For a heating installation, at "Craven Park," for the London County Council:—

The Wembley Heating Company, Limited, Wembley	£124
J. Grundy, Limited, City-road	1 7
G. & E. Bradley, Lever-street	110
Shelby Manufacturing Company, Peckham	105
Palowkar & Sons, Queen-street	102
L. Norden, Forest-gate*	93

HACKNEY.—For a heating installation at the "Shacklewell," for the London County Council:—

G. Barker, Whitechapel	£275
C. R. Price, Bishopsgate	263
G. Butters, Hackney	254
W. Silk & Son, Homerton	250
F. Ball, Upper Clapton	241
E. Lawrance & Sons, Limited, City-road	225
Vigor & Co., Poplar	197
J. C. Mather, Islington*	163

HARROGATE.—For the extension of the royal pump-room, for the town council.—Mr. C. E. Rivers, borough surveyor:—

EXCAVATORS AND MASONS:—
C. Dawson & Son, £408; T. Godfrey, £440; A. Hymas, £356; Kershaw & Hill, £349; G. Winterburn, £321; C. A. Nettleton, £320.*

CARPENTERS AND JOINERS:
J. W. Rudd, £569; J. W. Taylor, £559; G. H. Carrick, £548; J. Allen & Sons, £519; G. W. Ledger, £516; F. Harvey, £505; W. Watson, £499.*

GLAZIERS:—
Atkinson & Sons, £223; W. Ballerby, £204; C. Scholes, £203; Foster & Sons, £193; G. Thompson, £192; C. A. Allen, £183; T. Rayner, £184; J. Croft, £179; Braithwaite & Co., £177.*

PAINTERS:—
Goodall's, Manchester, £92; H. Eshelby, £90; I. Brown, £78; Broadbank & Son, £76; Holdsworth, Shipley, £72; Topham Brothers, £67; Decorative Supply Company, £59; Morley & Son, £59; Noddings & Son, £58; W. Norman, £52.*

FIBROUS PLASTER:—
G. H. Bankarts & Co., London, £150; H. H. Martyn & Co., Cheltenham, £147; Goodalls Limited, Manchester, £260; R. Fortune, £255; J. Turner & Co., Liverpool, £250; F. De Jong & Co., London, £244; Rae, Pixton & Co., London, £218; J. Dobson, Leeds, £215; A. Calverley & Son, £138; Waring & Gillow, Manchester, £180; W. H. Horn, Limited, Bradford, £153.*

IRONFOUNDERS:—
Macfarlane & Co., £1,541; J. Allen (sen.) & Son, Limited, Glasgow, £1,360; Lion Foundry Company, Glasgow, £1,180; O. Atkinson & Sons, £1,150; Sloan & Davidson, Stanningley, £1,020; Carron & Co., Stirling, £925.*

COPPER ROOFING:—
Braithwaite & Co., £815; Ewart & Co., £429; Braby's, Limited, £332.*

HEBDEN BRIDGE.—Accepted for works of paving, for the urban district council.—Mr. T. Waddingham, surveyor:—
W. H. Worthington, Limited, Manchester.

HESTON.—For the supply of tar and Tarvia, for the urban district council:—

	Per Gallon.
TAR.	d.
Smart & Son, Poplar	4½
Forbes, Abbot & Co., Limited,	4½
Catchpole & Sons, Rotherhithe	4½
Crow & Sons, West Ham	4½
Grindley & Co., Limited, Poplar	4½
TARVIA.	
Bristowe & Co., Limited	5½

NEWRY.—For additions to the town hall, for the urban district council:—

H. & J. Martin, Belfast	£5,200
H. Savage, Newry	4,895
W. J. Campbell & Son, Belfast	3,997
J. Wynne, Dundalk	3,982
Thornbury Brothers, Belfast	3,808
J. & W. Stewart, Belfast	3,750
D. Neary, Newry	3,648
W. J. Colville, Newry	3,632
J. Graham, Dromore	3,620
P. McAleenan, Castlewellan	3,600
P. Ritchie, Belfast	3,550
I. Copeland, Belfast*	3,300

NORWOOD.—For a heating installation at the Strand School, for the London County Council:—

Palowkar & Sons, Queen-street	£1,872
Tilley Brothers, Kingsland-road	1,858
B. Harlow & Son, Macclesfield	1,777
J. C. Christie, Aldgate	1,755
J. Yetton & Co., Limited, Limehouse	1,720
G. & E. Bradley, Lever-street	1,619
W. G. Cannon & Sons, Limited, London-road	1,595
Brightside Foundry and Engineering Company, Limited, Westminster	1,497
A. Macintosh & Sons, Limited, Cambridge	1,422
H. J. Cash & Co., Limited, Westminster	1,398
C. P. Kinnell & Company, Limited, Southwark	1,325

PADDINGTON.—The following contracts have been accepted by the borough council:—
H. Boyer.—Scavenging, sloppins, washing, gritting, &c., £3,207.
G. E. Cloke.—Removing and disposing of house refuse, &c., £2,150.
J. Latter.—Street watering, £955.

ROMFORD.—For the supply of blue Guernsey hand-broken granite, for the urban district council.—Mr. T. Turvey, surveyor:—

	Per ton. s. d.
Brookes, Limited, Westminster	15 0
Fry Brothers, Greenwich	14 9
A. & T. Manuelle, Gracechurch-street	14 7
J. Mowlem & Co., Westminster	14 6
W. Griffiths & Co., Bishopsgate	14 3

ST. PANCRAS.—For a heating installation at the county secondary school, for the London County Council:—

Palowkar & Sons, Queen-street	£1,930
Strode & Co., St. Pancras	1,657
C. P. Kinnell & Co., Limited, Southwark	1,625
Tilley Brothers, Kingsland-road	1,612
J. C. Christie, Aldgate	1,608
J. Yetton & Co., Limited, Limehouse	1,590
McLaughlin & Harvey, Limited, Brecknock-road	1,573
J. Grundy, Limited, City-road	1,467
Korting Brothers, Limited, Westminster	1,432
H. J. Cash & Co., Limited, Westminster	1,422
J. & F. May, Lincoln's Inn-fields	1,419
G. & E. Bradley, Lever-street	1,417
Brightside Foundry and Engineering Company, Limited, Westminster*	1,653

SOUTHEND.—The following tenders have been accepted by the corporation for the making-up of streets under the Private Street Works Act:—

Warrior-square West.—W. Iles	£623
Warrior-square East.—W. Iles	515
St. Mary's-road (Section 2).—W. Buxton	487
Claremont-road (Section 3).—W. Buxton	458

The Tender of Millar's Timber and Trading Company, Limited, for the supply of Jarrah wood sleepers for the extension of the tramways from the White Horse to Thorpe Bay, at 5s. 10d. per sleeper, has been accepted. It is estimated that approximately 4,800 sleepers will be required.

THIRSK.—The following tenders have been accepted by the rural district council —

Whinstone.—Cradock & Co., Limited, 7s. 1d., 9s. 7d., 5s. 6d., 7s. 9d. per ton; Ord & Maddison, 7s. 9d., 10s. 3d., 7s. 11d., 6s. 5d. per ton.

Limestone.—Ord and Maddison, 5s., 6s. 5d. per ton.

Slag.—W. C. Clark, Limited, 5s., 5s. 2d., 4s. 11d. per ton; G. Bradley, 4s. 6d., 4s. 7d., 4s. 6d., 4s. 4d., 4s. 3d., 5s. per ton; B. Samuelson & Co., Limited, 4s. 4d., 4s. 5d., 4s. 9d., 4s. 8d., 4s. 4d., 4s. 7d., 5s. 1d., 4s. 2d. per ton.

Turned slag.—B. Samuelson, Limited, 9s. 7d., 10s. 7d., 11s. 7d., 11s. 10d. per ton.

Annealed slag.—W. C. Clark, Limited, 6s. 10d., 5s. 6d., 5s. 9d., 6s. 3d. per ton; W. H. Musgrave, 4s. 9d., 6s. 10d., 5s. 3d., 5s. 9d., 6s. 3d. per ton.

Steel slag.—Cloke's Extension, Limited, 6s. 2d., 6s. 5d., 5s. 11d., 6s. 9d. per ton.

WESTHOUGHTON.—For the erection of steam roller shed and additions to stables, for the urban district council.—Mr. George Hayes, surveyor:—

Smith Brothers, Blackpool	£558
J. Coop, Westhoughton	557
S. Jones, Farnworth	510
A. Wigan & Son, Ince	503
J. Dickinson & Son, Westhoughton	484
T. Lee, Westhoughton	471
J. Horrocks, Westhoughton	457
W. Darbyshire, Wigan	451

WORTHING.—For laying wood paving, for the corporation.—Mr. F. Roberts, borough surveyor —

T. Doney, Plymouth	£2,501
J. Mowlem & Co., Limited, Westminster	2,337
W. Griffiths & Co., Limited, Bishopsgate	2,341
Acme Flooring & Paving Company, Victoria park	2,291
Improved Wood Paving Company, Queen Victoria-street	2,181

MEETINGS.

Secretaries and others will oblige by sending early notice of dates of forthcoming meetings.

FEBRUARY.

7.—Chadwick Trust Lecture: Mr. H. Percy Boulnois, M.Inst.C.E., on "The Hygiene of the Home," Royal Sanitary Institute, 90 Buckingham Palace-road, S.W. 8.15 p.m.

7.—Institution of Municipal and County Engineers: Dinner and Presentation to President, Lyons' Victoria Mansions Restaurant. 6.30 p.m.

7.—Institution of Municipal and County Engineers: Eastern District Meeting, New Middlesex County Council Buildings and Lyons' Victoria Mansions Restaurant.

8.—Royal Institute of British Architects: President's Address to Students; Presentation of Prizes.

10.—Surveyors' Institution: Mr. Wm. Woodward on "Building By-Laws and Regulations as Affecting the Housing of the Working Classes." Mr. M. Price Holmes, on "Some Urban Housing Problems." 8 p.m.

11.—Institution of Civil Engineers: Ordinary Meeting; papers to be read:—"Durban Harbour, South Africa," by Cathcart William Methven, M.Inst.C.E., and "Natal Harbour Works," by Charles James Crofts, M.Inst.C.E., Institution of Mechanical Engineers. 8 p.m.

11.—Royal Sanitary Institute: Discussion on Eighth Report of the Royal Commission on Sewage Disposal, on Standards and Tests for Sewage, and Sewage Effluents Discharging into Rivers and Streams, 90 Buckingham Palace-road. 7.30 p.m.

13.—Junior Institution of Engineers: Visit to Osram Lamp Company's Works, Hammersmith. 2.30 p.m.

14.—Institution of Mechanical Engineers: Annual General Meeting. 8 p.m.

14. Chadwick Trust Lecture: Mr. H. Percy Boulnois, M.Inst.C.E., on "The Hygiene of the Home," Royal Sanitary Institute, 99 Buckingham Palace-road, S.W. 8.15 p.m.

15.—Institution of Municipal and County Engineers: East Midland District Meeting at Newark.

15.—Junior Institution of Engineers: Annual Dinner, Hotel Cecil. 6.30 p.m.

17.—Institution of Civil Engineers (Students' Meeting): Vernon Harcourt Lecture on "Canals and Canalised Rivers," by Mr. J. A. Saner, M.Inst.C.E. 8 p.m.

17.—Institute of Sanitary Engineers: Paper by Mr. A. J. Martin, M.Inst.C.E., Hon. Sec., "A Plea for Scientific Research in the Field of Sewage Purification."

17. Royal Institute of British Architects: Messrs. A. Saxon Snell and Wm. Milburn, on "Modern Hospitals." 8 p.m.

21. Chadwick Trust Lecture: Mr. H. Percy Boulnois, M.Inst.C.E., on "The Hygiene of the Home," Royal Sanitary Institute, 90 Buckingham Palace-road, S.W. 8.15 p.m.

22.—Institution of Municipal and County Engineers: Meeting at Southampton.

24.—Surveyors' Institution: Annual Dinner, Whitehall Rooms. 7 p.m.

MARCH.

3.—Society of Engineers: Presidential Address.

8.—Institution of Municipal and County Engineers: North Eastern District Meeting at Leeds.

APRIL.

23.—Royal Sanitary Institute: Ordinary General Meeting. 4 p.m.

APPOINTMENTS OPEN.

Offices, and applications received up to 4.30 p.m. on Thursdays will be inserted in the following day's issue, but those advertisers who are recommended to arrange that they should reach THE SURVEYOR *not later by noon on* **Wednesdays** *to ensure their insertion in the current week's publication. Such advertisements may be sent by telegram only, to Telephoned (No. 1382 Holborn), as well as confirmation by letter.*

BOROUGH OF RICHMOND (SURREY).

The Richmond (Surrey) Town Council invite applications for the position of Assistant Borough Surveyor.

Commencing salary £250 per annum.

Age not to exceed 25 years.

Candidates must have had practical experience of such engineering and building works as are usually carried out by a Municipal Surveyor, and must have been accustomed to the control and management of an outdoor staff of foremen and workmen.

Preference will be given to Candidates who are Associate Members of the Institution of Civil Engineers.

Candidates must also be thoroughly conversant with up-to-date methods of road construction and maintenance, and be competent to set out and superintend works during construction.

The person appointed will be required to attend certain Committee Meetings, held in the evening.

A list of duties, conditions of appointment, and Form of Application will be furnished to intending candidates by the Borough Surveyor, Town Hall, Richmond (Surrey), on receipt of an addressed foolscap envelope.

Canvassing Members of the Council is strictly prohibited, and will disqualify.

Applications, endorsed "Assistant Borough Surveyor," must reach the undersigned not later than Wednesday, the 19th February, 1913.

HENRY SAGAR.
Town Clerk.

Town Hall,
Richmond, Surrey,
28th January, 1913.

COUNTY BOROUGH OF BURNLEY.

The Corporation of Burnley invite applications for the appointment of Architectural Assistant in their Borough Engineer and Surveyor's Department, at a wage of £2 15s. per week. Candidates must have a thorough knowledge of Construction, and must be accustomed to taking out Quantities and Measuring-up work.

Applications, in candidate's own handwriting, stating age and experience, and accompanied by copies of not more than three recent testimonials, must reach me on or before Thursday, the 13th February, 1913, the application to be endorsed "Architectural Assistant."

PEREGRINE THOMAS,
Town Clerk.

Town Hall, Burnley.
January 31, 1913.

COUNTY BOROUGH OF SWANSEA.

APPOINTMENT OF BOROUGH ARCHITECT.

The Corporation of Swansea invite applications for the appointment of Architect to the Corporation of Swansea, at a salary of £500 per annum.

The gentleman appointed must devote the whole of his time to the duties of the office; staff and accommodation will be provided by the Corporation.

Applicant must be a fully qualified and practical architect.

Conditions and particulars of the appointment can be had on application to the undersigned.

Canvassing is prohibited, and will disqualify any candidate.

Applications, accompanied by not more than three recent testimonials, endorsed "Borough Architect," to be sent to the undersigned by 25th February next.

H. LANG COATH,
Town Clerk.

Guildhall, Swansea.
January 21, 1913.

COUNTY OF WEXFORD.

WEXFORD COUNTY COUNCIL.

DEEPS BRIDGE.

CLERK OF WORKS OR RESIDENT ENGINEER.

The Wexford County Council invite applications from fully qualified persons to act as Resident on the Works of the New Bridge about to be built at The Deeps, on the River Slaney, County Wexford.

Salary will be at the rate of £3 per week, inclusive.

Full particulars of duties may be obtained on application to me by letter at my Office, Courthouse, Wexford.

(Signed) W. F. BARRY, Assoc.M.Inst.C.E.,
County Surveyor

County Surveyor's Office,
Courthouse, Wexford

PUPIL.—The Borough and Waterworks Engineer of Leamington (A.M.I.C.E.) has a vacancy in his office for a Pupil.—Address, Town Hall.

CORPORATION OF ACCRINGTON.

Required, in the Office of the Borough Engineer, a competent Assistant. He must be a person of undoubted ability, well versed in Municipal work, a good Draughtsman and Surveyor, able to prepare Plans, Specifications, Details and Estimates for all classes of work incidental to a Municipal Office.

Salary £100 per annum.

Applications, endorsed "Assistant," stating age, experience, and qualifications, accompanied by not more than three recent testimonials, to be delivered to me not later than Monday, the 10th day of February next.

Preference will be given to those holding the Diploma of the Institution of Municipal and County Engineers or kindred Institution.

WILLIAM J. NEWTON, A.M.I.C.E., M.S.A.,
Borough Engineer.

Town Hall, Accrington,
January 30th, 1913.

COUNTY OF WORCESTER.

APPOINTMENT OF ASSISTANT SURVEYOR.

The Highways and Bridges Committee of the Worcestershire County Council are prepared to receive applications for the appointment of an Assistant Surveyor for the North-Eastern District of the County.

The District comprises about eighty miles of main roads, including bridges, and the Officer appointed will act under the superintendence of the County Road Surveyor, and will be required to live at or near Bromsgrove.

The commencing salary will be £175 per annum, to cover all out-of-pocket expenses whatsoever, except the necessary books, stationery, &c., which will be provided by the Council.

The Assistant will be required to provide and maintain an approved motor-cycle or car, towards which he will be allowed a sum of £25 per annum. He will be required to give the whole of his time to the service of the county, and to give security, if necessary, to an amount approved. Insurance premium paid by the Council.

Applications will only be entertained from candidates whose age is between 25 and 35, and preference will be given to those who are properly qualified, and have had considerable experience with modern methods of road construction, including tar-macadam, pitch and tar grouting, tar painting, &c.

The Conditions of the Appointment and Forms of Application can be obtained from the undersigned, and all applications must be sent in on the Form provided, marked "Assistant Surveyor," and delivered to my Office by 10 a.m. on Monday, the 17th February, 1913, accompanied by copies of four recent testimonials.

Canvassing in any form will be a disqualification.

The Officer appointed must be prepared to enter upon his duties by the 1st April, 1913, and to undergo if required a medical examination by an approved medical man.

S. THORNELY,
Clerk of the County Council.

Shirehall, Worcester.
February 3, 1913.

CITY OF MANCHESTER.

The Rivers Committee require the services of a competent Clerk of Works immediately, on the Main Drainage Works. Salary £3 3s. per week. Applicants must be prepared to work night duty if required.

Applications, stating full particulars as to experience, &c., accompanied by copies of three recent testimonials, to be addressed to the Chairman of the Rivers Committee, Town Hall, Manchester, not later than 10 a.m., on Monday, February 17th, 1913.

Canvassing, directly or indirectly, will be a disqualification.

THOMAS HUDSON,
Town Clerk.

Town Hall, Manchester.
January 31, 1913.

CITY OF MANCHESTER.

The Rivers Committee invite applications for the position of Outdoor Engineering Assistant on the Main Drainage Works. Salary £200 per annum.

Applications, in writing, stating experience, with copies of three recent testimonials, to be sent to the Chairman of the Rivers Committee, Town Hall, Manchester, not later than 10 a.m., on Monday, February 17th, 1913. Canvassing, directly or indirectly, will be a disqualification.

THOMAS HUDSON,
Town Clerk.

Town Hall, Manchester.
January 31, 1913.

APPOINTMENTS WANTED.

TOWN PLANNING OR SPECIAL MUNICIPAL SURVEYS.—Practical Surveyor, with long and varied experience of special municipal surveys for many local authorities, is prepared to assist Borough Engineers with Town Planning Schemes, &c. —Address: M., c/o THE SURVEYOR, 24 Bride-lane, Fleet-street, E.C.

GENTLEMAN with London Office and sound connection among Engineers, Architects, Surveyors and Contractors in London and district is desirous of representing a first-class manufacturer. Highest references.—Box 1,220, office of THE SURVEYOR, 24 Bride-lane, Fleet-street, E.C.

(Continued on p. xxiv.)

BUILDING LAND FOR SALE.

By direction of the Right Honourable the Earl of Northbrook.

LEWISHAM.

(8 miles from London Bridge, and between the district of Hither Green and Catford and the Town of Bromley.)

FOR SALE BY PRIVATE TREATY,

either as a whole or in self-contained sections,

THE HIGHLY IMPORTANT FREEHOLD BUILDING ESTATE

of some

425 ACRES

adjoining Grove Park Station on the East, with frontages to the main Bromley Road on the West. There is a frequent service of trains to the City and West End, and frontages to motor-bus route. The property is ripe for immediate development on Garden City lines or otherwise. Exceptional facilities for drainage, water supply and lighting.

Particulars, with Plan, showing capabilities of development, from MESSRS. KNIGHT, FRANK & RUTLEY, Auctioneers and Estate Agents, 20 Hanover-square, W., or MESSRS. WALTON & LEE, 10 Mount-street, Grosvenor-square, W.

TENDERS WANTED.

ELY RURAL DISTRICT COUNCIL.

TO GRANITE AND GRAVEL MERCHANTS.

The Ely Rural District Council, at their meeting on the 27th of February instant, will be prepared to consider Tenders for 4,210 tons of Granite and 1,010 tons of Gravel.

Forms of Tender may be had on application to Mr. F. W. Firby, District Surveyor, Sutton, Isle of Ely.

Sealed Tenders, endorsed "Tender for Road Material," to be delivered to me on or before Tuesday, the 18th February instant, but the Rural District Council do not pledge themselves to accept the lowest or any Tender.

Samples must be sent to the Workhouse, Ely.

By Order,
E. B. CLAXTON,
Clerk.

Egremont-street, Ely.
February 4, 1913.

CITY OF WESTMINSTER.

ANNUAL SUPPLIES AND SERVICES

The Westminster City Council invite Tenders from persons willing to Contract for the Execution of the undermentioned Works and the Supply of the undermentioned Materials, Articles, &c., for the 12 months ending the 31st March, 1914:—

1. Ballast and Sand.
2. ————
3. Boots, &c. (New and Repairs) (one year or three years).
4. Bricks.
5. Brooms and Brushes.
6. Carriageway and Footway Repairs (Asphalte).
7. Carriageway Repairs (Macadam).
8. Carriageway Repairs (Granite Sett Pavement).
9. Carriageway Repairs (Wood Pavement).
10. Cement and Lime.
11. Christ Churchyard Garden Maintenance.
12. Coal and Coke.
13. Disinfectants.
14. Drysaltery, Soaps, and Sundries.
15. Dust Baskets (New and Repairs).
16. Flags (Sandstone and Artificial).
17. Footway and Channel (Mason's Work).
18. Gas and Hot-water Fittings.
19. Granite (Broken).
20. Granite Setts, Kerb, and Channels.
21. Gullies (Stoneware Construction).
22. Harness (New and Repairs).
23. Hats, Caps, &c.
24. ————
25. Horse Hire and Cartage Work.
26. Hose Pipe (New and Repairs), Leather.
27. Iron Castings.
28. Petroleum Spirit.
29. Painters' Materials and Miscellaneous Oils.
30. Pitch and Creosote Oil.
31. Plates, Sheets, Bolts, &c., Tree Guards and Sundries.
32. Re-tyring Wheels, Repairing Springs, &c.
33. Rubber and Waterproof Goods.
34. Sewerage and Drainage (Minor Works)
35. Shovels, Picks, Sewer Implements, and Edge Tools.
36. Stencil Paper, Ink, &c., for Duplicating Machines.
37. Stoneware Goods.
38. Street Name Plates (Supply and Fixing).
39. Tarpaulin.
40. Timber.
41. Tool Handles.
42. Towels.
43. ————
44. Wood-paving Blocks
45. Washing Towels.

Specifications and Forms of Tender may be obtained on application at the Town Clerk's Office, Westminster City Hall, Charing Cross-road, W.C., on and after Wednesday, the 5th February, 1913, between the hours of 10 a.m. and 4 p.m. (Saturdays 10 a.m. and 12 noon).

Each Tender, on the official Form supplied, is to be delivered at the City Hall, in a sealed cover, addressed to the Town Clerk, Westminster City Hall, Charing Cross-road, W.C., and marked with the name of the Tender. Tenders may be placed by or on behalf of tenderers in a locked box at the City Hall provided for the purpose. No Tender will be received after 9.30 a.m. on Thursday, the 20th February, 1913.

The Contractors will be bound by the Contract, in the case of all workmen employed by them, to pay wages at rates not less, and to observe hours of labour not greater, than the rates and hours recognised by the Associations of Employers and Employees and in practice obtained in the district where the work is to be executed.

Tenderers are prohibited from directly or indirectly canvassing Members or Officials of the Council in reference to any Tender, and the Tender of any person who does so canvass will be rejected.

The Council do not bind themselves to accept the lowest or any Tender.

JOHN HUNT,
Town Clerk.

Westminster City Hall,
Charing Cross-road,
London, W.C.
January 30, 1913.

WEXFORD COUNTY COUNCIL.

NOTICE TO BUILDERS AND CONTRACTORS.

DEEPS BRIDGE.

The Wexford County Council will, at a meeting to be held on February 26th inst., at 3 p.m., be prepared to consider Tenders for the Erection of a New Reinforced Concrete Bridge at The Deeps, on the River Slaney, County Wexford.

Copies of Specification, Quantities, and Form of Tender may be obtained from me gratis; copies of Plans and Drawings (six) may also be obtained on payment of £1 1s. (non-returnable)

The approved cost of the work, exclusive of the Bascule Opening Span, but including Engineering fees at 5 per cent, is £3,750, and Tenders must not exceed this amount.

Tenders must be sent to the Secretary, County Council, Courthouse, Wexford, and must reach him not later than the morning of February 26th, 1913.

The lowest or any Tender will not necessarily be accepted.

(By order of the Wexford County Council)
(Signed) W. F. BARRY, Assoc.M.Inst.C.E.,
County Surveyor.

County Surveyor's Office,
Courthouse, Wexford.
February 1, 1913.

EAST SUFFOLK COUNTY COUNCIL.

MAIN ROADS.

STEAM ROLLING.

The East Suffolk County Council invite Tenders for Steam Rolling during the financial year ending 31st March, 1914.

Specification and Form of Tender can be obtained on application from the Chief Surveyor, County Hall, Ipswich.

Sealed Tenders, addressed to me, and endorsed "Tender for Steam Rolling," must be delivered at the County Hall, Ipswich, on or before the 17th day of February, 1913.

The Council do not bind themselves to accept the lowest or any Tender.

A. TOWNSHEND COBBOLD,
Clerk of the County Council.

County Hall, Ipswich.
February 3, 1913.

BOROUGH OF SOUTHEND-ON-SEA.

GENERAL STORES.

The Corporation of Southend-on-Sea invite Tenders for the Supply of the following Articles for a period of one year from April 1, 1913:—

No. 1.—Stoneware Pipes, Bends, &c.
No. 2.—Flints, Bricks, Gravel, &c.
No. 3.—Timber.
No. 4.—Ironmongery.
No. 5.—Paints, Oils and Colours.
No. 7.—Cement, Lime and Chalk.
No. 8.—Team Labour.
No. 9.—Forage.
No. 10.—Tar-paving and Tar-macadam.
No. 11.—Iron Castings.
No. 12.—Granite Kerb and Channel.
No. 13.—Broken Guernsey Granite.
No. 14.—Broken Granite.
No. 15.—Pitch and Creosote Oil.
No. 16.—Harness Supplies and Sundries.
No. 17.—Brooms and Brushes.
No. 18.—Iron and Steel.
No. 19.—Disinfectants.

Forms of Tender may be obtained upon application to Mr. E. J. Elford, M.Inst.C.E., Borough Surveyor, Southend-on-Sea, on and after the 10th inst.

Tenders, endorsed "Yearly Contracts," to be delivered at my Office not later than nine o'clock a.m. on Wednesday, 26th inst.

The Corporation will not be bound to accept the lowest or any Tender.

By Order,
H. J. WORWOOD,
Town Clerk.

Town Clerk's Office,
Southend-on-Sea.
February 4, 1913.

The Surveyor

And Municipal and County Engineer.

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Minutes of Proceedings.

Royal Commission on Sewage Disposal: Eighth Report.

The discussion which took place at the Royal Sanitary Institute this week was extremely interesting in several respects. In the first place, a member of the Royal Commission was in the chair, and in his introductory remarks gave a *résumé* of the conclusions of the report, with some of the reasons for those conclusions. Secondly, two of the chemists who have been carrying out investigations for the Commissioners, and upon whose advice doubtless the recommendations were made, also contributed to the discussion. The essence of the subject before the meeting was expressed in a few words by Dr. McGowan when he said that the purpose of the standards and tests suggested in the report was not so much for the purpose of vindicating the quality of effluents as to show what effect they would have upon the water of the river or stream into which they were discharged. The result of the discussion as a whole appears to show that while the principle underlying these recommendations and the suggested methods of administering them commends itself to engineers who have to construct and manage the works required for the treatment of the sewage, exception is taken to them by some chemists. It is impossible to avoid the thought that those who criticised the report adversely have not studied it thoroughly or possibly have not understood it properly. Dr. McGowan thought that when the standards and tests suggested in the eighth report have been more carefully studied those who now criticise them will probably modify their views. From the remarks made by the chairman we gather that the appendices, when they are published, will provide much additional information which could not be embodied in the report. The opinions expressed by Mr. J. D. Watson, chief engineer to the Birmingham Tame and Rea District Drainage Board, represent, we believe, the views of the majority of engineers and surveyors. He welcomed the prospect opened up by the eighth report of effecting a saving of public funds, and he considered this report a great step forward in the question of sewage disposal, and that every one should feel indebted to the Royal Commission for the work carried out during the fourteen years of its existence. Dr. Gilbert Fowler, of Manchester, also thought that the two tests now recommended give the best measure of purity which could have been chosen. He pointed out that the aim and object of all sewage works is to maintain the river water in a satisfactory condition, and it is to this end that the standards and tests have been established. He admitted that the chief difficulty was that of administration, and made an interesting suggestion for dealing with this problem.

Much of the discussion—which will be reported in next week's issue—was of a highly technical character, and was of greater interest to chemists than to engineers, but some remarks made by Dr. Adeney will appeal with special force to all practical men. Incidentally we think that the value and extent of the work done by Dr. Adeney during the past twenty-five years is not so well known as it should be. He stated that not only is the dissolved oxygen test easy and accurate, but it discriminates between the harmful and harmless impurities, whereas the old albuminoid ammonia and permanganate tests actually emphasise the harmless impurities in a sewage effluent or river water. The same speaker also expressed his agreement with what Mr. Watson had said, and in view of the expression of opinion upon this report which appeared in our American contemporary *Engineering News*, and which was quoted by the chairman on the present occasion in his introductory remarks, we see no reason to alter the views we expressed in these columns (THE SURVEYOR, November 29th, 1912) when we reviewed the eighth report.

* * *

Rural By-laws.

The retarding effect of a rigid code of building by-laws on the erection of cottages in rural areas has long been recognised. It was, therefore, with complete approval that we noticed the issue in August last year of a circular by the Local Government Board pointing out to district councils the necessity of periodically revising the by-laws in force so as to keep them in conformity with up-to-date ideas and practice. Signs are not wanting that this circular is producing practical results For example, there will be found in another column of this issue some account of the points which have received attention in connection with a revision of the by-laws at Skegness. Again, the subject of building by-laws and regulations as affecting the housing of the working classes formed the subject of a paper by Mr. W. Woodward, F.R.I.B.A., at last Monday's meeting of the Surveyors' Institution. A cheerful suggestion of Mr. Woodward that the Local Government Board should be abolished so far as it concerns itself about build-

ings is perhaps rather a drastic remedy for any evils which may have been due to the Board's shortcomings in the past. It reminds us of the Chinese method—so delightfully described by "Elia"—of roasting a pig by the simple device of burning down a house in which it had been incarcerated. While we cannot accept Mr. Woodward's opinion as to the general incompetence of those officials who are at present responsible for the administration of by-laws, we are at one with him in a plea which he made for greater elasticity; and we further agree that the legitimate functions of by-laws must be confined to procuring "the safety, health, and well-being of the bodies of the inhabitants." Mr. Woodward's paper leads up to a practical suggestion, as follows:—

> In each town in England there are to be found architects and surveyors in practice; most of them are members of either the Royal Institution of British Architects or of the Surveyors' Institution; and I would set up in each town an office (it may be the office of the architect or surveyor) which should be open every day, at stated hours, for the examination of drawings and specifications for new dwellings for the working classes. It would not take an architect long to see that these drawings and specifications represented dwellings which for planning and construction were suitable and proper, and would secure healthy dwellings. To provide for the settlement of disputes a tribunal should be instituted in each town, before whom builders and architects should appear. The tribunal should consist of three men, one an architect, one a surveyor, and one a builder, each of good repute and of high standing, and the decision of this tribunal should be final and binding on all parties.

This suggestion is well worth consideration and discussion, although for our part we firmly believe that the necessity for the creation of new officials does not exist, inasmuch as the examination of plans would be quite safe in the hands of the surveyors to the local authorities—provided the latter were unhampered by unduly restrictive by-laws. The weakness of the scheme as outlined by Mr. Woodward appears to be that the public who are to be protected have no control over the proposed new official, who is apparently to be directly responsible to nobody but himself.

* * *

Modern Methods of Water Purification.

The paper which Dr. Thresh read at last Friday evening's meeting of the Institution of Municipal and County Engineers at Westminster contains a very valuable summary of modern methods of water purification, together with a considerable amount of information given by way of illustration. The opinions expressed by the author are also of considerable value; for instance, with regard to mechanical filters he emphatically states that a long experience justifies him in asserting that the mechanical filter alone cannot be depended upon to purify polluted water efficiently. A chemical in the form of a coagulant is required. This process is considered as being less costly than slow sand filtration, and possibly equally efficient, but where a higher degree of purification is required sterilisation is found to be necessary. The uses of chlorine for this purpose are dealt with at some length, and the author seems to lay undue stress upon the need for dechlorination. As we have pointed out on previous occasions, the objections which were first raised to the process on account of the taste and smell due to overdosing with chlorine are generally found to be non-existent in practice. Experience shows that a very small dose of chlorine is all that is required with a clear water, and one has only to refer to the many instances in America to prove that in most cases there is no need for dechlorination. Dr. Thresh points to the growing use of chlorine for water sterilisation in this country. He considers it certain that in time the English people will get over their prejudices and prefer the purified water to a water of doubtful quality; he believes that "within comparatively a few years all waters derived from sources liable to pollution—and very few people are really aware how common such sources are—will be treated with chlorine," or by one of the other sterilising processes.

Of the ozone process Dr. Thresh has very little to say that is good; he regards it as expensive, and does not think "that there is any possibility of its being adopted by any waterworks in this country." On the other hand, he appears to consider that there is a great future for the ultra-violet rays process, which he finds to be very efficient. Among a number of experiments, all of which gave excellent results, a quantity of sewage filtered through a jelly-bag was mixed with a tank of London tap-water, this water being sterilised satisfactorily. There were over 1,000 B. coli per cubic centimetre in the water, and after treatment the coli were absent from 400 cubic centimetres throughout. The comparative costs of sterilisation by the three processes are given as ·24 pence per 1,000 gallons with the ultra-violet rays, ·9 pence by the ozone process, and ·28 pence by the chlorine process. But until a plant has been installed in this country and has been submitted to a prolonged test the author does not think that any one would be justified in recommending the adoption of the ultra-violet rays. Thus the chlorine process holds the field at the present time.

* * *

Irish Tests of Road Metal.

As will be gathered from the article relating to tests carried out by Professor Alexander, which appears on another page, the profession of highway engineering is the richer for a useful contribution to knowledge, as the result of the recent work carried out at University College, Cork. Professor Alexander's observations are as worthy of attention as are his practical results, and his further work in this subject will no doubt be carefully followed by surveyors. As regards the machine which he uses for the attrition test, the six points of difference between this apparatus and that used by Mr. Lovegrove suggest that there is room for both types, and that information which is not divulged by one of them may be obtained by testing the stone in question with the other machine. In Professor Alexander's machine the dust and chips drop out of the barrel as fast as they are formed. This may be of advantage in making the difference between the two types greater than it would otherwise be; but it must be pointed out that dust and chips are usually present when attrition is going on under service conditions, though, it must be admitted, not always in a proportion so large as in the case of a rattler test. The relation between the results obtained from the attrition test and those found under service conditions does not necessarily depend upon the closeness with which the artificial test approaches the natural one. If the results are proportional they *are* proportional, as was found to be the case with stones tested with a "rattler" by Mr. Hector Gullan, in Belfast, and used for streets in that city. It is, of course, well known that some stones give results under the attrition test which are not borne out by their behaviour on the road, and it is by designing new forms of testing apparatus that engineers are most likely to be able to reduce the number of materials the nature of which cannot be tested in the laboratory. As regards Professor Alexander's references to limestones, it must be pointed out that the rattler test is notoriously untrustworthy as a guide to the value of these stones as materials for road crusts, or as a measure of their actual wear resistance in service. Equally dangerous is it to generalise in the matter from observations of the behaviour of a few kinds of limestone. Professor Alexander's remarks on the results of his experiments demand more careful consideration than can be given them at the moment, and we hope to be able to return to the subject of tests of road metal on a future occasion, and to compare his results with those of other investigators.

Urban Housing.

Among the many useful statistical tables which have been issued as a result of the Census of 1911, one of the most interesting in regard to housing conditions in the Metropolitan area is that which shows the percentage increase or decrease of population in each borough during the decennial period 1901-1911. This table shows that in all the inner districts of London there has been a marked decrease in the population, and that this has been accompanied by a corresponding increase in those districts which form an outer ring, known as "Greater London." At present this outward tendency shows few signs of abating, although it may fairly be predicted that if more efficient and comfortable housing accommodation were provided the inner districts would again attract the workers. The proper development of the inner ring was the theme of a paper on the subject of Urban Housing, read by Mr. Montague Price Holmes at a meeting of the Surveyors' Institution on Monday last. Mr. Holmes pointed out that in many of those inner districts the original building leases are now expiring, and that many large ground landlords will consequently be in a position to deal with considerable areas and carry out extensive improvements. Having regard to the general movement of population indicated by the Census returns quoted, it may well be asked what is the best method of re-development to be adopted? It may be taken as axiomatic that the separate cottage is in every way to be preferred to the tenement house or block dwelling for a respectable working-class family. Hitherto it has generally been assumed that the high value of land in central districts makes the erection of small houses impracticable from a business point of view. The present position, however, is that this inner belt of land, while not being absorbed for commercial or business purposes, is being deserted by its former residents. Its value, therefore, must very speedily depreciate, and Mr. Holmes's conclusion is that it may be good business, as well as in the interests of the working classes, to utilise this land for the erection of small houses suitable for occupation by working-class families. Mr. Holmes' paper was of a thoughtful character, and we are fully in accord with its main conclusions.

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An Interesting Presentation.

The presentation on Friday to the president of the Institution of Municipal and County Engineers (Mr. R. J. Thomas), on the occasion of his approaching marriage, was the happy culmination of a happy thought well conceived and well carried out. It was essentially a testimony to the regard and respect which is felt for the president, professionally and personally, by members of the Institution of all ranks—not least notably, the juniors. There is no doubt that if donations had been accepted from a wider field the gift available would have been of much greater intrinsic value, but no fault will be found with the principle of confining the appeal to the loyal body of which the president is such a distinguished chief. It was readily responded to by an overwhelming majority of the members, many of them stationed in most distant parts of the world, and was evidently accepted as a tribute which it is given to few to deserve—and to win. Perhaps we may be permitted on the occasion to say, on behalf of those who were not qualified to be included as donors towards the testimonial, that our good wishes go with it none the less wholeheartedly.

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Councillors as Individuals.

We have frequently taken occasion to point out that members of local authorities have no powers or privileges as individuals unless invested with particular duties or functions by special authority of council or committee. It is necessary that this should be clearly understood, as in practice there are many—still far too many—such members who, *qua* members, think they are entitled at all times and on all occasions to dictate to or interfere with paid servants of the council. Put briefly and bluntly, these members are pests and sources of mischief-making and annoyance. We raise the point again because it has been curiously brought to mind by the sad and direct result of such a misconception of privilege as has just happened at Molesey. Here a member of the Fire Brigade Committee took upon himself to test the efficiency of the brigade by calling them out on a false alarm. Unfortunately, one of the firemen who responded on the occasion caught a chill, which resulted in his death within a few days. We add no word of reproach to the councillor in question, who acted in what he conceived to be the public interest and in accordance with what he conceived to be his right as a member of the Fire Brigade Committee. He admits his error of judgment, and has expressed his contrition in practical form. But the moral remains, and we hope it will be taken to heart by councillors all over the country.

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The Orphan Fund.

Elsewhere we publish a brief note of the proceedings on Friday last of the committee of the Orphan Fund of the Institution of Municipal and County Engineers. It will be welcome news to the profession generally to learn that the finances of the fund make a somewhat better showing for last year than for the preceding year—in fact are satisfactory enough to enable the committee to make grants to the considerable amount of £155 towards the maintenance and schooling of orphans of deceased members. What a godsend this will be to widows left with a mere pittance it is not difficult to realise, and subscribers to the fund will surely feel rewarded for any sacrifice they have made when they picture the relief they are bringing to many a straightened home. We particularly welcome this item of news as somewhat of an innovation—to our mind a very wise and effective one. It is well that periods of twelve months should not pass without news of the activities of the fund, and it can do it nothing but good to let its supporters—and potential supporters—know at shorter intervals that the committee and Mr. O. Claude Robson, the ever-active hon. secretary and treasurer, are daily, so to speak, striving to make it a real and substantial help to the needy.

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The Road Board Trials of Road Surfacing Materials.

It must be very clearly understood that the interim nature of the report recently issued by the Road Board, and relating to trials of road materials, is fully recognised in all that has been written about it in our pages. The nature of the report was indicated in our issue of January 24th, the reports on the different sections at Sidcup were summarised in our issue of January 31st, and, owing to pressure on our space, we were obliged to defer to the following issue a review of these trials, with comments suggested by what seemed the most significant passages in the report. As regards the trials in the boroughs of Wandsworth and Fulham a summary and review will be found in the present issue. Since the importance which attaches to these trials is unquestioned, and since, we hope, our appreciation of the skill and care with which they have been conducted is evident from our own reviews and from the space which we have given to it, it is unnecessary to say more; the only consideration of general application which need be specially insisted upon being the distinction which must be drawn between the significance of trials such as those at Sidcup and the more definitely scientific series of tests carried out *as a series* in Fulham.

Tests of Road Metal.

By Prof. C. W. L. ALEXANDER, assoc.m.inst.c.e., University College, Cork.

In December, 1911, the writer communicated with a number of engineers and quarry owners with a view to obtaining samples of stone for submission to an impact and attrition test in the Olsen Rattler installed in University College, Cork. His request was readily responded to, and he is thus enabled to present the appended results, which may prove of some interest to those engaged in the making and maintenance of roads.

This form of test has generally been applied in comparatively small closed cylinders, such as that used by Mr. Lovegrove at Hornsey—a drum of 11 in. diameter, charged with 4 lb. of metal, and rotated for 8 000 revolutions in 400 minutes. The Deval machine has a cylinder about 20 cm. diameter and 34 cm. long, revolving round a diagonal of the rectangular section of the cylinder for 10,000 times at from 30 to 33 revolutions per minute. The charge is 5 kilogrammes.

The author's machine is one generally employed in the impact and attrition tests for paving bricks. It is a barrel, 20 in. long, 28 in. in diameter, whose cross-section is a fourteen-sided polygon, with ¼-in. slot between each of the staves forming the sides. The ends are solid, and the barrel revolves about a horizontal axis parallel to its length.

The charge is 100 lb. of metal, together with 100 standard cast-iron cubes, each weighing about 1 lb. If the charge should be less the number of these cubes is correspondingly reduced. The test lasts about 55 minutes, and the number of revolutions is 1,800.

The cylinder is enclosed in a large casing in the corner of the laboratory to deaden the noise and to shut in the dust. The space between the double walls is filled with peat, and a counter is attached to the wheel to record the exact number of revolutions.

When the 1,800 turns have been given, and after sufficient time to allow the dust to settle has elapsed, the door is opened and a tray is withdrawn from below the cylinder. This contains the debris that has passed through the ¼-in. slots. It is sieved on a riddle of ⅛-in. mesh, and hitherto the author has put this resultant through a 50 by 50 sieve, the emerging medium being a fine powder like cement. It seems sufficient, however, to classify the products of the test as—(*a*) "Metal"—that is, stone over ¼ in., the great bulk being simply rounded stones of about 2-in. diameter; (*b*) "chips," between ⅛ in. and ¼ in.; (*c*) "dust," matter below ⅛ in.

It will be seen that this test differs from Mr. Lovegrove's in several respects:—

(1) The amount of metal is twenty-five times as great.

(2) The angular speed is over 50 per cent greater, and the peripheral speed is over four times as great.

(3) The number of revolutions is ⅔ths of those at Hornsey.

(4) The dust and chips drop out of the barrel at once, instead of being retained and of assisting in the grinding action.

(5) The operation can only be conducted on the dry metal.

(6) The presence of the cast-iron cubes greatly increases the severity of the action, and is responsible for the impact effect, which is not given in the other machines.

The writer readily acknowledges the greater completeness of tests carried out both in the wet and in the dry conditions, and does not wish to offer any comparison of the advantages of the two ways. He thinks, however, that there is some merit in the larger volume of metal, the addition of the cubes of iron, and the greater speed.

The results appear to be in agreement with the general run of Mr. Lovegrove's, and the wear of the stone on the roads seems to follow these results quite closely, as Mr. Hector F. Gullan has already pointed out in connection with his valuable work at Belfast. Those wishing to compare the wear of stones in the wet and the dry conditions are referred to Mr. Lovegrove's statistics. These show the behaviour of stones of different composition, some being more affected by the presence of water than others; but, speaking broadly, the figures given by the dry test are a very fair guide to the probable wearing power of the stone on a water-bound road crust. It is necessary to point out that if the foundation of a road is bad, or its contour and drainage imperfect, the best metal in the world will not make a good, lasting surface. The author has, in several cases, found that the muddy and cupped condition of roads recently resurfaced was ascribed to the inferior quality of the metal when the trouble was really due to the absence of a proper foundation, and to the low situation of the road.

The following is a summary of the samples of metal tested:—

In the tabular results given below,

Column 1 refers to numbers in the College record book;
Column 2 gives the weight in pounds of the metal tested;
Column 3 gives the percentage that exceeded ¼ in. size (after test);
Column 4 gives the percentage under ¼ in. and over ⅛ in., called "chips";
Column 5 gives the percentage under ⅛ in., and called "dust";
Column 6 is the quotient of the figures in Column 3 by those in Column 4 multiplied by 100;
Column 7 is the quotient of Column 3 by Column 5 multiplied by 100;
Columns 8 and 9 give the name of stone and locality;
Column 6 has been headed "impact," and Column 7 "attrition," because the figures in these are some indication of the relative value of the metal for resisting blows and rubbing respectively.

Limestones.

1 No.	2 Amt.	3 Metal.	4 Chips.	5 Dust.	6 Impact Value.	7 Attrition Value.	8 Rock.	9 Locality.
80	100	65	16	19	405	325	Limestone	County Cork
42	100	66	8·5	25·5	780	260	,,	,,
79	100	66	12·55	21·45	525	310	,,	,,
84	100	66	12·44	21·56	530	305	,,	,,
41	100	68	12	20	565	340	,,	,,
78	100	68	12 7	19 3	535	355	,,	,,
85	100	71	9·37	19·63	760	365	,,	,,
40	90	71	16·5	12·5	430	570	,,	,,
63	100	72	7 5	20·5	965	350	,,	,,
65	13	81	5·75	13·25	1,405	610	,,	County Kilkenny

Sandstones.

1	2	3	4	5	6	7	8	9
62	100	76	10 80	13·20	705	575	Sandstone	County Cork
48	100	79	7·75	13·25	1,020	595	,,	,,
83	100	81	4·7	14·3	1,730	545	,,	,,
81	100	82	5	13	1,640	630	,,	,,
57	87	83	3·25	13·75	2,550	605	,,	,,
82	95	84	8·86	7·15	950	1,180	,,	,,
47	100	85·5	7·4	7·1	1,155	1,205	,,	,,
49	100	86·5	7·5	6	1,165	1,445	,,	,,
44	100	89	6·25	4·75	1,439	1,880	,,	,,

Granite and Syenite and Gneiss.

1	2	3	4	5	6	7	8	9
68	84	77·4	11	11 6	705	665	Granite (pink)	Mayo
72	57½	79	8·9	12·1	890	655	,, (pink)	Mayo
70	45	81·1	6·5	12·4	1,250	655	,, (white)	—
69	100	82	6 2	11·8	1,320	695	Gabbro	Louth
43	100	85	6	9	1,420	945	Vogesite	Donegal
50	100	85·5	6·25	8·25	1,370	1,040	Gneiss	Leitrim
71	46	85·8	6 3	7·9	1,370	1,090	Granite (white)	—
67	88	86	5	9	1,720	955	,, ,,	Galway
61	100	86·5	5·25	8 25	1,650	1,050	Granite	Mountsorrel
58	58	87·25	1·75	11	5,000	790	Diorite	Wicklow
60	79	87·34	5·30	7·36	1,650	1,190	Diabase	Penmaenmawr
64	100	87·5	6 2	6·3	1,405	1,390	"Whinstone"	Antrim
52	100	88	5	7	1,760	1,260	Basalt	Titterston
51	100	88·5	5·50	6	1,610	1,480	Basalt	Rowley Regis
46	100	89·5	3·6	6·9	2,480	1,300	Syenite	Mountsorrel
59	75	90·75	5	4 25	1,815	2,140	Diabase	Penmaenmawr
73	100	92	2·5	5·5	3,680	1,680	Gabbro	Louth
66	100	94·5	2	3·5	4,725	2,700	Diorite	Donegal

Those tests in which the weight of stone is under 100 lb. are probably more favourable to the samples, and No. 65, with 13 lb., is obviously made to rank too high. It should be disregarded.

In estimating the value of a stone, the author thinks that the percentage of "metal" over ¼ in. surviving the test should first be studied. Next in importance to this is the "attrition value," and, finally, it may be helpful to take the "impact value" into account when comparing with other results.

The percentage of "metal" is not decisive in itself. For example, consider Nos. 61, 58 and 60. The amount of metal is nearly the same in the three, but the Wicklow stone gives 33 per cent more dust than the Mountsorrel, and 50 per cent more than the Penmaenmawr. Of course, its resistance to impact is very high, and apart from the increased cost of preparing it, this is undoubtedly a favourable feature. Again, the "impact value" is misleading by itself, for the limestone No. 42, while actually showing less chips

than granite No. 72, has over double the volume of dust.

The author, in dividing the weight of chips and of dust by that of the metal, secures a pair of figures which gives some indication of the resisting power of the material to impact and attrition.

In a rough way the following table shows the values which should be attained by stones if divided, according to their probable wearing qualities, into three classes:—

MINIMUM VALUES (RATTLER TEST).

	Metal percentage.	Impact value	Attrition value.
First class stone ..	85	1,200	800
Second class stone .	80	900	600
Third class stone ..	75	700	500

Any metal falling under 75 per cent of metal is unsuitable for a good road, as it goes to form mud and dust, and cracks under traffic.

Judged by this standard the limestones all fail, and no one familiar with the stone in use over a large part of County Cork will quarrel with this verdict. Very often a limestone is very hard to break and seemingly a tough stone, but the attrition value is never satisfactory. The difficulty of breaking is not much guide as to the wearing quality.

The sandstones are better in every respect, particularly the fine-grained varieties.

In the third table will be found the harder stones. The first two granites were weak owing to the decay of the felspar.

No. 69 and No. 73 were from the same quarry, but the latter was composed of very much finer crystals, and the denser, more compact structure gave a far higher wearing power.

No. 43 is a dark stone, easily broken to cubes of 2-in. size, but hard to smash up smaller. It is a good road metal.

No. 50 is the only gneiss, and it comes out well.

Nos. 61 and 46 are samples from two of the well-known Mountsorrel quarries. Both are, of course, excellent stones, but the syenite is tougher.

The Wicklow diorite gives the smallest amount of chips of all the stones, and although its attrition value is not high, it is the sort of stone that would be likely to make a good sett, not wearing on the arises, while maintaining a non-slippery surface.

The remaining stones call for little comment, as they are all of very high quality. The author is under an obligation to the proprietors of the various quarries for being thus able to compare some Irish stones with those of recognised quality. The Donegal diorite, as used in Derry, comes out the best of the series, but when a sample shows a percentage of metal in the neighbourhood of 90, one would be unwise to attach too much importance to the exact figures, or to decide, by one such laboratory test, the absolute value as road metal.

It is hoped that the above results may prove both interesting and helpful. Without careful observation of the behaviour under known traffic conditions, such as Mr. Gullan has made in Belfast, it is impossible to translate these laboratory figures into others giving the life of a road crust; but one will be making little error in assuming that the life will be proportional to the attrition value, and the cleansing costs inversely as the same figures.

The writer might state that samples No. 78, 79, 80, 81, 82, 83 were submitted to him by a county surveyor together. If the figures for these tests are compared, the qualities of the stones will be seen at once. The owner of one or more of the first three samples, being dissatisfied with the results, supplied samples No. 84 and 85. The figures for these differed but little from the previous tests.

When one considers how much metal is used in water-bound roads in Ireland, and thinks what depends upon the quality of the metal, he will see the value of tests like these.

London County Hall.—At a recent meeting of the London County Council the chairman of the Establishment Committee was asked whether it was not a fact that the estimates for 1912-13 provided for expenditure of £157,850 on the construction of the new county hall, and that only £38,427 was actually spent up to December 31st last; and whether the building would be completed by 1920. The chairman of the committee, in reply, said he saw no reason why the dates of completion given last July should not be adhered to —namely, Section A, April, 1916; Section B, March, 1916; Section C, June, 1915.

TRAMWAY TRACKS AND MARGINS.

DO LOCAL COUNCILS BENEFIT?

It will be remembered that in our issue of the 17th ult. (p. 111) we reproduced a statement of Mr. Wm. Oxtoby, the borough engineer of Camberwell, that no saving results to the local council from part of the cost of maintaining the roads being borne by the London County Council in respect of their tramway tracks and margins. Other metropolitan borough engineers have, at our request, favoured us with their experience in the matter, the communications we have received up to the time of going to press being as follow:—

Mr. WM. NISBET BLAIR (St. Pancras).—It is common knowledge that the sides of a road cost a great deal more for maintenance where tramways exist in the centre than in a road without tramways, but it is problematical whether or not it is greater than the upkeep of a tramway area would be to a local authority without tramways on it in a road. My strong impression is that the increased cost for sides of roads is greater than the probable cost of maintaining the centre.

Mr. J. RUSH DIXON (Woolwich).—I concur in the opinion expressed by the borough engineer of Camberwell, that the existence of a tramway and margins results in no saving of the cost of scavenging and maintaining the road generally, and more especially when it runs through a macadam road.

Mr. H. C. J. EDWARDS (Lambeth).—I am of the same opinion as Mr. Oxtoby—viz., that no saving to the local council results from part of the cost of maintenance of the roads being borne by the London County Council in respect of the tramway tracks and margins, as all the traffic is diverted from the centre of the road, where the tram tracks are, to the breasts of the road, instead of being distributed over its whole width, and thus the paving of the breasts wears out more quickly than it otherwise would do.

Mr. P. G. KILLICK (Finsbury).—Have reported on many occasions to my Works Committee that, in my opinion, there is no saving in maintenance of roadway to borough councils where tram lines are laid, owing, principally, to concentration of traffic on breasts of road instead of being distributed.

Mr. WILLIAM F. LOVEDAY (Stoke Newington).—I have, in reply to a circular letter addressed to the borough councils by the London County Council on this subject, reported to my committee in almost identical terms to those of Mr. Oxtoby. From experience, it has been proved that the wear is very much greater upon the breasts of the road where there are electric tramways, in consequence of the general traffic being compelled to use the breasts. In one instance this was the case to such an extent that I had to renew the channels annually after the electric trams had been installed as compared with the horse trams.

Mr. E. B. B. NEWTON (Paddington).—My experience goes to show that if there is any saving, which is doubtful, it can be but trifling.

Mr. J. SUTCLIFFE (Deptford).—I regret I am not in a position, from my experience, to give you a direct answer to your inquiry. I have known cases of individual roads of which, were Mr. Oxtoby's statement directed to them, it would be perfectly true, but I cannot say that this is universally the case.

Mr. FRANCIS WOOD (Fulham).—I agree that there is no saving in the cost of maintenance of roads by reason of tramway tracks being maintained by the tramway authority. I have made an exhaustive report on this matter, which has been communicated to the London County Council.

Public Health Law.—This concise little work* has been prepared mainly for the use of all concerned in local government work who may find the larger books too elaborate. In twenty chapters it covers the ground sufficiently for its purpose, including such matters as highways, but omitting rating, elections, &c. For students it should be of assistance in preparing for examinations in Public Health Law, while the practitioner will find its arrangements well suited for easy reference.—*The Law Times.*

*A Manual for Municipal and County Engineers and Surveyors, Town Clerks, Clerks to District Councils, and other officers and members of local authorities. By S. G. Turner, of the Middle Temple, Barrister-at-Law, A.M.I.C.E., &c. London: St. Bride's Press, Ltd. Price 10s. 6d.

Tyre Widths and Wheel Loads.

By ARTHUR E. COLLINS, M.Inst.C.E., City Engineer of Norwich.

[The short paper which follows was submitted at the Eastern District Meeting of the Institution of Municipal and County Engineers which took place on Friday evening last at Westminster, Mr. R. J. Thomas, the president, in the chair.]

As a representative of our institution to the Joint Commission appointed to inquire into the matter of loads on highway bridges, I found the commission were very quickly faced with the question of loads on wheels, a subject I have been interested in since before I entered municipal engineering. In my opinion there is no reasonable basis of practice or legislation in this country for regulating these loads. I do not propose to take up your time by detailing the very unsatisfactory and unscientific enactments that exist, but to suggest what appears to me to be a reasonable basis on which to found legislation.

As a result of ordinary observation, I think all of us can agree that an ordinary cart wheel of 4-in. tyre width by 5 ft. diameter, and loaded to 28 cwt.—*i.e.*, 7 cwt. per inch width of tread—does not cause unreasonable wear or damage to any ordinary road in average condition. Even such a wheel must rest on something more than a mere line, and to do so both the tyre and the road surface must yield until sufficient surfaces are in contact to carry the load.

While under any particular conditions it is difficult to get the exact area of contact, from general observations I think it reasonable to assume that, under the conditions I have named, this may be taken at 4 sq. in.—*i.e.*, width of tyre × 1 in.

The yield of an ordinary tyre is inappreciable; consequently the road surface must do the yielding; this, with the conditions and assumptions detailed, amounts to ·0042 in., that being the versed sine of a 1-in. chord of an arc of 30 in. (the wheel radius). For the purpose of my argument I will assume that this depression of the road surface of ·0042 of an inch is the proper amount to allow for, in which case the allowable weight per inch width of wheel for each diameter is easily ascertained, and I have set it out in diagram form herewith.

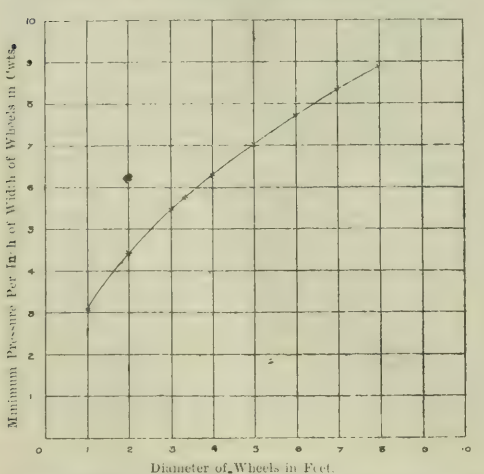


Diagram Showing Allowable Loads on Different Size Wheels per Inch Width of Tread.

By reason of the transverse contours of roads not being straight, it is useless indefinitely to widen road wheels to reduce intensity of pressure. In general practice I do not think anything beyond a wheel width of 14 in. is of value.

I am not insisting on the weight of 7 cwt. per inch width of tyre for a wheel 5 ft. diameter. The weight and dimensions are convenient ones to illustrate my contention. It requires much consideration to settle the actual basis, but, this being done, the proportioning of weight to width and diameter becomes a simple matter of arithmetic, resting upon a reasonable basis. It is unreasonable to expect average roads to carry such weights as are imposed by heavy steam wagons with the wheels of small diameter common to them. I do not find much fault with ordinary traction engines, as they have wheels of large diameter.

I do not seek to limit the proper uses of highways, but I earnestly desire to compel makers and users of heavy motor vehicles so to arrange their wheels and distribute their weights as to limit the load on any wheel to not exceed 5 tons, the wheels to conform to regulations such as I have sketched out as to widths, diameters, and weights carried. If this memorandum causes thought and helps toward legislation upon a reasonable basis I shall be satisfied. The distribution of the wheels of vehicles is more a bridge than a road surface matter, but it requires to be dealt with.

The President (Mr. R. J. Thomas) said the question raised by Mr. Collins appealed very strongly to him. He had been for some time agitating for an alteration in the unit of weight allowed under the Heavy Motor Car Order of 1904, for if anyone compared that unit with the one referring to road locomotives they would find that a larger proportion of weight was permitted in the case of the former vehicles. Although traction engines were specially obnoxious by reason of the projecting cross bars on their wheels, that evil was more than counterbalanced by the small diameter wheels of the heavy motor cars. Although in the Heavy Motor Car Order it was assumed that only two-thirds of the weight of the vehicle was on the back axle, cars were now being built so that when they were fully loaded three-quarters of the weight was on the back axle. It was a point on which he considered they ought to press very strongly for amendment.

Mr. W. Nisbet Blair (St. Pancras) stated that on one particular line of road in his borough the ordinary 3-in. by 6-in. granite setts had been split by a steam lorry carrying coal to the electricity works. For twenty years that road had been a good granite paved street, with a good 6-in. concrete foundation. The first evidence of destruction which they had was the obvious loss of shape of the road, due to the breaking up of the foundation; they had renewed the surface from time to time, and they had been able to show without the least doubt that the damage was due to the passing of that one vehicle. The worst of it was that the lorry was carrying coal to their own electricity station. The damage he had mentioned was not limited to one class of sett, all classes of granite being treated alike, and the splitting always took place through the middle of the sett—the last direction in which one would expect it to go. It had been argued that the damage occurred by reason of the absolutely rigid bed on which the setts were laid, but they had found that setts simply bedded on ballast without cement had also broken. If such destruction were to continue on any extensive scale it was going to be serious for their roads.

Mr. F. J. Wood (East Sussex) alluded to the difficulty of heavy motor traffic on the main Brighton road. The outlay of the county council had been enormous, and the whole of the expenditure came out of the county rates, as they received no income from the vehicles that used the road or from any authority, except, perhaps, some consideration from the Road Board in cases where they made improvements of foundations. What he had said applied to other roads. His view was that it was a hardship that an agricultural county like theirs should have to bear the whole cost of road maintenance, and he thought the time had come when such counties should have a considerable grant from the Imperial Exchequer in order to lessen their burdens.

Mr. W. Harbur (Cardiff) asked whether Mr. Blair had found that wood-paved roads suffered in the same way as the sett pavements.

Mr. Nisbet Blair, in reply, said the blocks did not split, but the concrete foundation was seriously broken up.

On the proposal of the President a vote of thanks was accorded to Mr. Collins for initiating the discussion.

Mr. Collins said he hoped the extent of the dis-

cussion did not mean that consideration was not going to be given to the question he had introduced, and he thought it would be a good thing if the meeting decided to ask the council of the institution to bring the matter officially before the Road Board, and, perhaps, before the forthcoming International Road Congress. Whether the foundations of a road were rigid or not, the setts were destroyed just the same, and whatever the nature of the paving, it was only a question of time as to when it would be destroyed.

The PRESIDENT assured Mr. Collins that the question had already been before the Roads Committee of the institution, and that representations had been made to the Local Government Board, who were responsible for the Heavy Motor Car Order, and he had no doubt that the subject would not be lost sight of. The County Councils Association had also been communicated with.

THE LONDON TRAFFIC PROBLEM.

THE 'BUS *v.* TRAM CONTROVERSY.

"The 'Bus *v.* Tram Controversy and other Aspects of the London Traffic Problem" was the title of a paper read by Mr. Wm. Yorath Lewis, A.M.I.MECH.E., A.M.I.E.E., M.AM.SOC.MECH.E., at a meeting of the Society of Engineers last week.

The author, in his introductory remarks, said it was his aim to endeavour to awaken Londoners to the seriousness of the present situation. The importance of the London traffic problem was hardly appreciated by those whom it most concerned, nor was it realised to what an extent the cost of living and other matters affecting the whole community were dependent upon transport. It was astonishing to learn, for instance, that the very large proportion of the 7,000,000 people in London who habitually used surface facilities would each spend on 'bus and tram fares an average of at least 20s. this year; while each would pass fully four 8-hour days in travelling less than 300 miles on these vehicles, to say nothing of three 8-hour days that he would spend in waiting for vehicles and an equal time in watching for opportunities to cross the congested streets. They would probably make 1,500 million journeys this year, at a cost of £7,000,000, and yet there was no sign of concerted action except on the part of those who were financially concerned.

For this reason especially it was the author's opinion that the traffic facilities should be controlled by Government. The Press might do much to safeguard public interests, but it did not seem to realise that the object of the traffic trust formed on the American model was to place the London County Council in such a position that it would have no other remedy than to buy them out at an enhanced valuation. The traffic problem should, if possible, be lifted out of the arena of party politics, for cheap and effectively rapid transit was the life blood of trade and the breath of individual prosperity.

Mr. Yorath Lewis advocates the co-operation of Londoners for their own protection by means of a "London Transport Association," whose income might easily be £50,000 a year at a very low subscription per traveller. It should be founded on a universal representation. The author contended that the Londoner should awake to the fact that this matter had an important bearing upon his personal welfare, and should bestir himself to gain some impartial evidence on the subject. The formation of a "London Transport Association" was suggested, for the purpose of studying the problems, educating the public, and using all possible means to secure cheap and effectively rapid transport. In this way the Press would receive valuable aid in putting before the public the best suggestions for the solution of London's many and differing transport problems—passenger and freight. At present the London County Council was baulked in every direction, and its tramway undertaking was excluded from the lucrative short-journey traffic which would be ensured by inter-connections through the central area.

Mr. Yorath Lewis then set out to investigate whether motor omnibuses adequately filled the needs of the central area and the connections with the immediate surroundings. He concluded that if they did so, which was not by any means the case, it was only at enormous cost to the traveller using them, although they "operated under conditions of unmatched freedom," conditions which could not be justified. The "door-to-door" speed possible with 'buses within the central area was on the average only 4 miles an hour. The average amount paid per passenger-mile ridden was at least 1d., and of every penny taken 58 per cent was clear profit. In comparison with this, they found that on the Glasgow tramways the amount paid per ridden mile was under a halfpenny, while on the London County Council tramways the amount paid per ridden mile was as low as ¾d. The huge profit made by 'buses in the central area enabled the omnibus company to make big average profits, even if the suburban traffic was run at such rates as left in some cases little, if any, margin.

The analytical statements and facts founded on them given in the paper bore out the assertion that Londoners were being exorbitantly charged for the services rendered by the motor 'buses, and that the time "is ripe for them to take such action as will ensure reform." In the outskirts the trams served the public at least 36 per cent less than the omnibuses, and the public consequently rode 55 per cent further on the former than on the latter. Mr. Yorath Lewis concluded very naturally that his own system the Adkins-Lewis System of Continuous Transport was superior to motor omnibuses and tramways for the central area, and that there could be no doubt any form of continuous travelling would be much more effective than intermittent service. There was abundant evidence as to the safety of the system and its feasibility for public service, and if such a one could be established it would solve the problem of short haulage traffic across and within the central area of London.

ATMOSPHERIC POLLUTION.

STANDARD SOOT AND DUST MEASUREMENT APPARATUS.

At the conference of delegates of local authorities and learned societies convened by the Coal Smoke Abatement Society in connection with the International Smoke Abatement Exhibition in March last attention was drawn to the desirability of steps being taken to decide upon and secure the general adoption of a standard method for the measurement of atmospheric pollution by smoke and other products of combustion and dust. A committee was appointed "to draw up details of a standard soot and dust measurement apparatus and methods of its use." The committee is presided over by Dr. W. H. Shaw, D.SC., LL.D., F.R.S. (director Meteorological Office), and its other members include Dr. John Owens, M.D., ASSOC.M.INST.C.E., Dr. R. Lessing, PH.D., F.C.S., and Mr. F. G. Clark (representing the Coal Smoke Abatement Society), and Mr. J. B. C. Kershaw, F.I.C. (Hamburg Smoke Abatement Society).

The method of investigation which, after full inquiry, has now been adopted by the committee as most likely to give satisfactory results is that used in the inquiry, conducted in 1911-12 under the auspices of the *Lancet*, with the object of ascertaining the degree of pollution of the atmosphere in and around the Metropolis. The standard apparatus recommended takes the form of an enlarged rain gauge having a catchment area of 4 sq. ft., which receives all rain, soot and other matters falling thereon, and deposits them in a large bottle, the contents of which can be regularly analysed.

The committee's report and recommendation have recently been submitted to all important cities in the United Kingdom, with the result that Birmingham, Bradford, Glasgow, Leicester, Malvern and Newcastle-on-Tyne have already agreed to set up the standard apparatus in accordance with the committee's advice, and a large number of other towns are favourably considering the proposal.

Dr. John Owens, 47 Victoria-street, Westminster, is acting as hon. secretary to the committee.

Business Announcement.—Messrs. Herbert Morris, Limited, Empress Works, Loughborough, have now opened their new office in Birmingham. This office is under the management of their representative, Mr. E. H. S. Taylor, and is situate in Norwich Union Chambers, Birmingham. (Telephone: 3683 Central; Telegrams: "Comorris, Birmingham.") Messrs. Morris have found it absolutely necessary to open this office on account of the rapid increase of their business in the Midlands, and it has followed quickly on the opening of similar offices in Glasgow and Leeds.

Road Board Trials in Wandsworth and Fulham.

ENGINEERING ADVISORY COMMITTEE'S INTERIM REPORT.

Our first notice of this report on the trial lengths of different kinds of road crust, or upper courses, put down for test under service conditions at Sidcup and in two London Boroughs, appeared in the issue of January 24th, page 137, and included some notes on the traffic carried by the roads selected for these trials. Summaries of the reports on the individual lengths at Sidcup will be found on page 250 of January 31st, and a review of results as far as they can be seen at present will be found on page 281, February 7th.

The present article relates to the trials in Wandsworth and Fulham.

THE TRIALS IN WANDSWORTH BOROUGH.

In this borough bituminous binders were used for all five sections, one crust being pitch-grouted and the other four prepared by the mixing or coating method, two with slag and two with Guernsey granite. The date in each case is that on which the crust was finished.

Section 1.

(August 9th, Tar Slag Macadam, by Messrs. Constable, Hart & Co., Limited.)

The coated slag was spread in two layers, the first graded from 2½ in. down to 1½ in., and the second graded from 1½ in. down to ¼ in.; laid cold. Total thickness, 4 in. The surface was dressed with tar, slag dust, and fine chippings in September, 1911, and in July, 1912. The condition was good in summer and in winter. It was "slightly slippery" during November, 1912, when grit was used occasionally. The average wear in twelve months was 0·35 in. In June and in November, 1912, the condition of the surface was "good; wear uniform."

Section 2.

(September 21, 1911, "Tarmac," by Tarmac, Limited.)

The coated slag was spread in three layers—the first graded 2½ in. to 1½ in., the second 1½ in. to ½ in., and the third ⅜ in. chippings finished with slag dust. The material was laid cold, having been coated fourteen days before use. Total thickness, 4 in. The surface was "slightly slippery" in November, 1912, and grit was used occasionally. The condition in summer was good. In June and in November, 1912, the condition was "good; wear uniform." The surface was dressed with tar and slag dust in July, 1912. The wear in twelve months was 0·57 in. Under "General Remarks" this section is described as "very good," except for an accidentally caused depression.

Section 3.

(September 20, 1911, Bituminous Macadam, by Taroads Syndicate, Limited, Road Board Specification.)

The stone used was Guernsey granite, "spread in two layers," the first graded from 2½ in. to ½ in., the second being a topping of ⅜-in. stuff. (Really one layer, with a blinding of ⅜-in. chippings.) The surface was finished with fine chippings, and the total thickness was 3 in. It was dressed with tar in July, 1912. In winter the condition was "good, and presents a good foothold," the same remark applying to the condition in June and in November, 1912, while in summer it was "very good." The section is described as "very good," and as showing little signs of wear. The measurement of wear is not given.

Section 4.

(September 6, 1911, Bituminous Macadam, by Taroads Syndicate, Limited, Road Board Specification.)

This crust, 3 in. thick, was similar to that of Section 3 but was laid hot. It was dressed with tar in June, 1912, and in the autumn of 1912 a small area was dressed with tar and granite dust. It was patched on seven occasions in the first twelve months, the area repaired being 95 sq. yds. out of a total area of 1,357 sq. yds. In summer the condition was "fair," and in winter there were no complaints of slipperiness. The note for both June and November, 1912, is "fair and presents good foothold." This section was not as good as No. 3, and overheating is suggested as possibly the cause. The wear in twelve months was 0·46 in.

Section 5.

(August 5, 1911, "Pitchmac," by Taroads Syndicate, Limited, Brodie's System.)

The stone was Guernsey granite spread in three layers, each grouted separately—the first 2½ in., the second 1½ in., and the third ⅜ in. The grout was hot "Pitchmac" and sand, and the surface was finished with ⅜-in. uncoated chippings. Some small patching work was done in the first twelve months, and in the autumn of 1912. The wear in twelve months was 0·08 in. The condition in summer and in winter is described as "fair." During the frost of last winter, 1911-1912, the pitch became brittle, the studded tyres of motor cars cut or rasped away the top dressing of pitch and chippings, and the surface became uneven. Under the action of further wear the surface improved.

The Widths of the Sections.

It should be pointed out that the average width of the road—Kingston-road, alongside Richmond Park—was 26 ft. 7 in. on Section No. 1; 31 ft. 6 in. on Section No. 2; 32 ft. 2 in. on Section No. 3; 28 ft. 10 in. on Section No. 4, and 33 ft. 5 in. on No. 5. The conditions vary somewhat as regards favourable or unfavourable effects of local conditions upon the different sections of the road.

THE TRIALS IN FULHAM BOROUGH.

An important feature of these trials is the use of bituminous materials other than tar for the binders.

In two cases Trinidad Lake bitumen was used as a binder, and in a considerable number of sections the binder was a mixture of bitumen and tar or materials derived from tar.

Section 1A is in Stephendale-road, 1B in Brill-street, 1 to 5 and No. 12 in Bagley's-lane, 6 to 8 in Harwood-terrace, 9, 10 and 11 in Sands End-lane. All the sections were put down by the Fulham Borough Council (Mr. Francis Wood, M.Inst.C.E., borough engineer).

Sections 1, 1A and 1B.

(October 31, 1911.)

The crust was made with 60 per cent of granite and 40 per cent of Trinidad Lake bitumen, consolidated to 3 in. in the centre, and 2½ in. at the sides. There were no repairs up to November 30, 1912. In June and in November, 1912, the condition was "very good." During the summer it was good and not slippery, and during the winter good, and "not unduly slippery." The wear in twelve months was 0·05 in. This section, the first cost of which was 4s. 1d. per square yard, was considered as the standard with which other lengths were to be compared.

Section 2.

(September 29, 1911.)

Similar to No. 1, but with slag instead of granite. The first cost was 5s. 1d. per square yard. It proved as good as Section 1. The wear in twelve months was 0·22 in.

Section 3.

(September 26, 1911.)

Similar to Sections 1 and 2, but made with 60 per cent clinker and 40 per cent of "bituminous matrix." The first cost was 3s. 9d. per square yard. The results were as good as in the case of No. 1, except that small patches of material were slightly crushed during the winter, and the life may be shorter.

Section 4.

(September 27, 1911.)

A crust similar to those of the preceding sections, but with 60 per cent of gritstone and 40 per cent bituminous mixture. First cost per square yard, 5s. 9d. There were no repairs during the first twelve months. The condition during summer and winter, and in June, 1912, is described, in each case, as "good." In November, 1912, the condition was good, but there were indications of crushing of the exposed upper surfaces of stones, the cause of this being, it is suggested, overheating of the gritstone. The average wear, as measured, was just over 0·09 in., but it is not considered that the rate of wear can be judged at present.

Section 5.

(September 28, 1911.)

The thickness of the crust and the proportions of stone and binder were the same as in the preceding sections; but the stone was Kentish ragstone and

the matrix was four parts bitumen and one part "tar compo." First cost, 3s. 11d. per square yard. There were no repairs in the first twelve months, and the only repairs done in the autumn of 1912 were at a corner where traffic concentrates. The condition during winter and summer was "satisfactory," and in June and November, 1912, was "good." The wear in the first six months (not twelve months) was 0·125 in. The considerable amount of apparent wear is thought to be due to overheating of the carbonate of lime of the ragstone.

Section 6.

(October 5, 1911.)

Similar to Section 5. No repairs up to the end of November, 1912. The condition during summer and winter, and in June and November, 1912, is in each case described as "good." The wear in twelve months was 0·10 in. There are indications of some crushing of exposed stones near the centre line.

Section 7.

(October 3, 1911.)

The same thickness as the preceding sections, but the stone was "granite" and the matrix in this case was 3 parts of bitumen to 2 of "tar compo." First cost per square yard, 4s. 6d. No repairs were done up to the end of November, 1912. The condition of the surface during the winter and summer is described as "good," and it is noted that there were "No remarks observable owing to the use of tar" during summer. This statement is probably made because this section is in a somewhat narrow street, with continuous buildings on both sides, fairly close to the carriageway. The surface in June and in November, 1912, was "very good." The twelve months' wear was less than 0·07 in. "Here and there patches show signs of disintegration of the wearing surface."

Section 8.

(October 3, 1911.)

The same thickness as the preceding sections. The stone was "granite," 60 per cent, with 40 per cent matrix, the latter being 7 parts bitumen and 3 parts tar compo. As no repairs were needed up to the end of November, 1912, the statement, as printed, that this crust was put down in 1811 is clearly too good to be true. The condition during winter and summer, and in June and November, 1912, was "very good." The wear in twelve months was a little under 0·09 in. The surface shows a tendency to waviness, and there are signs of disintegration of the wearing surface.

Section 9.

(October 12, 1911.)

This section is quite different from any of the preceding, consisting of an old macadam foundation (3 in. to 2½ in.), with a surface made of bituminous "matrix" (bitumen only used), consolidated to 1 in. No repairs were done up to the end of November, 1912. The condition in June and in November, 1912, was "good." During winter it was "good, although scaling," in summer, "good, no scaling." The twelve months' wear was 0·21 in. Lamination, thought to be due to the use of too heavy a roller, took place wherever the traffic was most concentrated. In spite of this section having lost nearly all its wearing surface, the condition of the road is still "good."

Section 10.

(October 12, 1911.)

This crust consisted of an old tar-macadam foundation (2½ in. to 3 in.), surfaced with a "matrix" made of bitumen and tar. The surface was brushed with dry cement. There were no repairs. The condition of the surface was "good" in June and November, 1912. During summer it was "good, no scaling." The wear was 0·30 in. The last two sentences under "Section 9" apply also to this section.

Section 11.

(October 5, 1911.)

This section is similar to "Section 7," except that granite was used instead of Kentish ragstone. The proportion, as in that case, was 60 per cent stone and 40 per cent binder, or matrix, the latter being 4 parts bitumen and 1 part tar compo. Thickness, 3 in. in the middle and 2½ in. on the sides. Up to the end of November, 1912, there were no repairs. The condition during winter and summer was "good," and in June and November, 1912, "very good." "Here and there patches show signs of disintegration of the wearing surface." The wear in twelve months was a little over 0·06 in.—about the same as Section 7.

Section 12.

(October 6, 1911.)

Similar to Section 6. No repairs to end of November, 1912. The condition of the surface was "good" during winter and summer, and in June and November, 1912. The wear was 0·02 in. On the map the proportions of the matrix are given as 7 parts bitumen to 3 of tar, in the text 8 parts bitumen or 2 of tar. "Here and there patches show signs of disintegration of wearing surface."

THE REPORTS BRIEFLY REVIEWED.

The trial sections in the borough of Wandsworth were on a part of the London-Portsmouth road, and are comparable with those at Sidcup, but the road has a more rural character. The summer traffic is about 5,700 estimated tons per day, and the autumn traffic about 5,080 estimated tons. During the whole period covered by the interim report the traffic was probably a little less than twice that on the Eltham-Sidcup road. About one-third consists of motor cars and motor cabs, and about one-fifth of the heavier forms of motor traffic.

The traffic on the roads selected for the trials in the borough of Fulham is considerably less than that at Sidcup, and of a different character. (See p. 137, January 24th.)

TRIAL SECTIONS ON THE PORTSMOUTH ROAD.

As stated in the report, the trial lengths on the Portsmouth road, in Kingston Vale, were made for the purpose of "making comparison between the rates of wear of previously treated tarred granite when compared with similarly treated tarred slag-macadam." This applies to Sections 1 to 4. Nos. 1, 2 and 3 were laid cold. The tar-slag sections were somewhat slippery in November, 1912; but this seems of less significance than the fact that, while these two sections gave rise to "no complaints of slipperiness during winter, the third section, made with Guernsey granite, is definitely described as presenting "good foothold" during winter and in November, 1912. All three seem to have given satisfaction, but Section 4, which was spread and rolled hot, was not quite so good as Section 3, overheating being suspected. The wear of the tar-slag section was 0·35 in. in one case, and 0·57 in. in the other, Section 3 showing "little signs of wear," the measurement not being given; while the wear of Section 4 was 0·46 in. It must be remembered that the amount of wear necessary to give good foothold, when foothold depends on wear, must be somewhat in proportion to the amount of traffic; and in these cases the measurements of the amounts of wear suggest that the crusts were well designed and well made for the conditions of the road.

The results as regards foothold seem nearly balanced, as between slag and granite, in this case, for the condition of Section 4 (granite) is described as giving rise to "no complaints of slipperiness" during winter, and is not definitely stated to have afforded good foothold. Comparing the crust laid cold with that laid hot, the latter seems to have been less satisfactory, and patching was necessary, amounting to a considerable proportion of the area.

Section 5 was laid by the same firm, and made in the same way as Section 19 at Sidcup, which was described as "quite one of the best." The rasping action of studded motor car tyres on the Portsmouth road section may perhaps be put down to higher speeds, and the fact that this stretch of road is just beyond a place where two roads from the London area converge, and is quite straight for some distance ahead, suggests that this is a place where motor car speeds are accelerated when going south-west, while there may often be occasion for cars to be braked when proceeding north-east towards the fork-roads. Moreover, the road is an open one, 45 ft. to 51 ft. between fences. At Sidcup, on the other hand, Section 19 is at a place where speeds are not likely to be so high. It also seems that the Portsmouth road Section 5 is more exposed to the sky than Section 19 at Sidcup, and the surface probably attains much lower temperatures in frosts. If, however, the wear measurements are comparable, the slipping action on the Portsmouth road (wear 0·08 in.) may, after all, have been merely due to the fact that the surface, not having worn as at Sidcup (wear 0·26 in.), consisted of relatively aged materials which had lost their "nature" by exposure, and were thus more easily injured. In any case, it may be suggested, the

better results at Sidcup were due to the more reasonable and suitable amount of wear. There are many tarred roads in the country, secondary or tertiary roads, on which the wear seems to be almost nothing for months at a time, until, suddenly, the surface breaks up and it becomes very patchy.

TRIAL SECTIONS IN FULHAM BOROUGH.

The trial lengths in Fulham were put down by direct labour, under the supervision of the borough surveyor, Mr. Francis Wood, M.INST.C.E. These trials are of a much more scientific character than the trials at Sidcup and in Kingston, for at the former place the opportunities given to competing firms precluded the possibility of making systematic tests, in the scientific sense, while in Kingston Vale the issues were confined to a comparison between granite and slag, one comparison between hot work and cold work, and one with a similar section on the Eltham-Sidcup road. These tests were definite enough, and of a very useful character, but in Fulham a larger number of trials were made, and the study of the influences of different factors was made by instituting comparisons between crusts which differed as regards one element only, taking them pair by pair.

Comparing Sections 1 and 2, we find that the granite crust wore down 0·05 in. and the slag crust 0·22 in. According to the report, the latter was "equal to" the former as regards the condition of its surface in winter and summer. This implies that No. 2 was only "not unduly" slippery; though as the "equal to" may mean "as good as," it may be that the crust which wore 0·22 in. actually gave a better foothold than that which only wore 0·05 in. No. 3, a similar crust made with clinker, showed signs of slight crushing, possibly due to the small amount of wear, 0·06 in. In the case of No. 4, grit-stone, slight crushing is attributed to overheating, and the same applies to Section 5, Kentish ragstone. In this case the wear for twelve months was about 0·09 in. Pair by pair, 1 and 2 and 3 and 4 have each one variable, the smallest wear being that of the granite and Trinidad Lake bitumen section, though the clinker with "bituminous" matrix ran it very close. Three different proportions of bitumen and "tar-compo." were used for the binder of Sections 5 to 8. Nos. 7 and 8 are a pair, with one variable as regards the crust, and the conditions of the sites were similar, though not quite the same. Apart from comparisons between one crust and another it may be remarked that the results with these sections are, on the whole, very satisfactory. No. 9 is an interesting example of the carpeting system. It is a matter for consideration whether the stage at which the crust below the carpet was taking the bulk of the wear could not have been reached without using so thick a carpet, whether, in fact, this was essentially a case of successful surface-dressing rather than of useful carpeting. Possibly, however, a thinner carpet would not have adequately "fed" the crust below it, and at the same time have withstood the wear of traffic for a period sufficiently long for the former action to take place effectively. This point will, no doubt, be cleared up by a later report. The only other point that seems to demand notice in an "interim review" is the very small amount of measured wear of Section 12. The extent to which a crust with an upper course as described would "give" elastically cannot be judged unless we know the nature of the course below, say, a depth of 8 in., and a reviewer is therefore at a disadvantage in seeking to reconcile the satisfactory results (presumably such as regards foothold) with the small amount of measured wear.

Generally, the trials in Fulham are of a very encouraging character so far, and it is to be hoped that further trials of the same scientific character will be carried out. It is not much use comparing crusts with several variables, taking them pair by pair. Lastly, it may be suggested that identical crusts should be compared—(*a*) Under the same conditions of site as nearly as possible, and different traffic conditions, and (*b*) under as nearly as possible the same traffic conditions, but on sites which present marked differences as regards other influences.

Stourport Water Supply.—At a recent meeting of the Stourport Urban District Council the agreement with the Bewdley Town Council for the supply of water was sealed, and the tender of Mr. G. Law, of Kidderminster, at £1,750, was accepted for the work of bringing the water from the Bewdley reservoir. At present the Stourport Council obtains its supply from Kidderminster.

THE SURVEYORS' INSTITUTION.

PRELIMINARY EXAMINATION, 1913.

The following have satisfied the examiners in connection with the above—namely, Messrs. A. M. Aldous, Putney, S.W.; *G. Back, Cavendish-square, W.; R. Baddeley, Horsehay, Salop; S. R. Bagshaw, Kentish Town, N.W.; H. F. Ball, Sittingbourne, Kent; J. S. Balmford, Longwood, Huddersfield; A. H. Bartlett, Oxford; R. J. Bates, Putney, S.W.; R. E. Baty, Monkseaton, Northumberland; J. V. Bennett, Tinsley, Sheffield; F. W. Bethell, Bush Hill Park, N.; A. L. Boughey, Liscard, Wallasey; A. H. Brooks, Harborne, Birmingham; A. de M. Chesterman, Bath; N. R. Coles, Bristol; B. Cooper, Reading; E. R. Cowley, West Hampstead, N.W.; W. B. Cox, Upper Tooting, S.W.; E. Davies, Aberdare, Glam.; J. T. R. Davies, Haverfordwest; T. T. Davies, Aberayron; J. A. Dawson, Birkenhead; E. C. Elmhurst, Barnsley; H. Fayers, Watford; H. T. Fenn, Tufnell Park, N.; R. C. Finch, Streatham, S.W. (pupil with surveyor to Acton Urban District Council); L. B. Fitch, Colchester; A. S. Fraser, Penrith; H. W. Freeland, Tonbridge; T. F. C. Frost, Watton, Norfolk; R. M. Fry, Willesden, N.W.; F. Goldsmith, Horndean, Hants; H. P. Haggett, Newport, Mon.; H. Heaton, Purston, Pontefract; A. V. Hedges, Burnley; W. Hill, Egremont; A. C. Hitchings, Wollaston, Stourbridge; C. H. J. Homan, Rochester; D. S. Hopcraft, Reading; E. W. Hornby, Garstang; F. L. Jenkins, Washford, Somerset; H. D. Johnson, Grove Hill, Middlesbrough; R. W. P. Jones, Abergele; F. E. Lawrenson, Stoke Newington, N.; H. S. Lock, Oxford; D. A. Longley, Beckenham; G. A. McCallum, Barry; J. F. Macmahon, Birmingham; J. W. P. McNaught, Ely; K. E. May, Southend-on-Sea; R. V. Menzies, Englefield Green, Surrey; H. L. Mercer, Lancaster; G. A. Middlemiss, Morpeth; E. T. Moldram, Chiswick, W.; C. J. Montague, New Malden; A. V. Newton, Trull, Taunton; N. H. Parfitt, Newport, Mon.; H. E. J. Paton, Llanelly; G. N. E. Pentelow, Sydenham, S.E.; L. J. Pickrell, Ravenscourt Park, W.; G. A. Pidgeon, Birchington-on-Sea; H. C. Powell, Caversham; S. D. Procter, Great Harwood; F. H. Pugh, Sheldon, near Birmingham; A. E. Ross, Beverley; G. N. Saunders, Ashford; J. Scott, Winchmore Hill, N.; G. H. Scriven, Gravesend; A. E. Smith, Plumstead, S.E.; C. I. H. Smith, Winchester; R. Smith, Sutton, Surrey; L. Spence, Penarth; V. L. Storey, Wouldham, Kent; W. S. Sucking, Moseley, Birmingham; D. Theobald, Norwich; I. M. Thomas, Aberystwyth; H. S. Tilson, King's Lynn; E. H. Tolley, Southborough; J. W. Tomkins, Moseley, Birmingham; G. M. Turner, Birmingham; H. H. Walton, Chilwell, Nottingham; G. Warren, Hornsey Rise, N.; R. C. Westacott, Highgate-road, N.W.; J. P. Wilkinson, Radcliffe, near Manchester; E. Williams, Abergele; H. C. Williams, Birkenhead; R. P. Wilcock, Windsor Great Park; W. H. Winch, Cranbrook, Kent; A. C. M. Windsor, Cheapside, E.C., and H. H. Young, Balgowan, Dorking.

SCOTTISH CANDIDATES.

Messrs. R. S. Andrews, Alloa; C. N. Galletly, Auchterarder, and T. Prentice, Dowanhill, Glasgow.

Company Promotion and Flotation.—Mr. Herbert W. Jordan, F.I.D., managing director of Messrs. Jordan & Sons, Limited, the well-known law publishers, on Tuesday delivered an extremely interesting lecture on the "Promotion and Flotation of Limited Companies." The lecture, which was under the auspices of the Secretaries' Association, dealt succinctly with the history of companies, their utility, and the necessary steps for their formation.

Motor Street Sprinklers in Europe.—Regarding the use of special power-wagon outfits for municipal service, *Scientific American* mentions that the city of Paris is now employing a number of automobile sprinklers and sweepers. It is stated that the city of Berlin is to purchase sixteen combined sprinklers and sweepers, representing the sum of £10,000. As to the fire department work, the Berlin department now has fifty auto-pumps in service, and, unlike those of Paris, most of them are operated by storage battery. The annual upkeep figures as high as £140,000. Munich is following the movement and is experimenting with automobile service. The first of these outfits gave good results, and an entire change will likely be made.

* Head of list.

Modern Methods of Water Purification.*

By JOHN C. THRESH, M.D., D.Sc., Lecturer on Public Health, London Hospital Medical College.

The first question that anyone interested in the subject may be inclined to ask is, "What is the necessity for improved methods of purification?" "Is not the standard method adopted in this country—viz., that of slow sand filtration—perfectly efficient and satisfactory?" I have not got a word to say against the efficiency of slow sand filtration if properly conducted; but, alas! it is more frequently conducted improperly than properly. Many works have no arrangement for securing an absolutely regular rate of flow through the sand beds, nor have they the necessary staff and arrangement for examining frequently the waters passed by each bed, so that as soon as one is found to be defective it can be cut out, or for examining the water from a recently cleaned bed, so that no water passes from it into the mains until its full purifying action has been attained. Moreover, to obtain constant results, the water prior to filtration must not greatly vary in character; if it does, the difficulties in the way of efficient filtration are enormously increased. Again, waterworks have often been established on sites where the requisite area for sand filtration is not available, and it is often desired to construct works in such positions. Finally, properly constructed slow sand filtration works are exceedingly expensive to provide and maintain. For these reasons innumerable investigations have been conducted with the view of devising processes which should be equally, or, if possible, more efficient, capable of being adopted at any waterworks, requiring less skilled labour and less supervision, and less costly to instal and maintain.

The various processes actually in use may be classified as under:—

(1) Preliminary treatment of water before filtration to improve its quality and render the process of filtration more reliable and less difficult. This may be divided into two groups: (*a*) Those processes in which no chemicals are used, and (*b*) those in which chemicals are used.

(2) Mechanical filtration: (*a*) Without the use of chemicals, (*b*) with the use of chemicals added prior to filtration.

(3) Processes in which filtration plays only a subsidiary part, being required only in cases where the water shows signs of turbidity: (*a*) Chlorination, (*b*) Treatment with ozone, (*c*) treatment by means of ultra-violet rays of light.

Taking these in order, the first to be considered is the preliminary treatment of water which will afterwards be sand filtered. This treatment is desirable whenever a water varies greatly in character, or is constantly turbid and rapidly chokes up the pores on the surface of the sand, and especially when the source of supply is known to be more or less affected by the influx of sewage or sewage effluents, or of polluting matters from land, &c.

In some cases it is absolutely necessary to take water from a polluted river, even when in flood, in others flood water can be excluded. In the former case a system of pre-filtration is desirable as well as a system arranged for storage of the partially filtered water. In the latter case storage alone is necessary, unless, as rarely, if ever, occurs in this country, the water contains clayey matter in suspension which absolutely refuses to settle in a reasonable time, when the addition of a small proportion of sulphate of alumina is necessary to clarify the water.

By pre-filtration is meant the passage of the water rapidly through a succession of filters of small area, composed of material coarse in the first bed and less coarse in each successive bed, the final one usually being constructed of coarse sand. This system has been perfected by Puech and Chabal, and their filters are extensively used on the Continent for the pre-filtration of river water. The first filter consists of gravel about 1 in. diameter, which acts as a coarse strainer, but removes also a considerable quantity of slimy matter which adheres to the surface of the gravel. The same action takes place in the subsequent filters containing finer material until after passing the fourth filter the water is practically clean and bright. The total thickness of filtering materials in the four filters is only 4 ft., and they are so constructed as to admit of being very readily cleansed. With six successive filtrations, I understand that Messrs. Puech and Chabal claim that the process is as efficient as that of slow sand filtration, and far less costly than providing storage and slow sand filters. I have seen the system at work in the Thames Valley, and also near Paris, but acting as pre-filters only, and there can be no doubt that the effect produced is most marked, but I should not be inclined to propose an installation of even six filters as a substitute for storage and slow filtration.

When the water to be treated is not too turbid, storage alone has an extraordinary purifying effect. This has long been known, but Dr. Houston's recent report to the Metropolitan Water Board has brought it prominently before the notice of all interested in the subject of water purification.

Storage insures a certain amount of purification of the water by natural processes, sedimentation, insolation, and destruction of objectionable bacteria by the action of other low forms of life, &c. It is a well-known fact that the bacilli of typhoid fever do not live long in water, and that in a stored water they tend rapidly to disappear. Experiments which I have made, or assisted in making, in connection with the waters of various rivers prove that over 99 per cent of the typhoid bacilli introduced into such a water disappear within one week. One week's storage therefore increases the safety of the water over a hundredfold. In fourteen days 99·9 per cent of the bacilli disappear; hence fourteen days' storage increases the safety a thousandfold.

Dr. Houston, who has carried out on a large scale a series of investigations on the effect of storage, summarises his results as under (Third Research Report):—

1. Storage reduces the number of bacteria of all sorts.
2. Storage reduces the number of bacteria capable of growing on agar at blood heat.
3. Storage reduces the number of bacteria capable of growing in a bile-salt medium at blood heat, chiefly excremental bacteria.
4. Storage reduces the number of coli-like microbes.
5. Storage reduces the number of typical B. coli.
6. Storage alters certain bacteriological river water ratios; for example, it reduces the number of typical B. coli to a proportionately greater extent than it reduces the number of bacteria of all sorts.
7. Storage, if sufficiently prolonged, devitalises the microbes of water-borne disease (*e.g.*, the typhoid bacillus and cholera vibrio).
8. Storage reduces the amount of suspended matter.
9. Storage reduces the amount of colour.
10. Storage reduces the amount of ammoniacal nitrogen.
11. Storage reduces the amount of oxygen absorbed from permanganate.
12. Storage usually reduces the hardness, and may reduce (or alter the quality of) the albuminoid nitrogen.
13. Storage alters certain chemical river-water ratios; for example the colour results improve more than the results yielded by the permanganate test.
14. Storage has a marked levelling effect on the totality of water delivered to the filter-beds.
15. Storage tends generally to lengthen the life of the filters. (Only under exceptional conditions is the converse true.)
16. An adequately stored water is to be regarded as a "safe" water, and the "safety change" which has occurred in a stored water can be recognised by appropriate tests.
17. The use of stored water enables a constant check to be maintained on the safety of London's water antecedent to, and irrespective of, filtration.
18. The use of stored water goes far to wipe out the gravity of the charge that the chief sources of London's water supply are from sewage-polluted rivers.

* Paper read at the Eastern District Meeting of the Institution of Municipal and County Engineers held at Westminster on Friday last

19. The use of adequately stored waters renders any accidental breakdown in the filtering arrangements much less serious than might otherwise be the case.
20. The habitual use of stored water would lighten the grave responsibilities of the Water Board as regards the safety of the London water supply, and would tend to create a sense of security among those who watch over the health of the metropolis.

His final conclusion is "That raw river water should be stored antecedent to filtration, preferably for thirty days. The question whether the thirty days' storage should be fixed on a maximum or on a minimum basis must be left unanswered; but if the former alternative be chosen the desirability of employing supplementary processes of water purification to tide over emergencies is worthy of consideration."

In his Seventh Research Report he advocates small pre-storage settlement reservoirs, and says: "If this pre-storage system of settlement were adopted there is no reason why, when the river water was especially unsatisfactory in quality, the good results obtained by simple sedimentation should not be considerably enhanced by the use of such coagulants as sulphate of alumina, alumina-ferric, &c."

In a later report he advocates the use of lime for securing clarification and purification. The effect of lime has long been known, for it has been shown that the softening of a water usually improved its bacteriological quality. That this is not invariably the effect is due to the way in which the softening process is conducted. If carried out both for the purpose of softening and purifying the water good results may be uniformly obtained. In the new edition of my work on "The Examination of Water and Water Supplies" a table is given showing the effect of softening on a water of very variable quality. Sometimes the raw water contained thousands of bacteria per cubic centimetre, and the bacillus coli in 1 cubic centimetre, yet when softened and passed into the mains it rarely contained twenty bacteria per cubic centimetre, and never contained the bacillus coli in 50 cubic centimetres, and very rarely in 100 cubic centimetres. The softening process also removed 40 per cent of the organic matter originally present in the water.

It follows, therefore, that, providing time is given, a very high degree of purification can be obtained by the use of lime sufficient to soften a hard water, and without filtration, if time is given for complete sedimentation, and doubtless such a water, if subsequently sand filtered, would be practically sterilised. With dirty, turbid river waters an excess of lime is required to effect purification, and such a water must then be mixed with a sufficient bulk of water of suitable character before being filtered. This is the process which Houston appears to regard with favour for the treatment of Thames flood water. Naturally the process is inapplicable to soft waters, so that its utility is limited. In the case of soft water sulphate of alumina, a slightly ferruginous quality of which is called "alumina-ferric," could be used instead of lime, but if more than about 1 grain per gallon is added (depending upon the amount of carbonates present in the water), some chalk or lime would also have to be added in order to precipitate the alumina, as it is this precipitation which causes the clarification and purification of the water. I have experimented with this process on a very large scale—that is, at works purifying some millions of gallons of river water per day—and its use has been abandoned. It certainly enabled filter beds to be more quickly brought into use after cleaning, and, to a certain extent, improved the quality of the filtered water, but the results were not so uniformly good as to justify the retention of the process, especially after a much more reliable process had been discovered.

The use of chemicals, therefore, as an adjunct to slow sand filtration has only a limited application. It will be seen later that chemical and other processes may be used for the further purification of sand-filtered water, but in such cases the chemicals, &c., effect the real purification, and the filtration is only of subordinate interest; consequently such processes come into Group 3 of my classification.

The second group of processes dispenses with the use of slow sand filters, rapid mechanical filters being used. Most of these filters contain the filtering material, which is usually sand, but sometimes a patented material such as "polarite," in closed iron cylinders, admitting of the water being passed through under considerable pressure. They differ chiefly in the arrangements adopted for securing efficient and rapid washing of the filtering material. These filters are too well known to require description, and when all that is necessary is the clarification of a water they are very useful indeed, but if the water is liable to pollution not one of these filters is reliable. They may pass for a time a water of great purity, but after each washing the water which passes is very impure bacteriologically, and towards the period when washing is required the water again is of inferior quality. If the filters are not used continuously day and night there is a tendency for bacteria to grow upon the surface of the filtering material, and to be washed through when the filter is put into use. A long experience with these filters justifies me in asserting that alone they cannot be depended upon to efficiently purify a polluted water. This is now so generally acknowledged that I believe all the mechanical filter makers recommend the addition of some coagulant—almost invariably sulphate of alumina with or without a little lime—to the water prior to its passage through their filters. In some cases the coagulant is added as the water passes into the filter, but better results can be obtained if the water after the addition of the coagulant is allowed to stand for fifteen minutes to one hour before being filtered. There is no doubt that by these means, in many cases, a very pure water can be obtained—a water as good as can be obtained by the slow sand filtration of the same water.

Every mechanical filter maker publishes results obtained under the above conditions, and in several instances I have been able to verify them.

Notwithstanding that these processes are less costly than slow sand filtration, and possibly equally efficient if properly supervised, a higher degree of purification is now being desired, one which will practically sterilise and thus destroy any disease germs which may be present in the raw water; and this brings us to our third group of processes in which filtration plays a subordinate part. Filtration is still necessary because none of the processes to be described can be depended upon practically to sterilise water unless that water is free from visible suspended matter, or which is, in other words, perfectly clear and bright. The reason for this almost certainly is that neither the chemical nor physical processes used can destroy bacteria if in masses or if enclosed in an envelope of inorganic or organic material of appreciable dimensions. Possibly, if sufficient time could be given the enclosed bacteria would be reached and destroyed, but time is an important factor, and unless the bacteria can be very rapidly destroyed the process is not practicable.

Of the three processes used for destroying bacteria that which depends upon the use of chlorine as the sterilising agent is by far the most generally adopted. In this country, in South Africa and in North America, many, many millions of gallons per day are being sterilised, and in most cases, apparently, with perfectly satisfactory results. When I published my first paper on "Sterilisation of Potable Waters by Means of Chlorine," I believe the process had never been used save in cases of grave emergency, and in these cases with such results that the communities affected often preferred the risk of drinking the water known to be polluted rather than the water which had been treated with chlorine. The reason of this was pointed out in the paper referred to. The importance of having a clarified water was not previously known; hence excessive quantities of chlorine had to be used to effect sterilisation, and no attempt was made to remove this excess. Where there was a process of filtration the chlorine was added to the water before instead of after filtration.

If an excess is present the water has a curious disagreeable taste, and when a large excess is present the water has a marked action on brass water fittings. The use of these excessive quantities brings the process into disrepute, and is absolutely unnecessary if the process is properly applied. The chlorine process is being used at the present time for purifying millions of gallons of water daily in this country and without any person being able to detect it, and the original impure water is converted into a water of the highest standard of bacterial purity.

With a clear and bright water, whether clarified by filtration or not, about 1 part of chlorine will destroy all harmful bacteria, and practically sterilise 3,000,000 parts to 6,000,000 parts of water. The quantity which must be added depends upon the amount of organic matter in the water, the temperature of the water, and the time which can be allowed for the action of the sterilising agent. Where the water can-

not be stored for a few hours, then some additional process must be used to remove the excess of chlorine used. Exposure to air and light soon causes the small excess of chlorine to disappear, but where this cannot be secured the excess may be removed by the addition of a little sodium bisulphite or by passing the water through a bed of charcoal. One firm has patented an apparatus which enables the water (previously filtered, if necessary) to be dosed with the desired amount of chlorine, and then retained sufficiently long for practical sterilisation to be effected. After this it passes through a layer of specially prepared charcoal and passes out of the apparatus pure and sweet. This charcoal appears to retain its extraordinary properties for many months, and when it begins to fail simple recarbonisation restores its efficiency (De-Chlor process). Properly used, this apparatus gives most excellent results, but if it is only used intermittently the filtering material appears to permit of certain bacteria (not the disease-producing ones) multiplying, and then when, after standing some time, the apparatus is used again the water contains too many bacteria. One of these appliances has been in use at Reading for more than a year, and the results are so satisfactory that additional plant is being put down. In another town I have had one installed to purify the water from a small brook liable to pollution, and we have examined samples of water at regular and irregular intervals for many months, and every sample has been perfectly satisfactory—very different indeed to the samples we used to receive as the product of the slow sand filters.

In another case a very large quantity of filtered Thames water is being treated by a modification of this process, and so far all the samples of water received have been of a very high degree of bacterial purity. Better results could not be obtained even if long-stored water were treated, and there is no storage whatever, the water being taken direct from the river to the filter beds.

In still another case water is treated without any filtration whatever, and de-chlorination takes place merely by the action of air and light, and with extraordinarily good results. The amount of chlorine added is regulated to a nicety without any automatic appliance, and in such quantity that the excess over and above what is necessary to secure destruction of objectionable bacteria disappears before the water is passed into the mains.

In the United States this process has been adopted for the purification of a large number of water supplies during the last few years, and it is now generally recognised as a perfectly reliable and a most satisfactory method of water purification. Its simplicity and its inexpensiveness has appealed to the States, and doubtless in time the English people will get over their prejudices and prefer a purified water to a water of doubtful quality. My impression is that within a comparatively few years all waters derived from sources liable to pollution, and very few people are really aware how common such sources are, will be treated with chlorine, or by one of the other methods to which I am about to refer, before being delivered to the consumers.

The ozone process is in use in several towns on the Continent, and the reports I receive from correspondents differ very much from those published by the various firms interested in the apparatus. I have only seen it at work in Paris, and I was not at all favourably impressed by it. Air is ozonised by the silent electric discharge, and the room in which this is accomplished is a fearsome place to enter. Highly skilled men must be in charge. The air when ozonised is caused to travel slowly and in a minute state of division through cylinders containing the water to be treated, which is also traversing the cylinder. The water must be clear and bright before it can be treated, and such a water after a few minutes' contact with the ozonised water is rendered practically sterile. The water as it emerges both tastes and smells of ozone, but this quickly passes off.

Properly supervised, the results obtained are neither better nor worse than can be obtained by the far simpler methods of chlorination, and it is a question whether the chemical actions which take place in the water are not identical. Ozone is believed to be a molecule containing 3 atoms of oxygen, which in the presence of water decomposes into ordinary oxygen and so-called nascent oxygen, which is supposed to cause the bleaching and sterilising effect. Chlorine when in contact with water slowly combines with the hydrogen in the molecules of water liberating the oxygen, which at first must be in the nascent state, and will, therefore, produce the same effect as the ozone.

Save on a very small scale, I do not think ozone has been used in England for the purpose of water purification, and the same applies to the United States, and I do not think there is any probability of its being adopted by any waterworks. This process requires the use of very complicated and expensive electrical apparatus, and supervision by a skilled man, something more than an intelligent artisan; in fact, he must be a well qualified electrical engineer. This, of course, adds to the cost, about which I shall have to add a few words later.

Sterilisation by ultra-violet rays—that is, by means of the rays which extend beyond the violet end of the solar or other spectrum, and which are noted for their powerful chemical effects, has only just become practicable. In my laboratories we have had all the various appliances introduced into this country under observation. In all cases the rays are produced by a mercury lamp made with transparent quartz. Ordinary glass is useless, as it absorbs nearly the whole of the effective rays. Quartz, on the other hand allows these rays to pass and to exert their powerful effect upon anything upon which they are thrown. If this should happen to be the human eye, the destructive effect is soon apparent; hence such a lamp has always to be carefully screened so that the rays do not reach the eyes. The whole problem of water sterilisation by means of these rays consists in ensuring that every drop of water is momentarily exposed to the full effect of the rays. The water must therefore be as near as possible to the lamp. In one process which we tried the lamp was actually immersed in the water, and about its sterilising effect there can be no doubt. Provided the water was perfectly clear and bright the results were marvellous. Practical sterilisation appeared to be almost instantaneously secured. Unfortunately the lamps could not be depended upon, the quartz fracturing frequently. This difficulty has not yet been overcome, though thousands of pounds have been spent in the attempt, and it is fatal to the use of the lamp in this way for water sterilisation. It cannot be depended upon for a moment. The lamp may crack almost as soon as the current is switched on, or it may continue to burn for several hours, but at longest it could be depended upon to crack within a couple of days, and as the cost of each lamp is considerable the process would not only be unreliable, but very expensive.

We have now in use a lamp which is fixed just above the surface of the water, and by an ingenious arrangement within the cylinder all the water has to pass over the area nearest to the lamp. This ensures practical sterilisation, and the breaking difficulty is overcome. We have tried it with impure Thames water and with water to which we have added sewage, or sewage effluents, the bacillus coli and the bacillus typhosus, and the results are uniformly satisfactory.

Like the chlorine and ozone processes, reliable results can only be obtained with clear and bright waters; hence a naturally turbid water must be clarified before it is passed into the sterilising apparatus. The apparatus is simple compared with that of the ozonising process, and simpler even than the chlorination process, and if extended experience shows that it is reliable, and the electricity can be produced at a sufficiently low price—1d. to 1½d. per unit—it should have a great future before it.

The apparatus with which my colleague Dr. Beale and myself have been working was said to have a capacity of 130 gallons per hour, and the electrical supply to the lamp was derived from a direct current of 90 volts tension.

The internal arrangement of the apparatus includes a series of inverted cones which act as baffle plates, causing the water to pursue a definite course, and ensuring that the bacteria contained therein are exposed to the rays for a definite period. The lamp is fixed in a horizontal position a short distance above the cones, and although the water is not actually in contact with the lamp, it passes several times in close proximity thereto. An electric bell is attached, which continues to ring should the lamp, for any reason, cease to act while water is flowing through.

With the above apparatus we have tried a large number of experiments with uniformly excellent results, but only one need be quoted. We mixed with a tank of London tap water a quantity of sewage filtered through a jelly bag, and commenced running

it through the apparatus at the rate of 20 gallons per hour, and we gradually increased it to 70 gallons per hour. I may say here that, with ordinary waters, we had found that practical sterilisation was effected when the apparatus was dealing with the maximum quantity, 130 gallons per hour. With this very filthy water sterilisation was complete at all rates up to about 50 gallons per hour, and it was practically complete at 70 gallons per hour.

Polluted water used.	Treated water passed off at rate of		
	22 galls.	41 galls.	70 galls. per hr.
Bacteria per c.c.	—	—	—
Growing on gelatine 3,740	0	0	1
,, ,, agar 1,570	0	0	1
The bacillus coli over 1,000 per c.c.	Absent in 400 c.c. throughout.		

There can be no question therefore of the efficiency of the apparatus. The diagram appended is one of the lamps somewhat differently enclosed so as to be utilised for sterilisation on a very large scale, and with which we hope shortly to be able to continue our experiments.

It will be seen therefore that waters can be practically sterilised by chlorination, by ozonisation, and by exposure to ultra-violet rays, and next comes the very important question of the relative costs.

The following figures are based upon the cost at works where the processes are installed, and, of course, do not include the cost of preliminary filtration or the pumping, which is in nearly all cases necessary.

Cost per annum of Treating One Million Gallons of Water per Day.

	Ultra-violet ray process.	Ozone process.	De-Chlor process.
Electrical current* or chemicals	£120	£120	£55
Lamps and renewals	30	—	10
Labour	60	1,250	60
Interest repayment on capital outlay	150	—	300
	360	1,370	425
Equivalent per 1,000 galls. treated	·24d.	·9d	·28d.

* 1d. per unit.

Where the requisite electric current can be obtained at 1½d. per unit the ultra-violet ray process would be still as cheap as the chlorination process, but with current more than 1½d. per unit the chlorination process would be the cheapest. The cost of ozonisation puts the process out of court. In the great majority of cases, therefore, the chlorination process would be the cheapest, and under certain circumstances it would probably be the most satisfactory.

The selection of one or the other processes should therefore depend upon the conditions obtaining at any particular works. If a chlorination process were decided upon the method adopted for chlorination and dechlorination would have to be varied according to circumstances. The removal of every trace of excess of chlorine is absolutely necessary, and this is better effected when chlorinated lime has been used than when chlorinated soda has been used. In some cases it will be cheaper to get rid of the excess by storage; in others by the use of dechlorinating apparatus, such as that devised by Messrs. Candy.

The ultra-violet ray process requires no modifications, and if it fulfils its promise it has a great future before it; it will probably prove both the cheapest and simplest. It would also require least space, and could, in many cases, be installed at very short notice. Until a plant has been installed in this country and submitted to a sufficiently prolonged test, I do not think anyone would be justified in recommending its definite adoption; hence at present the chlorine process of water sterilisation holds the field.

Waterproofing of Cement.—We understand that the patent powder "Pudlo," which renders cement waterproof, and the makers of which are Messrs. Kerner-Greenwood & Co., King's Lynn, is being used on the new Prudential Buildings, Rochdale. This is only one of many important buildings this has been specified for. This powder is now well to the fore, and architects are including it in all classes of cement and [illegible] work.

THE FIRE BRIGADE OR THE FIRE SPRINKLER.

A QUESTION OF EFFICIENCY.

(Contributed.)

Of the services maintained for the ratepayers by the various municipal authorities not the least efficient are the fire brigades studded throughout these islands. Generally under the direction of a thoughtful and experienced fire-fighter, the brigades in many of the larger manufacturing districts are monuments of the high efficiency to be attained in the skilful manipulation of specially contrived apparatus by earnest men as the result of rigorous and systematic training.

This splendid system costs much money (the London Fire Brigade, for instance, is maintained at a cost which may be computed at £1,000 per day), and yet, after vast expenditure of money, the *Times* Annual Financial Review of January 17, 1913, estimates that the cost of home fires in which the damage amounted to £1,000 or more totalled, during 1912, no less a sum than £2,703,450—£2,700 000 dead loss to the nation, to which should be added how much for inconvenience and loss of profits, and wages to employees? After the spending of money freely in the purchase of all the splendidly efficient apparatus, in the maintenance and training of brave and skilful men, we are faced with a national ash-heap valued at many thousands of pounds each day.

Heap no reproaches on the heads of the fire brigade. Remember they start with a disadvantage which, reduce as they may, they cannot eliminate; they are not on the spot, ready for immediate action at the critical moment, and the fire is.

There is an invention known as the "Grinnell" automatic sprinkler, which ensures for any premises in which it is installed absolute immunity from disastrous fire, by reason that it, unlike the brigades, is on the spot—an unsleeping, never failing, silent guardian, waiting for any fire that may originate. It is not new, untried or experimental; the first "Grinnell" was brought out in 1882, and in the thirty years that have elapsed some 15,800 actual fires have occurred in buildings fitted with this appliance, and have been extinguished with an average loss from fire and water of less than £60 per fire.

Business men recognise that there is a risk of fire in our manufactories, our warehouses, our stores, and shops, and to reduce it we try to make the buildings fireproof, and, so far as possible, buy insurance against loss on invested capital. The "Grinnell" automatic sprinkler system goes a long step further; it practically makes both buildings and contents really fireproof, and ensures that an outbreak of fire shall be the cause of its own extinction. The automatic sprinkler is a fire brigade constantly on guard over the premises in which it is fitted; and immediately and wherever fire occurs automatically water is poured upon it through sprinkler "heads," the outbreak is confined to a small area, and the fire is rapidly extinguished. The sprinkler head is a device screwed into and holding back the water contained in a system of piping which is horizontally arranged on all the ceilings of a protected building. Vertical main pipes rise from floor to floor and feed these horizontal pipes freely and abundantly with water, which they in turn receive from suitable outside supplies—such as street mains, pumps drawing from reservoirs, as may happen to be the more convenient—with the usual addition of elevated storage tanks. The main water supplies, usually two in number, unite at a convenient position, and at the point of admission to the sprinkler system proper are controlled by a complete set of valves comprising a main shut-off valve and a patent alarm valve, the function of which is to sound a loud and continuous alarm immediately a fire occurs, and, the sprinkler opening, proceeds to drown the fire.

The sprinkler head is a pear-shaped piece of brass, centrally containing a valve which is held in position by means of fusible solder melting at 155 deg. Fahr. The sprinklers are placed, approximately, 10 ft. apart on all ceilings of protected buildings (consideration is given to all girders, beams, partitions, &c., that may affect the distribution of water from the sprinkler); they are also fixed at the top of hoists, conveyors, dust trunks, and under staircases, as all of these act as flues in case of fire.

The "Grinnell" automatic sprinkler system is adaptable to all classes of buildings, shops, stores, warehouses and manufactories, warm or cold, and

businesses are safeguarded by them against disastrous fire in all countries of the world.

All insurance companies allow substantial rebates from the fire premiums on premises having sprinkler installations, and the saving of insurance alone is usually sufficient to show quite a good return upon the cost of outlay. But what is of infinitely more importance is the fact that they absolutely secure the business against the disorganisation and inevitable loss attendant upon disastrous fire.

PETROL MOTOR VACUUM CESSPOOL EXHAUSTER.

We have on several previous occasions referred to the vacuum system of cesspool emptying, which is claimed to have been first exploited in this country about fifteen years ago by Messrs. Merryweather & Sons, of Greenwich.

A plant of this kind is usually arranged for horse draught, and the necessary vacuum in the tank is obtained by means of a hand-worked air-pump. With the machine here illustrated, however, the propulsion is effected by a petrol motor-engine, which is also employed to operate an air-pump in order to create the vacuum. It may be explained that with this system of cesspool emptying, on a vacuum being created in the tank the contents of the cesspit are drawn up through suction hose and thence into the tank, with an entire absence of nuisance.

Merryweather's Motor Vacuum Cesspool Exhauster.

The details of the chassis are similar to those of the makers' standard fire brigade chassis, but certain alterations are embodied in the design, including deeper and heavier side frames, and a specially large differential gear driven by spur gearing from the gear-box countershaft and totally enclosed in a separate casing. The side chains and sprockets are also of much stouter design. The framework is entirely of steel with parallel sides of channel section. Angle steel box-stretchers are fixed where necessary for carrying the motor mechanism and vacuum cylinder, and the whole framework is securely riveted together. The wheels are of the artillery pattern with cast steel hubs, and wrought iron tyres 5 in. wide front and 7 in. back. The petrol motor is of the four-cylinder vertical type, of 50 b.h.p., with dual ignition and carburetter of the latest automatic type. The clutch is of the multiple disc type, and the transmission is by means of side-roller chains to the rear wheels, with a three-speed gear box and gate-change speed lever. The brakes are two in number—viz., a foot brake working on the transmission gear, and a powerful screw brake direct to the tyres of the driving wheels, with handle on the "near" side.

The vacuum cylinder is of galvanised steel, and has a capacity of 400 gallons. The air is exhausted by means of a double cylinder, single-acting vacuum pump of the "Ravensbourne" type, driven by means of a friction clutch from the transmission gear. The exhausted air is delivered into the engine exhaust pipe, and passed through the silencer with the exhaust gases. A non-return valve is fitted to the pump delivery pipe, so that the exhaust gases cannot penetrate to the pump valves.

The particular plant illustrated, which has been constructed for colonial service, is geared at low speed, to enable the heavy load to be taken on steep uphill journeys with ease.

In addition to cesspool work, an apparatus of this nature is admirably suited for clearing street gullies, obviously being far more cleanly in operation than the hand scoops usually employed.

INSTITUTION OF MUNICIPAL AND COUNTY ENGINEERS' ORPHAN FUND.

A meeting of the Committee of the Orphan Fund of the Institution of Municipal and County Engineers was held at 11 Victoria-street, Westminster, on Friday, the 7th inst., at five o'clock, when the following members were present, viz.:—Messrs. R. J. Thomas, Aylesbury, president (in the chair); W. N. Blair, St. Pancras; W. Harpur, Cardiff; E. Purnell Hooley, Nottingham; S. Stallard, Oxford; E. Willis, Chiswick; O. Claude Robson, Willesden (hon. secretary and hon. treasurer).

The balance-sheet for the year ending December 31, 1912, was submitted by the hon. treasurer, and showed the finances of the fund to be in a somewhat better condition than in the preceding year, enabling the committee to make grants for the ensuing year to the extent of £155 towards the maintenance and schooling of orphans of deceased members.

The question of utilising some of the invested capital in connection with the purchase of a perpetual presentation to a school was considered by the committee, but deferred for further report from the hon. secretary.

The hon. secretary also reported the appointment of a new trustee (Mr. Sidney Stallard, county surveyor of Oxfordshire) in place of the late Mr. John Thomas Eayrs, the whole of the invested funds having now been transferred in the names of the new trustees, viz.:—Messrs. Sidney Stallard, Thomas Henry Yabbicom, and Oliver Claude Robson.

A proposition was made that the co-operation of the district representatives on the council of the institution should be solicited, with a view to efforts being made towards increasing the subscriptions to the fund, and the hon. secretary was instructed to communicate with the district representatives accordingly.

"The Civic Engineer's Who's Who."—The first issue of "The Civic Engineer's Who's Who" (London: St. Bride's Press, Limited, 24 Bride-lane, E.C., 2s. 6d. nett) gives wonderfully complete lists of the engineering officials of England and Wales. For a first issue it is very creditable.—*Glasgow Herald.*

Office Conversations.

MORE OR LESS IMAGINARY.

[Contributed.]

V.—A Point of Honour.

No, Mr. Rufus, I'm awfully obliged; but I can't do it. Stupid, am I? Quixotic? Possibly I am; but I can't do it any the less. Yes, I quite appreciate all you say. Ten guineas are not easily picked up for a few hours' work, especially when private practice is not allowed. I needn't fear in the present case, as you have obtained Mr. Marrion's consent to making me an offer? Very kind of the chairman, I'm sure, but doesn't it strike you that I should have been consulted first? Wounded vanity? Nothing of the sort. Merely professional instinct, for it wouldn't have made any difference if you *had* come to me first. I couldn't take the work on, and there's an end of it. You'd like me to give my reasons? Certainly, only you mustn't object to a little plain speaking.

* * * *

You're chairman of the council of an adjoining district, and your surveyor is not only a brother officer, but a neighbour. Personally, I have only met him twice, to my remembrance, and he has impressed me neither one way nor the other. He may be the best fellow in the world, or the worst—anyhow, it makes not the slightest difference. You pay him—let me see, is it £120 or £130 a year? Not you individually—my remarks are none of them to be taken as in any way personal—but the council, of course. £130? And for that he carries out the whole of the ordinary duties of an urban district surveyor, together with those of inspector of nuisances. I suppose his salary as surveyor is about £30, with £100 as inspector. Oh, £40, is it? Then for £40 he performs the duties of highway surveyor, building inspector and water and sanitary engineer; prepares plans and specifications for any scheme or work that may come along; has the charge and responsibility of all council buildings and properties; manages allotments, and sewage disposal and other works; attends meetings about four evenings a week; prepares reports on every conceivable subject; and does anything else that he may find time for. I mustn't forget the £90? Oh, yes, I must; that's his salary as sanitary inspector, which is quite a separate appointment, and I suppose you know—yes, it's enough to make you smile—that half of it is repaid by the county. It's done everywhere? Of course it is, but that doesn't make it any the more honourable a proceeding, does it?

* * * *

And now let's get to the crux of the matter. Among the "other work" which your surveyor has been doing for his £40, beyond his regular duties, is the preparation of a supplementary scheme for the disposal of a portion of your town's sewage. He has, I presume, in the usual way, been working on this during the hours he should have been seated by the fireside, in the bosom of his family, so to speak. Hasn't got any family? Isn't married? Well, let's say then during the hours he should have been playing a game of billiards at the club, or prospecting round among the eligibles of the district for a girl to make his wife when his next rise becomes due. The plans and so forth have undoubtedly been prepared in what is, in the case of a municipal engineer, facetiously termed his own time. He can't claim a commission, and if he is granted an honorarium it 'll work out at something like 1½d. or 2d. an hour. No, it's of no use your shaking your head. I've had some. And now you come to me, when the plans are completed and the specification drawn up, and ask me—*me*—to run through them and give an expert opinion. I can do it in a few hours, you say, and your council 'll give me a fee of ten guineas!

* * * *

No, Mr. Rufus. As I've said, I'm very much obliged to you *for* the offer, but I can't accept it. You can find plenty of engineers (and good men, too) who will. I've not the least doubt. I could name a score in Victoria-street alone—consulting engineers of great standing, men eminent in their profession—although I doubt whether ten guineas would be a sufficiently tempting bait. Still, that's beside the question. My point is that I'm a brother officer, and I'm not going to risk the chance of cutting a brother officer's throat. No, I don't even hint that his scheme is any but the best. Thin-skinned, am I? Yes, I'm proud to say I am, and if I had a thicker hide and a more elastic conscience, do you know what I'd do? Why, I'd take your ten guineas and praise the scheme up to the skies, vote it not only the very best possible, but the only scheme to meet the circumstances of the case. Dishonourable! Of course it would be, and that's why I don't do it; but I'd sooner do that than risk having to condemn the scheme of a poor devil receiving £40 a year for hard professional work and then being compelled to chuck in a couple of hundred pound's worth of work for nothing!

* * * *

Heated? I should just think I am. It wouldn't be half so bad if he was treated in a decent manner—— Yes, I do mean to say that he isn't. Answer me, now! Suppose your council had engaged the services of a consulting engineer, a man who would have stipulated for his 5 per cent, and who possibly wouldn't have come out of his office for less than twenty-five guineas. Well, we'll say that this man has prepared the plans and so forth; has, in fact, got everything in readiness for the inquiry. Now, Mr. Rufus, would you at this stage have asked me to give my opinion of the scheme? No, don't beat about the bush—you know you wouldn't. And that being so, I say it's an insult to the man you have instructed (I won't say engaged) to come to me now. If he wasn't competent to prepare the scheme, you shouldn't have asked him to; if he was, there the matter should end, and the Local Government Board inspector be left as the final arbiter. No, I can't do it, and that's an end of it. What? If my council instructs me? Well, they can scarcely do that. But suppose they did? Eh? There'd only be one thing left for me to do then. You'd like to know what that is? Why, I'd give the scheme my most hearty approval, without troubling to look at the plans at all, and just a moment, Mr. Rufus—I'd send your surveyor the ten guineas fee with my very best regards.

* * * *

I guess he'll have something to smoke if he puts all that in his pipe. Personally, I haven't the slightest doubt that the plans will turn out to be useless, and the scheme will have to be done by a qualified engineer after all. And the poor chap 'll get the sack, sure as fate—it's wonderful what some people expect for 15s. a week! Who is it? Mr. Verstall? Verstall!—Verstall—oh, I know; show him in! Why, here's the very man himself. Morning, Mr. Verstall; glad to see you. Come about your plans, have you? Well, really I—— Want me to look through them for you? Hum—it's a bit awkward, you know, as between ourselves I've just refused the offer. What do I mean? Why, your chairman has just left me—offered me ten guineas to run 'em through and report. Refused? Of course, I did—could I do anything else? Who am I to criticise a brother official's work? Good of me? Tut, tut! not a bit of it. You'd have done the same in my place—or I hope you would, anyhow. Now, what exactly do you want me to do? You can't ask me after what I've said—you can't offer me a fee? My dear fellow, I don't want any fee from you. If I'd been keen on a fee I could have got it from the other side, couldn't I?

* * * *

That's settled then; and now how am I to get a look at the plans? Your chairman seems to be carting them round with him, and I don't wish to come in contact with him again yet. You have tracings at your office—a complete set already done? Then suppose you run up to my house to-night with them, and we can go into the whole matter without fear of disturbance. You'll bring the ordnance sheets of your district, won't you, and be prepared with figures and all that sort of thing? Right-O! Say eight o'clock. Good-bye; and oh, Mr. Verstall, of course you'll keep the visit to yourself. I've not the least doubt that your plans 'll be all right; but there might be just a few trifling amendments necessary,

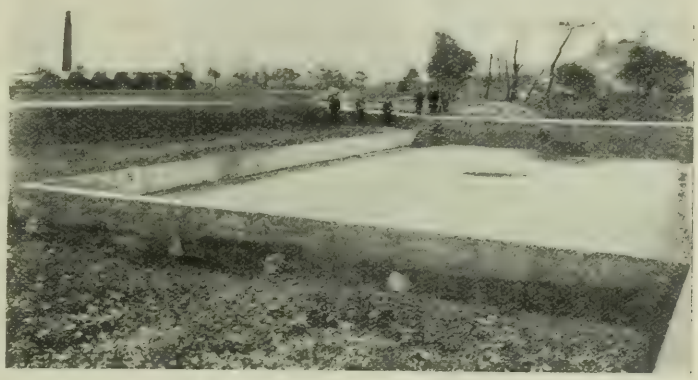
and it's just as well that no one should know that I had any hand in them. Good-bye; eight o'clock. Now I've let myself in for it properly. It 'll mean a week of evenings, if a day, and all to save the pockets of a council too mean either to engage an outside engineer or to pay a qualified man a fair salary. No, it isn't all for that. It means helping a poor devil out of the very deuce of a fix possibly, and saving him from dismissal. I've seen one poor incompetent put through his facings by a Local Government Board inspector, and it wasn't a pleasant sight. Anyway, I'll help this lame dog over his particular stile. 242 Town, please! That you, Kate? I'm bringing a friend home to-night, or rather he'll be calling at eight o'clock. Have a fire in my room, will you? Business? Yes, I'm sorry to say it is. Horrid? My dear girl, I really can't help it—eh? The Joneses coming? Oh, I shan't be so busy that I can't see them for half an hour or so. Too, think how I shall escape Letty's singing! Oh, that voice! Beast, am I? Right you are. Good-bye, dear. Just off to Dampwell to give poor old Badger a wake up. He never calls now, does he? Good-bye—home at about half-past six, I hope. Sure not to be? I never am? I'm afraid you're not far wrong; but I do my best. Bye-bye!

GLASGOW OPEN-AIR SWIMMING BATH.

FERRO-CONCRETE CONSTRUCTION.

Owing to its great elastic strength and monolithic character, ferro-concrete offers manifest advantages over ordinary concrete and masonry in the construction of reservoirs and large tanks. For the same reasons it is specially adapted for employment in swimming baths, either in buildings or in the open air. Two important considerations, it is pointed out in the February issue of *Ferro-Concrete*, are the perfect water-tightness of ferro-concrete and its freedom from the risk of injury due to local settlement of the ground, while the economy attending its adoption is a point that speaks for itself.

The open-air bath illustrated herewith represents a recent example which is of interest to municipal and county authorities. It was built from the designs of Mr. D. Burns, the burgh surveyor of Pollokshaws, who in June last received instructions from the burgh council to construct a large swimming bath in Greenbank Park. It was originally intended to execute the work in ordinary concrete with council labour, but the council afterwards decided to invite tenders for constructing the walls and outflow weir in Mouchel-Hennebique ferro-concrete, which during recent years has been employed in Scotland on an extensive scale.



Open-Air Swimming Bath, Pollokshaws, Glasgow.

The actual bath is about 110 ft. long by 40 ft. wide, the walls ranging from 4 ft. 6 in. to 6 ft. high above the bottom. The walls are of slender proportions with extended footings, as customary in reservoirs and retaining walls, and in addition to those enclosing the bath the wall construction has been carried for a considerable length beyond it. The bottom of the bath is of ordinary concrete 6 in. thick surfaced with granite chippings.

Working details of the ferro-concrete construction were prepared for the burgh surveyor by Messrs. L. G. Mouchel & Partners, of Westminster and Glasgow, who were represented during the execution of the work by Mr. T. O. Dixon, their district engineer for Scotland. The contractors were Gray's Ferro-Concrete Contracting Company, Limited, of Pollokshaws, by whom the entire work was completed in about six weeks.

Workington Gasworks Scheme.—The scheme for the development of the gasworks, at an estimated cost of £7,000, has been adopted by the Workington Town Council.

SUCCESS IN MUNICIPAL ENGINEERING.

The *Contract Record*, Toronto, has the following in its issue of the 22nd ult.:—

In another column we record the death of the city engineer of Dublin, a man of whom it was said that he was one of the successes of the Irish capital, and that his professional life had been lived without a mistake.

The sentiments are expressed in an obituary notice in a British journal too well known and too representative to require introduction. We find ourselves contrasting such conditions with those on this side of the Atlantic. Recent examples are not lacking of men who have served their city a span longer than the score of years placed to the credit of the City Engineer of Dublin, and who at the end of that time have been allowed to retire into comparative obscurity with a slur upon their reputation.

It seems that the engineering profession in Great Britain enjoy a better professional status than in this country. Marks of favour are constantly being conferred upon them. Last year the Chief Engineer to the London County Council was knighted and became a Commander of the Order of St. Michael and St. George. In 1912, also, the Lord Mayor of Bristol, a member of the profession, was knighted. The dignity of engineering is thus upheld and incompetent men do not take it upon themselves lightly to criticise the work of those in high places.

The same emolument is not obtained in Great Britain, but there is at least the satisfaction of knowing that a respectable-sized halo will appear about a man's head after he is gone. In Canada, the municipal engineer too often passes through years of tedious work and wanton criticism and then dies unhonoured and unsung.

The late City Engineer of Dublin was fortunate.

Rebuilding of Southwark Bridge.—At the last meeting of the City of London Corporation the chairman of the Bridge House Estates Committee said he had every hope that the rebuilding of Southwark Bridge would be begun at the end of this month.

Street Subways.—At the last meeting of the City of London Corporation a member inquired whether it had been brought to the notice of the Streets Committee that Dr. Waldo, city coroner, giving evidence before the Committee of the House of Commons, had stated that Ludgate-circus was one of the most dangerous places in London, and that subways were needed at Holborn-circus and the bottom of King William-street. It was stated in reply that the committee had already had under consideration the question of subways at Ludgate-circus. So far as the London Bridge end of King William-street was concerned, as the frontage line might be altered, it was thought better to leave the question of a subway over for a time. The suggestion in regard to Holborn-circus would be considered shortly.

Assistants' and Students' Section.

Conducted by SYDNEY G. TURNER, Assoc.M.Inst.C.E.

All communications in regard to this page must be addressed to The Editor, St. Bride's House, 24 Bride-lane, Fleet-street, E.C. *Envelopes must be marked "Assistants' Section" in the top left-hand corner. Correspondents are invited to submit questions for consideration and answers to the questions which appear. For the contributions considered to be the most meritorious, one or more premiums in books will be awarded monthly. Diagrams must be drawn to scale on separate sheets, ready for reproduction.*

QUESTIONS.

This week answers are invited to the following questions:—

300. Retaining Wall.—A retaining wall is required to support a roadway having no footpath, and consequently heavy vehicles such as steam rollers, &c., will seriously surcharge the wall. The height of the roadway above the adjoining ground is 8 ft., and the filling will be good clay. Design a suitable wall in mass concrete, and show calculations. (D. G. B., *Darlington.*)

304. Geodesy.—What is meant by reducing a horizontal measurement to mean sea level? (Perplexed.)

305. Mechanics.—A machine is driven from a pulley 4 ft. in diameter by means of a belt. If the difference of pull in the two sides of the belt be 20 lb., and the pulley makes 150 revolutions per minute, what is the horse power transmitted by the belt? (T. R.)

306. Building Materials.—What are "encaustic" tiles, and how are they made? (Pup.)

307. Hydraulics.—A stream is gauged over a rectangular weir or notch. The width of the notch is 3 ft. 6 in., and the height of the still water over the edge of the notch is found to be 14½ in. Find how many gallons pass over the weir per twenty-four hours, neglecting the velocity of approach. (D.)

308. Moment of Inertia.—Show how to find the moment of inertia of a tee section. What use is made of the moment of inertia in finding the strength?

[The Editor is at all times glad to hear from readers who desire to submit questions regarding matters of general interest, points of daily practice, &c., for insertion in the "Assistants' and Students' Section." Questions which are published are taken into consideration, as well as other matter, in awarding the Monthly Premium.]

REPLIES TO QUESTIONS.

303. Reinforced Concrete.—Give sketches of the usual forms of falsework for reinforced-concrete construction, showing how the moulding is arranged at the junctions, such as between the column and principal rafter, a column and cambered roof, &c. (T. H., *Leicester.*)

The general principles of reinforced concrete construction are embodied in the design and construction of walls, floors and columns. The sketches show the falsework which is required for a reinforced concrete floor supported by columns, main and secondary beams, which is typical of this class of construction.

Fig. 1 shows the floor supported by a secondary beam, and the arrangements for supporting the moulds for the main beam.

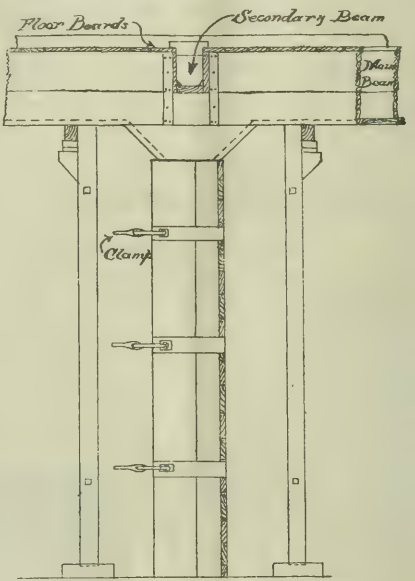


Fig. 2. Column and Main Beam.

Fig. 2 shows the junction of a main and secondary beam over a column.

Fig. 3 shows a clamp which is widely used for holding together the moulds. It is fixed by hammering in the small end, and grips tightly. The ease and rapidity with which the clamp is applied justify its extensive use.

The temporary timbering for reinforced concrete

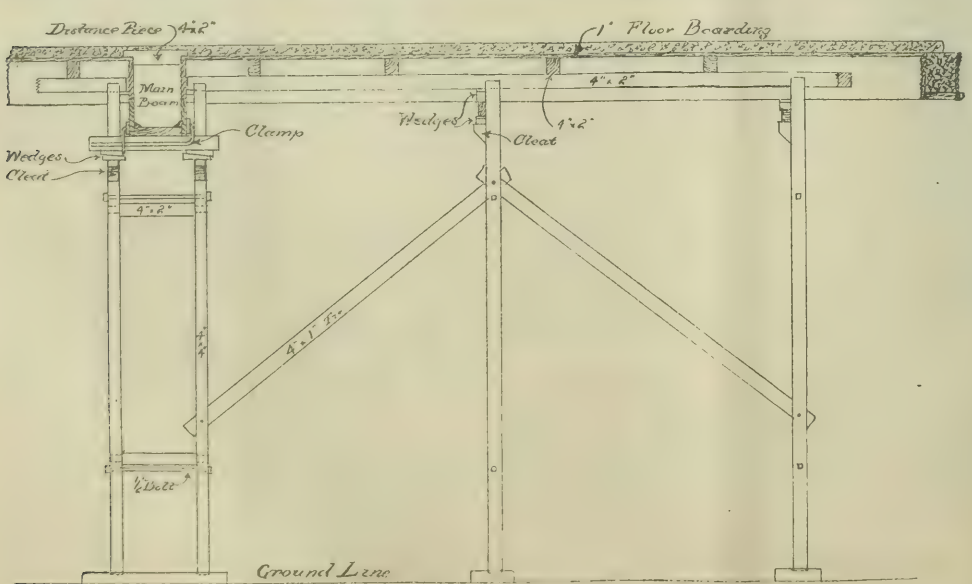


Fig. 1. Forms and Staging for Main Beams.

The Surveyor
And Municipal and County Engineer.

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work must be stiff enough to withstand the filling and punning of the concrete without much deflection.

The uprights are therefore placed solid in blocks of wood to prevent sinking, and the level of the cross piece which supports the moulds is fixed by a pair of wedges.

The planks used for the moulds should be straight and well seasoned so that they will not warp or twist when wet. The inner face must be smooth, and it is best to limewash this surface, or treat it with soft soap or mineral oil, so that the concrete leaves the forms smoothly.

The falsework for arches and cambered roofs is essentially the same as that for beams and floors,

FIG. 3. CLAMP.

but extra work is entailed in setting the uprights to their respective heights and in forming the curves for the bottom of the moulds. In a deep arch or beam the sides of the moulds are carried up as the concrete is filled in by stages and allowed to harden.

The timbering for reinforced concrete work must be specially arranged for each job, and by the exercise of ingenuity a great saving may be made by arranging the work so that the timber may be used repeatedly. (H. V. O., *West Bromwich.*)

Kesteven County Council and Road Board Grants.—The Kesteven County Council, at a recent meeting, approved a resolution affirming that, as the application of the bituminous method to road maintenance has been necessitated solely by reason of motor traffic, and as the Road Board decide upon the specific works for which grants are to be made, and require certified accounts in detail of the actual expenditure to be rendered to them, the grants made by the Road Board should be equivalent to the whole of the increased expenditure, and not be limited to a percentage.

PRESENTATION TO MR. R. J. THOMAS.

The wedding gift to Mr. R. J. Thomas, M.INST.C.E., president of the Institution of Municipal and County Engineers, subscribed for by over eight hundred members of that body, was formally presented last Friday evening following a dinner at which Mr. A. D. Greatorex, M.INST.C.E., past president, occupied the chair. The proceedings took place at Lyons' Victoria Mansions Restaurant, Westminster, and the company included Messrs. E. Purnell Hooley, P. G. Killick, W. Nisbet Blair, A. E. Collins, A. L. Grant, H. T. Wakelam, P. Dodd, J. W. Cockrill, W. T. Lancashire, W. Harpur, G. Green, W. Gregory, J. E. Sharpe, J. L. Redfern, C. Vawser, T. Bradshaw, R. C. N. Newport, E. J. Elford, L. R. Impey, T. N. W. Watts, N. Scorgie, A. D. Greatorex, J. S. Pickering, J. H. Norris, J. Marshall, R. S. W. Perkins, W. R. Collins, R. Collins, M. Hainsworth, J. Sutcliffe, F. J. Wood, C. Chambers Smith, A. T. Bridgewater, T. W. A. Hayward, J. Anstee, F. W. Ruck, S. Stallard, J. P. Norrington, E. B. B. Newton, E. H. Essex, J. Birch, O. E. Winter, C. G. Lawson, G. A. Phillips, Cuthbert Brown, O. Claude Robson, R. J. Thomas, Thos. Cole (Secretary), and H. A. Giles (Assistant-Secretary).

The CHAIRMAN observed that this was the first time in their history that they had met to honour a president of the institution on his wedding. He had little thought when last year he had himself received at the hands of Mr. Thomas, at the annual dinner, a token of regard from the council he should be called upon to make a presentation on their behalf to his successor in the presidential chair, and he felt very honoured by the duty which he had to perform. He would like to take the opportunity of thanking all who had so kindly replied to the circular he had issued, the nature of the response having been such that he had been unable to reply individually to those who had communicated with him. He might tell them that he had received replies from Mons. Putzeys, the city engineer of Brussels, one of their honorary members, and the late city engineer of Paris, Mons. Bechmann, who, they would remember, was among those who received them in Paris last Whitsuntide. Replies had also come from members in India, Africa, and Australia, from Mr. Brodie, the city engineer of Liverpool, who was engaged in connection with the planning of the new city of Delhi, and from the city engineer and the executive engineer of Tokio. He felt very gratified that his circular had met with such a hearty response, though the regard in which their president was held made him feel certain that his suggestion would meet with general acceptance. Mr. Thomas had been a member of their institution for over twenty-two years, and had served the institution well. He was honorary district secretary for the home counties for many years, and in turn was elected a member of the council, became a vice-president, and now occupied the proud position of president of the influential body to which they belonged. He had given very valuable services to the institution in the past, he was giving valuable services now in his capacity as president, and he felt certain that he would continue to serve them in the same admirable way in the future. On their behalf they had to ask Mr. Thomas to accept as a very small token of their esteem, and with their best thoughts for his future welfare, two silver entree-dishes, each of which bore the inscription: "Presented to our President, Robert John Thomas, M.INST.C.E., by the members of the Institution of Municipal and County Engineers, on his marriage, 19th February 1913." He felt certain Mr. Thomas would find them useful, and they would always remind him of the very high regard in which he is held by his brother members, all of whom would wish him long life and every happiness in the future.

MR. THOMAS, who was greeted enthusiastically on rising, said he was quite at a loss to know what to say, but this much he could say: the lady who had honoured him by promising to become his wife would be more than proud of that magnificent present. He was sure she would appreciate it very keenly as some slight assurance to her, at any rate, that her future husband had the regard of his fellow-members of the profession to which he belonged. They had always been very kind to him—too kind. He had, on his part, felt more than a regard for the old institution and for its members

both individually and collectively; anything he had been able to do on their behalf—and it had been very small—had been done with the desire to enhance the value of the institution, particularly, if he might say so, in the interests of the younger members, and the knowledge that a very large number of the associate members and students had thought fit to subscribe to the testimonial to him appealed to him very greatly. He knew that his future wife desired above all things that he should not lose touch with the old institution, because she came of a stock which had done excellent work in municipal life in Wales, and she was a good judge of roads when she motored over them. That was one of the proudest moments in his life. They had put him in the position of president of their institution—the blue ribbon of the profession—and they had now added to his indebtedness to them by giving him that valuable present—a gift which he would treasure as long as he lived.

CORRESPONDENCE.

For every ill beneath the sun
There is some remedy or none;
If there be one, resolve to find it;
If not, submit, and never mind it.
—Anon., *circa* 1813.

THE ROAD BOARD TRIALS.

To the Editor of The Surveyor.

Sir,—There are several points in the interim report of the Road Board upon which, with your permission, I wish to remark.

Sections 1 to 4.—These were laid down by the Kent County Council, and the prices stated in the original pamphlet as 1s. 9d., 1s. 10½d., 2s. 9d. and 3s. 11d. per yard respectively, prices which seemed to point to very economical construction on the part of the staff of the Kent County Council. The cost of these sections is now given in the interim report as 2s. 7½d., 2s. 8d., 4s. 1d. and 5s. 7½d. respectively, figures which are so much in excess of those originally given as to call for some explanation.

Single pitch-grouted macadam is variously stated as above as costing 2s. 9d. and 4s. 1d. per yard. The following sections were afterwards reconstructed by this method at costs (see interim report) which work out as follows: No. 1, 2s. 6½d.; No. 2, 2s. 1½d.; No. 12, 3s. 8½d. It would be interesting to know why the price of the same standard material should vary from 2s. 1½d. to 4s. 1d. on a standard length of road.

Section No. 8.—There seems to be no reason why the cost of repairs to water trench should be debited to this section and not to the water authority.

The depths of wear given do not inspire confidence in the method of measurement. Compare Sections No. 3, 0·04 in., No. 4, 0·08 in., and No. 5, 0·25 in. It scarcely seems credible that there will be ¼ in. on Durax cubes and only ·04 in. on single-grouted pitch macadam. It seems more probable that the cubes have settled into the tarred chippings or into the foundation, but future measurements of wear will show if this is so.

Statistics of traffic are given for fourteen days ended September 13, 1910, and seven days ended August 21, 1912. On a road where the character of the traffic is changing so much and where such important trials are in progress the Road Board will doubtless have recognised the desirability of taking statistics of traffic at frequent intervals. If so, it would have been of interest to have the results in the interim report.

As an assistant who cannot procure the specifications and reports of the Road Board at the cost of the local authority, I think the prices charged are excessive. The dissemination of the specifications and reports is as much a matter of public utility as the trials themselves, and it would be better to circulate them under cost price than retard their spread by excessive charges.—Yours, &c.,

J. Eastwood.

February 8, 1913.

[We are unable to say why the costs of the sections referred to were increased, but probably it was thought that the crusts as actually made would compare better with other sections. The contrary seems to have been the case with Sections 1 and 2, since, under the circumstances—including the extraordinary drought—it would almost certainly have been more economical to make thinner top courses so that the square foot per annum costs for the life in each case would have been less. As regards water-bound crusts, with or without tar-painting, it seems desirable to test whole crusts and not top courses only. As regards measurements of wear, it is an exceedingly difficult thing to determine wear accurately, apart from (1) compacting of the crust, (2) slight sinkage into the foundation or of the foundation, and (3) slight subsidences. On p. 250 of our issue of January 31st we noted that it was not stated that the setts of Section 5 were taken up and measured. We fully agree with our correspondent's contention as regards traffic statistics. Ed. Surveyor.]

REFUSE DESTRUCTION.

To the Editor of The Surveyor.

Sir,—In the article in your Special Annual Issue I notice a short reference to the destructor erected here in 1910 by Messrs. Dawson & Manfield, of Manchester. Will you kindly allow me to correct a statement on page 167—viz., that the power generated in the boiler can only be used for sludge-pumping purposes?

The steam generated is used for the following purposes: (1) For the pumping of the whole of our sewage up to three times the dry-weather flow. (We treat sewage from the adjoining district of Sowerby in addition to that of Sowerby Bridge proper.) (2) A dynamo is also driven for the minor purposes of sludge pumping. (3) Steam is also used for the disinfector station.

The article is quite correct in stating that a considerable quantity of heat is by-passed direct to the chimney, and this heat is, of course, available in the event of our demand for steam increasing.

The burning capacity of the plant is 34 tons per twenty-four hours and not 20 tons, the latter figure being possibly a misprint, as it is inconsistent with the fuller details furnished in the article.—Yours, &c.,

George E. Wrigley.

Engineer's Office,
Sowerby Bridge.
February 7, 1913.

[The only point is that there is no attempt to get any return in the way of by-products from the utilisation of the steam generated. That appears to be agreed upon.—Ed. Surveyor.]

STRUCTURAL ECONOMY.

To the Editor of The Surveyor.

Sir,—In your last issue a letter appeared from one of the most respected senior members of our profession with reference to the book "Structural Economy," by Mr. A. E. Slater. As one of the younger members I wish to support the remarks of Mr. Collins. The book will, I think, prove a good investment, and will assist towards attaining that for which engineers are always working—efficiency with economy.—Yours, &c.,

W. G. Cross.

Town Hall,
Tunbridge Wells.
February 11, 1913.

ROYAL INSTITUTE OF PUBLIC HEALTH.

PARIS CONGRESS.

The twenty-first annual congress of the Royal Institute of Public Health will be held this year in Paris, from May 14th to May 18th inclusive, upon the invitation of Le Conseil Municipal de Paris. Invitations to appoint delegates have been sent to all the municipalities, county councils, local authorities, universities, learned societies and other public bodies, and these invitations have met with cordial response. In view of the success of the meeting last year in Berlin, it is confidently anticipated that the Congress, having regard to the unique opportunities which will be given to representatives for becoming practically acquainted with Continental institutions and their work, will not only prove to be of much interest, but of the greatest value.

All communications on the subject should be made to the Honorary Secretary-General of the Congress, Royal Institute of Public Health, Russell-square, W.C.

LOCAL GOVERNMENT BOARD INQUIRIES.

The Editor invites the co-operation of SURVEYOR readers with a view to making the information given under this head as complete and accurate as possible.

INQUIRIES HELD.

Birmingham T.C. (February 4th. Mr. Edgar Jones). —£40,000 for the purchase of the land for the widening and improvement of Broad-street.—It was stated that the price to be paid for the land worked out at £34 9s. 8d. per sq. yard. The city surveyor, Mr. H. E. Stilgoe, said that if the purchase were delayed two of the premises at least would be re-let for a long term, and the price to be paid would be enhanced because the leaseholders would have to be dealt with. The inspector also inquired into the application for sanction to borrow the sums of £2,681 and £3,596 for the purchase, for purposes of open spaces and street improvement, of properties in St. James's-place and Sheepcote-street respectively. In the case of the Sheepcote-street improvement, the purchase price would work out at 20s. 11d. per sq. yard. The land was covered with fifty-six small houses, some of which were unfit for habitation.

Bognor U.D.C. and Westhampnett R.D.C. (February 6th. Mr. P. M. Crosthwaite).—£11,000 for works of sewage disposal, including provision for the disposal of sewage from Felpham and other areas in the rural district of Westhampnett. The Westhampnett Rural District Council had applied for sanction to borrow £4,000 for the purpose of sewerage for the parish of Bersted and Felpham, including the extension of certain works in the urban district. Mr. Ernest Herbert Stevenson, M.INST.C.E., gave details respecting the scheme. He was called in by the council, he said, after the Hannah's groyne scheme had been adversely reported on. The floating tests were eminently satisfactory, and he was strongly of opinion that no sewage sent to sea at the times he suggested would ever come back on shore. The district contained a population of 16,000, and the scheme provided for 30,000. The pumps would be capable of discharging 220,000 to 240,000 galls. per hour. The estimated cost was £10,746. The Westhampnett Rural District Council's application was then proceeded with, and, after hearing formal evidence, the inspector proceeded to view the site.

Coleraine U.D.C. (February 4th. Mr. J. F. MacCabe). —£3,200 for the purpose of erecting sixteen workmen's houses at Shuttle Hill.—The town clerk, Mr. W. Henry, stated that the council had already erected eight houses in Society-street. These had all been occupied since completion, and the scheme had proved self-supporting. They had arranged with a contractor for the erection of nine workmen's houses in Long Commons, and when the present scheme of sixteen houses was completed they would have thirty-three houses erected. Mr. W. J. Given, C.E. (surveyor), estimated that each house would cost £130 to erect.

Cork T.C. (January 30th. Mr. P. C. Cowan).—£12,864 for the purpose of paving works to supplement the scheme already adopted.—It was explained that the object of the scheme was to re-surface with Lake Trinidad asphalt the southern section of the city—the South Mall, the Grand Parade as far as the fountain, Old George's-street as far as Parnell-place, and down to the new road constructed by the Cork Railway Company. It was also proposed to re-surface the southern portion of Prince's-street, Marlboro'-street and Cook-street. Mr. J. F. Delany, city engineer, stated that he went into the question of asphalt surfacing of the streets, and inspected the Victoria-embankment, London, which was surfaced with the same material and on the same system as they proposed to surface the streets mentioned in the present application. He was favourably impressed with the surface of the Embankment, which, he understood, was reclaimed land. The surface of the Embankment, when he inspected it, had been laid with Trinidad Lake asphalt for from four to six years, and it was obvious that there had been no maintenance work done. It had been previously macadamed. The tidal conditions in London were very similar to what obtained in Cork. A specification had been drawn up, and a contractor had tendered to lay down the material and keep it in repair for ten years at a cost of 9s. 6d. per sq. yard, or about 11d. per sq. yard per annum.

Howden R.D.C. (February 5th. Dr. W. W. E. Fletcher). £3,200 for the provision of an infectious diseases hospital.—The site of the proposed hospital is within a mile of Howden market-place, and provision is made in the plans for fourteen beds. It is intended to add two other beds as private wards for special cases. The repayment of the principal and interest during a period of thirty years will require a rate of less than a halfpenny in the pound.

Leeds T.C. (January 29th. Mr. A. G. Drury).—£30,000 for works in connection with the gas undertaking.—The deputy town clerk, Mr. T. Thornton, stated that £18,000 was required for the extension of mains and services, and £12,000 for gas stoves. On the occasion of the last application for a loan for gas purposes, part of the sum required was for meters, but the corporation had since decided that in future they would pay for their meters out of revenue. The inspector inquired whether the demand for gas in the city was growing, and Mr. R. H. Townsley, general manager of the gas department, said the gradual increase in the use of incandescent lights had adversely affected the consumption somewhat, and another factor in last year's falling-off was the open winter. The absence of fogs told a big tale. In spite of the adverse factors the profits showed an increase.

Much Woolton U.D.C. (February 5th. Major J. Stewart).—£600 for thirty years to provide a public shelter and convenience at Lode's Pond, Woolton. The clerk (Mr. T. D. Syers) stated the pond was the gift of Lord Salisbury to Woolton in 1871, on three conditions—namely, for the benefit of the inhabitants, not to be used for building purposes, and it was to be used as a watering place for cattle, a shrubbery, and pleasure ground.

Portrush U.D.C. (February 4th. Mr. J. F. MacCabe). —£2,200 for the erection of additional workmen's dwellings.—It was stated that the council had already built twelve workmen's houses, and these had all been occupied from the moment they were completed. That scheme had been a very great success. There was a great demand for a good class of houses for working-men. There were now forty-four applications for such dwellings. The estimated cost of the proposed houses was £174 each, and the proposed rent was 4s. 6d. weekly.

Swansea T.C. (January 28th. Mr. R. G. Hetherington).—£3,600 for re-laying water mains across the New Cut and the half-time basin, North Dock. The town clerk, Mr. Lang Coath, stated that there were two strong reasons why the work should be done: (1) The St. Thomas district required a better water supply, and (2) it would provide a sufficient supply of water in the case of fire at Messrs. Weaver's and other works. Plans were produced by the borough engineer, Mr. R. H. Wyrill, who said there was no objection on the part of the Harbour Trust to the scheme.

Swindon T.C. (February 7th. Mr. F. O. Stanford —£4,000 for extensions at the Rodbourne sewage disposal works.—Mr. H. J. Hamp, AS-OC.M.INST.C.E., borough surveyor, gave the details of the following works included in the application:—The construction of two additional precipitating tanks, making a total tank capacity equal to the dry weather flow; the conversion of the existing contact beds into percolating filters provided with travelling sprinklers, the filtrate to gravitate into a pump well and then lifted with centrifugal pumps coupled to electric motors on to a new percolating bed (2 acres) constructed on ground level; the effluent to be distributed on the second bed by means of fixed spray jets under a 7-ft. head. Owing to the strong nature of the sewage, double treatment on percolating beds is necessary to produce satisfactory effluent.

Teignmouth U.D.C. (January 5th. Mr. F. H. Tulloch). —£100 for the purpose of widening Paradise-road.—The inspector pointed out that the contract was for £355. Did they want a loan of £400? The clerk (Mr. A. P. Dell) said there had been a certain amount of other expenditure, which had brought the amount up to £380. The inspector: I don't know if the Board will grant £400. Possibly there may be "extras." The surveyor (Mr. F. W. Knight): There may be, but I do not anticipate any. It was eventually decided to reduce the amount to £380.

APPLICATIONS FOR LOANS.

Bognor U.D.C.—£1,283 for widening a section of the promenade.

Branksome T.C.—£500 for sewerage and surface-water drainage.

Brighton T.C.—£9,400 for a boarding-house at the grammar school.

Calne T.C.—£500 for footpath improvements.

Darwen T.C.—£21,600 for new carbonising plant and other works at the gasworks.

Derby T.C.—£13,500 for electricity works extensions.

Diss U.D.C.—£425 for the erection of the waterworks engineer's cottage and the excess of expenditure over loans in connection with the waterworks.

Exeter T.C.—£2,360 (in addition to £15,190 already sanctioned) for the infectious diseases hospital.

Harrogate T.C.—£6,250 for the extension of the electric light plant.

Horsham U.D.C.—£1,600 for the North-street improvement scheme.

Middlesex C.C.—£2,483 for widening Back-lane, Chiswick.

Newcastle (Ireland) U.D.C.—£7,100 for a sewerage scheme.

Oldham T.C.—£1,635 for the provision of firemen's dwellings.

Ramsgate T.C.—£3,150 for the erection of a shelter.

Romford R.D.C.—£3,860 for the provision of cottages.

Scarborough T.C.—£1,000 for drainage works.

Stratton and Bude U.D.C.—£1,760 for road and sanitary works.

Tynemouth T.C.—£1,200 for the erection of stores at the fish quay.

Wakefield T.C.—£552 for a 12-ton road roller, fitted with a Morrison scarifier.

Waterloo-with-Seaforth U.D.C.—£4,000 for the purchase of premises for street improvements.

LOANS SANCTIONED.

Barnoldswick U.D.C.—£10,514 for the extension of the gas undertaking.

Bolton T.C.—£5,517 for the extension of the Eastern Hospital.

Bromley T.C.—£4,085 for private street improvements.

Darwen T.C.—£5,000 for conversion to the water-carriage system.

Dover T.C.—£1,000 for sixty years, and £210 for twenty years, for street improvements.

Hadleigh U.D.C.—£1,470 for the provision of cottages.

Hull T.C.—£5,325 for a school for fishermen, and £2,175 for the erection of a recovery school for children.

Leigh-on-Sea U.D.C.—£2,945 for making up certain roads.

Poole T.C.—£1,759 for private street works.

Scarborough T.C.—£1,530 for improvements in North Bay.

Silsden U.D.C.—£1,875 for street improvement works.

South Westmorland R.D.C.—£250 for water supply works.

Southwick U.D.C.—£550 for surface-water sewer extension.

Stockton T.C.—£3,800 for the extension of the borough hall.

Stourbridge U.D.C.—£700, to be repaid within sixty years, for the purchase of land for a street improvement at New-road; £400, to be repaid within thirty-six years, for the provision of an open space at Wollaston; and £100 for street improvement in connection with the same scheme at Wollaston, to be repaid in twenty-seven years.

FORTHCOMING INQUIRIES.

FEBRUARY.

	£
17.—**Stratford-on-Avon.** For sewage disposal purposes (Mr. R. H. Bicknell)	1,000
18.—**North Bromsgrove.** For works of sewerage (Mr. R. H. Bicknell)	890
18.—**Tynemouth.** For hospital purposes (Mr. R. A. Farrar)	11,600
18.—**Cuckfield.** For the provision of dwellings (Mr. H. S. Stewart)	2,200
18.—**St. Helens.** For the provision of a depot and construction of a reservoir (Major J. Stewart)	1,850
18.—**Witney.** For the purchase of the water undertaking (Mr. F. O. Stanford) ...	866
19.—**Kidderminster.** For sewage disposal purposes (Mr. F. O. Stanford)	13,500
19.—**Blackpool.** For street and gas supply purposes (Mr. F. H. Tulloch)	34,683
19.—**West Bromwich.** For sewage disposal works (Mr. R. H. Bicknell)	1,124
19.—**Weymouth.** For works of paving (Major J. Stewart)	3,720
19.—**Shipley.** For the provision of a public park (Mr. Edgar Dudley)	450
20.—**Droylsden.** For works of paving and the provision of a bowling green (Mr. M. K. North)	4,571
20.—**Cannock.** For works of sewage disposal (Mr. F. O. Stanford)...	10,442
20.—**Eastleigh.** For street and surface-water works (Major J. Stewart)	1,805
21.—**Southampton.** For fire station extension (Major J. Stewart)	1,000
21.—**Wallasey.** For the erection of a town hall and public convenience (Mr. F. H. Tulloch)	101,307
22.—**Guildford.** For the reconstruction of a bridge (Major J. Stewart)	2,000

INSTITUTION OF MUNICIPAL AND COUNTY ENGINEERS.

COUNCIL MEETING.

The official report of a council meeting of the Institution of Municipal and County Engineers, held last Saturday, was issued yesterday. Eighteen new members, fifteen members and five students were elected in the course of the proceedings, and other business included the nomination of the following for election as ordinary members of council, 1913-14—viz.: Messrs. J. Patten Barber, J. A. Brodie, J. S. Brodie, A. H. Campbell, G. F. Carter, A. E. Collins, W Harpur, H. P. Maybury, C. F. Wike, W. H. Blair, A. E. Brookes, D. Edwards, A. Gladwell, F. W. Jones, W. T. Lancashire, H. H. Palmer, J. E. Wilkes, G. Sturgess, E. E. W. Butt, E. Willis, H. G. Whyatt, W. F. Loveday, H. A. Brown, E. B. B. Newton, E. J. Elford, H. E. Stilgoe, J. Walker Smith, G. Green, W. J. Steele, and H. Richardson.

A gratifying response to the circular issued in respect to the formation of a mutual defence fund was reported. The secretary was instructed to issue to all members who have not yet replied an inquiry as to their intention with regard to the matter in order that the scheme might be completed.

The question of facilities for assistants attending meetings of the Institution was considered, and the secretary directed to arrange for the holding of meetings primarily, though not exclusively, for the junior members.

Approval was given to proposed North-western and North-eastern district meetings at Stretford and Leeds on March 1st and 8th respectively.

BUILDING TRADES EXHIBITION: OPENING DAY.

THE "SURVEYOR" SECTION.

The Lord Mayor of London, accompanied by the Sheriffs, will open in state the Building Trades Exhibition at Olympia on Saturday, April 12th next. The vote of thanks to Sir David Burnett for performing the ceremony will be moved by Mr. Reginald Blomfield, A.R.A., president of the Royal Institute of British Architects, and seconded by the Hon. Gerald Strutt, president of the Surveyors' Institution. This exhibition, the tenth of the biennial series organised in London by the Messrs. Montgomery, will be, if possible, even more representative of the various branches of the building trade than was its predecessor in 1911.

The Surveyor Section, in the gallery, will, as usual, have a special attraction for municipal engineers and surveyors, the arrangements of this part of the exhibition being in the hands of Mr. C. S. Mason, 24 Bride-lane, Fleet-street, E.C., to whom all inquiries with regard to space should be addressed without delay.

Creosoted Deal Paving. — The Improved Wood Pavement Company, Limited, 46 Queen Victoria-street, E.C., have just secured the contract for laying nearly 4,000 super yds. of creosoted deal in Montague-street, Worthing. They are also doing 12,000 yds. of similar paving in Stanstead-road, Forest Hill, and next month they will be taking up over 4,000 yds. of Jarrah wood in Waterloo Bridge-road, Lambeth, and substituting creosoted deal paving.

Municipal Work in Progress and Projected.

The Editor invites the co-operation of SURVEYOR *readers with a view to making information given under this head as complete and accurate as possible.*

The following are among the more important projected works of which particulars appear below: Buildings—Bradford £9,881, Canterbury £25,000, Dunfermline £11 000, Sheffield £34,300; housing and town planning—Sheffield; roads and materials—Brighton £6,483, Greenwich £3,300, Northumberland, Rhyl £7,500, Turton £36,494; sewerage and sewage disposal—Newcastle (Ireland) £7,100, Northwich £2,000; water, gas and electricity—Withernsea £37,000. Particulars of other works projected will be found on our "Local Government Board Inquiries" pages.

BUILDINGS.

Alnwick U.D.C.—The surveyor, Mr. Geoffrey Wilson, has received instructions to prepare a plan for a mortuary.

Ayr T.C.—Suggestions are being considered for the extension of the Heathfield Hospital for tuberculous cases.

Bangor T.C.—It is proposed to provide an observation block at the borough hospital, at an estimated cost of £600.

Bournemouth T.C.—The borough surveyor, Mr. F. W. Lacey, has prepared a scheme for a pavilion at the shore end of Boscombe Pier, which is being considered by a committee.

Bradford T.C.—An annexe to the central baths is to be erected at a cost of £9,881.

Canterbury T.C.—The extension of the borough asylum, at an estimated cost of £25 000, is under consideration.

Clacton U.D.C.—A shelter is to be constructed in the East Cliff, opposite the Grand Hotel.

Dawlish U.D.C.—The surveyor, Mr. S. F. C. Churchward, is engaged on plans for new shelters.

Dunfermline T.C.—The central public library is to be extended at a cost of £11,000, towards which Mr. Andrew Carnegie has promised £5,000.

East Dereham U.D.C.—The tender of Mr. F. Dent, of Dereham, at £61, has been accepted for the erection of posts and rails in the market place for the provision of cattle pens.

Glasgow T.C.—The aëration and filtration plant which has been installed in the public baths at the Gorbals was formally inaugurated last week. The plant had been in operation for a month, and during that period there had been a remarkable improvement in the purity and clearness of the water. Row's patent system of filtration and aëration is the system which has been installed, and the contractors are Messrs. Royles, Limited, Irlam, near Manchester.

Harrogate T.C.—The council have confirmed the proposal to erect a shelter, lavatory, and caretaker's house on Harlow Moor.

Llanelly U.D.C.—Sir Stafford and Lady Howard have purchased a site for a town hall for £3,841, and presented it to the council on behalf of the ratepayers.

Portrush U.D.C.—An engineer has been requested to report on the subject of the provision of public baths.

Sheffield T.C.—An expenditure of £31,800 is recommended by the Baths Committee for a comprehensive scheme to provide bathing facilities in parts of the city not served by existing baths, and with the object of covering requirements for some years to come. In some of the districts it is proposed to erect "cottage baths" similar to those seen by the committee on their recent visit to Birmingham. It is further proposed to expend a supplementary sum of £2,500 on the provision of public wash-houses.

Walsall T.C.—The borough surveyor, Mr. John Taylor, has reported that an open-air swimming bath could be conveniently provided off Mill-lane, at a cost of about £200, but the Baths and Parks Committee have not seen their way to recommend any scheme.

Whitley and Monkseaton U.D.C.—It has been decided to extend the sea wall along the links to Panama House

HOUSING AND TOWN PLANNING.

Bradford T.C.—The Health Committee recommend the purchase of 20 acres of land at Rooley-lane, at £180 per acre, for the purpose of erecting workmen's dwellings.

Greenock T.C.—It has been decided to proceed with the erection of five tenements in Serpentine-walk, at a cost of about £5,000.

Lurgan R.D.C.—With reference to the council's application for sanction to a loan of £13,600 for the provision of cottages and allotments, the Local Government Board have written stating that the Labourers' Act of 1911 was designed to meet the supply of 6,000 additional cottages at a cost of £1,000,000, this figure being based on an allowance not exceeding £170 per cottage. The average cost of the council's cottages was £226. The board could only sanction a loan of £10,200, leaving the council to borrow the residue in the open market. The council have appealed to the Local Government Board to reconsider their decision.

Nelson T.C.—The borough surveyor, Mr. W. Shackleton, has been instructed to prepare a scheme for laying out the land in the Catlow district for cottages with gardens attached.

Sheffield T.C.—The city engineer, Mr. C. F. White, states that the council had in hand the town-planning schemes dealing with seven different areas covering a total acreage of just under 6,000 acres. This was about the size of the whole of Derby, and almost the size of Chesterfield, Barnsley and Doncaster combined. It represented about one-half of the land in Sheffield available for further development and for inclusion in a town-planning scheme. It might be taken that for residential and good-class districts the number of houses to the acre would be limited to twelve, and in areas adjoining working-class districts to twenty or twenty-four.

PARKS AND OPEN SPACES.

Bridge of Allan T.C.—A plot of land has been secured, at the nominal rent of £1 per annum, for use as a public park.

Poole T.C.—A sum of £600 is to be expended in laying out Alexandra Park.

REFUSE COLLECTION AND DISPOSAL.

Horsham U.D.C.—The tender of Messrs. Heenan & Froude, at £122, has been accepted for the provision and erection of mechanical hoppers at the refuse destructor.

Willesden U.D.C.—The tender of Messrs. W. & J. Drinkwater has been accepted for the collection of house refuse in all the districts for the ensuing three years.

ROADS AND MATERIALS.

Banbury T.C.—The plan of the borough surveyor, Mr. N. H. Dawson, for making up Grosvenor-road has been approved.

Brighton T.C.—The proposal of the Works Committee to relay the roadways in Old-steine and Pavilion-parade with creosoted blocks, at a cost of £6,483, has been confirmed by the council.—Representatives have been appointed to confer with the Hove Corporation on the subject of what system of trackless trolley can be best applied to the district.

Durham T.C.—It is proposed, subject to the necessary funds being forthcoming from the county council, to pave part of the North road with Durax, and to repair the remainder of the road and other county roads within the borough.

Greenwich B.C.—It has been agreed to take up a loan of £3,300, repayable in twelve years, at 4 per cent per annum, to defray the cost of repaving works in Blackwall-lane and Tunnel-avenue.

Hendon U.D.C.—The tenders of Mr. F. G. Brummell and Mr. T. Adams have been accepted for street improvement works.

Leeds T.C.—The Road Board have made a grant of £9,000 for street improvement works.

Lindsey (Lincs) C.C.—The council have approved the following applications to the Road Board for

grants towards expenditures, and the council agreed: £184 for widening and improving a dangerous corner, by the Broughton Urban District Council; £17,114 for the construction of a new road which will be necessary when the new Keadby Bridge is opened, by the Scunthorpe Urban District Council; £312 for widening the road from Grimsby to Immingham, and taking off dangerous corners at Great Coates, by the Grimsby Rural District Council; and £147 for making a new road at Ashby Puerorum, by the Horncastle Rural District Council.

Littlehampton U.D.C.—The scheme of the surveyor, Mr. Harry Howard, for the improvement of Terminus-road and High-street by laying dustless Durax stone setts, at 7s. 9d. per square yard, at a total estimated cost of £1,500, has been approved, and the surveyor has been authorised to approach the county council with a view to obtaining their approval of the scheme and of getting a grant from the Road Board. Mr. Tester said the material suggested had been tested and found effective at Bradford and other places. The great advantage about it was that it was dustless and comparatively noiseless.

Lytham U.D.C.—Market-square is to be paved with wood at a cost of £550.

Mansfield T.C.—Property of the value of £1,750 is to be purchased for the widening of Newgate-lane.

Newcastle-on-Tyne T.C.—It has been decided to lay out Eldon-square at a cost of £1,700.

Northumberland C.C.—The War Office has agreed to contribute £12,000 to the £24,000 cost of reconstructing the Redesdale main road for 10 miles to Birdhope Crag Camp.

Rhyl U.D.C.—After considerable negotiations the frontagers on the east end of Rhyl have met the council in the matter of the rights they have on the sandhills, and the council will be able to proceed with its scheme of east end improvements, at a cost of £7,500, which will enable the east and west promenades to be connected. The council have decided to put the work in hand at once.

Seaford U.D.C.—Mr. B. A. Miller, the surveyor, has been deputed to attend a conference of district surveyors on the subject of dangerous corners in the County of Sussex.

Turton U.D.C.—Improvements are to be carried out in Turton, Darwen and Blackburn roads, at an estimated cost of £36,494.

West Ashford R.D.C.—Field Mill-road is to be widened at an estimated cost of £600.

Worthing T.C. The tender of the Improved Wood Pavement Company, Limited, at £2,181, has been accepted for wood paving in Montague-street.

SEWERAGE AND SEWAGE DISPOSAL.

Donaghadee U.D.C.—The council have accepted the tenders of Messrs. Kirk & Randall, Limited, of Woolwich, for the carrying out of contracts Nos. 1, 2, 4 and 5 in connection with the new water supply and sewerage schemes.

Marple U.D.C.—A sewage disposal scheme for Low Marple is to be carried out at an estimated cost of £3,000.

Newcastle (Ireland) U.D.C.—The council have approved of Messrs. Swiney & Croasdaile's plans of a sewerage scheme discharging into deep water a considerable distance below low-water mark of the lowest spring tides; also of public lavatories. The estimated cost of the scheme is £7,100.

Northwich R.D.C.—A new sewerage system is to be carried out at an estimated cost of £2,000.

Wolstanton U.D.C.—Consideration is being given to a sewage disposal scheme for Millbank, the probable cost of which would be £5,600.

WATER, GAS, AND ELECTRICITY.

Bakewell R.D.C.—At the last meeting the council's engineers, Messrs. Brady & Partington, of Chapel-en-le-Frith, were requested to prepare plans and estimates for a scheme of water supply for Eyam, in order that application could be made to the Local Government Board for permission to borrow the required amount.

Bridge of Allan T.C.—A sub-committee having reported in favour of taking over control of the gas-works, the council have approved of the report, but delayed consideration of the question until a final report and recommendation have been received.

Carmarthen T.C.—For the purpose of obtaining a further supply of water for the Carmarthen district, Mr. Kyle, who was engaged some time ago by the council to carry out boring operations at Cwmtawel, which is on the estate of the corporation, has submitted a report stating that a depth of 50 ft. had been reached. He had made a thorough test of the yield of water from the bore, and found that by pumping they could get constantly and without fluctuation 10 to 12 gallons per minute. This quantity had quite come up to his expectation. At a private meeting of the council it was decided to defer the consideration of the report until next August.

Horsham U.D.C.—The tender of Messrs. Lindfield & Son, at £264, has been accepted for an extension of the boiler-house at the electricity works.

Macclesfield T.C.—The tender of the West Gas Improvement Company, Limited, of Manchester, at £15,250, has been accepted for the installation of the Glover-West system of vertical retorts at the gas-works.

Walsall T.C. On the year's working the gas undertaking shows a nett profit of £9,489, an increase of £727 on the previous year.

Withernsea U.D.C.—Messrs. Taylor & Wallin have prepared a report with respect to a proposed scheme of water supply which is under the consideration of the council. The suggestion is to have a gathering ground of 400 acres at Bracken Hill, at Winestead, where there is an almost natural reservoir. After being impounded, the water would be twice filtered, and then carried to a service reservoir at Rimswell Lodge, and thence to Withernsea. The filter is designed to deal with 100,000 gallons. The total approximate estimated cost will be £37,000, at present-day prices, including cost of land and all expenses. Mr. Taylor estimated that a rate of 1s. 3d. per £ of rateable values on those who take the water, and a rate in aid for the deficit of about 1s. 5d. would meet the case.

MISCELLANEOUS.

Blackpool T.C.—The borough surveyor, Mr. J. S. Brodie, reports that out of 110 names of unemployed submitted to him less than thirty were found to be suitable for the heavy work which is now going on in several parts of Blackpool in connection with the relaying of the tramway tracks. He suggested, however, that work of a more suitable character might be found for these men in other directions, such as improving playgrounds and spare land, and his suggestion has been adopted. The Highways Committee agreed to the surface draining of the playground near the Claremont Council Schools, and of the spare land in Central Drive near the corporation stables. The Watch Committee have made a suggestion for the provision of about half-a-dozen "island" pavements in the middle of some of the busy roads. It is proposed to place one of these islands in Dickson-road, stretching, roughly, from Queen-street to Talbot-road, and another in Talbot-square, while it is suggested that the "island" at Hounds Hill should be moved further west. In connection therewith the borough surveyor has been instructed to take measurements and submit plans. It is suggested that the "island" at Talbot-road Station shall be 2 ft. wide.

Walsall T.C. The annual balance-sheet of the tramways undertaking shows a nett profit of £3,392, after deducting the following amounts: £500 on account of £1,000 to be contributed to the rates; £514 on account of the purchase of cars; £368 on account of the extension of the Birchills depot; and £603 for the purchase of a motor tower wagon.

Removal of House Refuse in London. At the annual meeting of the Metropolitan Boroughs Joint Committee the following resolution was passed on the subject of the interrogations by the London County Council with respect to the removal of house refuse: "That each sanitary authority should continue to be free to arrange for the removal of house refuse from premises once a week or oftener at their discretion, and that the local authorities should be empowered to compel occupiers of premises to place such refuse in proper receptacles in such convenient positions for removal as may be required by the sanitary authorities; and that the council members of the committee be requested to urge the London County Council to take steps to amend the Public Health (London) Act and the by-laws thereunder accordingly."

PERSONAL.

Mr. H. W. A. Carter, surveyor to the Matlock Bath Urban District Council, who was severely cut and bruised by being thrown from a motor-car, is progressing satisfactorily.

Mr. S. H. Chambers, surveyor to the Hampton Urban District Council, is, we are pleased to learn, recovering from his illness, and will leave on Saturday for a fortnight's stay at Brighton.

Teddington Urban District Council, at their meeting on Monday, decided to advertise for a clerk of works at £4 4s. per week, for the new sewage disposal works about to be commenced.

Mr. Harry Riding, surveyor, sanitary inspector and gas and water engineer to the Croston Urban District Council (Lancs), has been appointed to a similar position at Burley-in-Wharfedale (Yorks).

Mr. H. B. Howden, assistant surveyor to the Northfleet Urban District Council, has been appointed by the Board of Inland Revenue as valuation assistant on the staff of the chief valuer, Somerset House.

Mr. Francis P. Smith, M.AM.SOC.C.E., chemical and consulting paving engineer, New York City, on January 21st delivered an illustrated lecture on "Maintenance of Sheet Asphalt Pavements" before the Graduate Students in Highway Engineering at Columbia University.

Mr. Malcolm B. Bennett, LIC.R.I.B.A., of the Hove borough engineer's staff, has been awarded second place in order of merit in an open competition for a housing scheme at Belfast to cost £23,000. The designs, according to the assessor's report exhibited clever and simple planning.

Mr. Roland Fletcher, ASSOC.M.INST.C.E., at present assistant surveyor for the North Eastern Division of the County of Worcester, has been appointed by the county council to take charge of the Road Board reconstruction scheme, under the directions of the county surveyor, Mr. Chas. F. Gettings.

Dr. Houston, director of water examination to the Metropolitan Water Board, is about to proceed to Ottawa to advise the Canadian Government with regard to the prevalence of typhoid fever in that city. He will institute an inquiry into the condition of the water supply, to which, it appears, the trouble has been traced.

Mr. Albert Wollheim, ASSOC.M.INST.C.E., an engineer of wide experience in many parts of the world, died, we regret to learn, at St. Blasien, Black Forest, Germany, on the 1st inst. Mr. Wollheim, who was an accomplished linguist and an authority on municipal engineering on the Continent, was a frequent contributor to THE SURVEYOR, and was the author of "The Sewerage Engineers' Note Book." He was forty-seven years of age.

Mr. and Mrs. Willis Gale have been the recipients of many sincere wishes and handsome presents on the occasion of their silver wedding, which they celebrated recently. A silver salver, suitably inscribed, was presented to them on the 1st inst. by the members and officers of the Carshalton Urban District Council, another noteworthy gift being one from the council workmen who, at a supper to which they were entertained by the surveyor and his wife, presented the latter with a set of silver candlesticks and a silver pen-tray.

Mr. Edward J. Stead, ASSOC.M.INST.C.E., P.A.S.I., has been appointed county surveyor for the north-western division of Devon, at a salary of £400 per annum, with £200 per annum for travelling expenses. Mr. Stead commenced his career under the Lancashire county surveyor, and was subsequently for five years assistant to the Lancashire county bridge master, whose service he left on being appointed assistant district engineer in the Natal Public Works Department, South Africa. In 1908 he returned to England, and has for the last four years held the appointment of assistant county surveyor for Somerset.

Mr. J. W. Cockrill was congratulated by the General Purposes Committee of the Yarmouth Town Council, on Tuesday last, upon having been unanimously nominated president-elect of the Institution of Municipal and County Engineers for the ensuing year. In a report the committee expressed their gratification at the distinction which had been conferred upon Mr. Cockrill and on the borough, and it was unanimously resolved to appoint the Mayor and ex-Mayors a special committee to make arrangements for the annual meeting of the institution in July. The Mayor (Councillor R. G. Westmacott) added his felicitations to those of the committee, and promised that they would not only make the visit of Mr. Cockrill's professional friends to Yarmouth a pleasant one, but would also show them that he was honoured in his own town. The Deputy Mayor also spoke in appreciation of Mr. Cockrill.

"THE SURVEYOR'S" COMING-OF-AGE.

FURTHER FELICITATIONS.

Congratulations on our recent "coming-of-age" continue to reach us.

Mr. T. W. A. Hayward, borough engineer, Battersea, writes: Heartiest congratulations on your attainment of your "majority." I always look forward to Friday and the receipt of THE SURVEYOR with its budget of up-to-date information.

Mr. W. W. Crosby, M.AM.SOC.C.E., Baltimore, U.S.A., writes: Accept from one of your newer acquaintances, but one of your heartiest admirers, congratulations and good wishes on the attainment of your majority. May your future be none the less brilliant.

Mr. W. Willis Gale, surveyor, Carshalton Urban District Council.—Allow me to tender my congratulations on your recent anniversary. THE SURVEYOR is now of sturdy growth, full of vigour and mentally brilliant, largely due to the pabulum so regularly administered by its Editor.

By way of celebrating the "coming-of-age" of THE SURVEYOR, a special issue is published of that journal. "Then and Now, 1892-1913" is an interesting survey of the progress and development of engineering science and of the growth of the present system of municipal government. THE SURVEYOR will be congratulated widely on completing twenty-one years of very useful service, and its progress in the years to come may be expected to be as lasting and as assured as it has been since its foundation in the year 1892. *Westminster Gazette.*

MANCHESTER DEPUTY SURVEYORSHIP.

THE SELECTED CANDIDATES.

The following is the list of selected candidates for the deputy surveyorship of Manchester - viz., Messrs. A. F. Binnie, London; Thos. P. Collinge, borough engineer, Mansfield; N. F. Dennis, borough engineer, West Hartlepool; J. Rush Dixon, borough engineer, Woolwich; J. P. Harris, London County Council; H. F. Gullan, superintendent of works, Belfast; T. Moulding, city surveyor, Exeter; J. S. Pickering, borough engineer, Cheltenham; L. Roseveare, borough engineer, South Shields; H. Tremelling, borough engineer, Newport; H. Wontner-Smith, Bradford, and E. Worrall, surveyor to the Stretford Urban District Council.

The salary attached to the position is £750 per annum.

FOR OTHER ADVERTISEMENTS

See End of Paper.

TEDDINGTON URBAN DISTRICT COUNCIL

CLERK OF WORKS.

The above Council invite applications for the appointment of a Clerk of Works to supervise the works in connection with the erection of a Destructor and other buildings, Chimney Shaft, and the extension of Sewerage Works, &c., at the Sewage Disposal Works, Broom-road, Teddington.

The salary will be £4 4s. per week.

Candidates must have had recent experience in supervising similar works.

Applications, endorsed "Clerk of Works," stating age and experience, with copies of not more than three recent testimonials, which will not be returned, to be sent to me, the undersigned, not later than noon on Monday, the 3rd day of March next.

Canvassing Members or Officials of the Council, directly or indirectly, will be a disqualification.

(By Order)

G. H. SALMONS,
Clerk to the Council.

Elmfield House,
Teddington.
February 11, 1913.

EPSOM URBAN DISTRICT COUNCIL.

The Council are prepared to receive Tenders for laying about 7,300 sq. yds. of Wood Paving, and about 13,500 sq. yds. of Tar-macadam within their District.

The Plans, Conditions and Specifications may be seen, and Forms of Tender and other particulars obtained, on application to the Surveyor, Mr. Edward Robert Capon, Council Offices, Bromley Hurst, Church-street, Epsom, between the hours of 9 a.m. and 5 p.m., Saturdays between 9 a.m. and 1 p.m.

Sealed Tender, in Official Envelope which will be supplied, endorsed "Tender for Paving," must be received by the undersigned not later than 7.30 p.m. on Tuesday, March 11th, 1913.

The Contract is subject to the Local Government Board sanctioning the loan.

The Council do not bind themselves to accept the lowest or any Tender.

E. G. WILSON,
Solicitor and Clerk.

"Duncannon," Church-street,
Epsom.

TO CONTRACTORS AND OTHERS.

The Council of the Metropolitan Borough of Wandsworth is prepared to receive Tenders for the Making-up and Paving of Birchwood-road, Streatham.

The Specification and Drawings may be seen, and Forms of Tender obtained, of the Borough Engineer, Mr. P. Dodd, M.INST.C.E., at the Office of the New Streets Department, No. 56 East-hill, Wandsworth, S.W., between the hours of 10 and 4 (Saturdays, 10 and 12) upon payment of a deposit of Five Guineas.

Tenders, enclosed in sealed envelopes, and endorsed "Tender for Paving Birchwood-road," must be delivered at the Council House, East-hill, Wandsworth, S.W., and may be placed by the person tendering in the box provided for the purpose, not later than Four o'clock in the afternoon of Monday, the 3rd March next.

Persons tendering must, in the case of all workmen employed by them in and about the execution of the Contract, pay wages at not less and observe hours of labour not greater than the rates and hours recognised by the Associations of Employers and Employees and in practice obtained in the District where the work is to be executed.

No Tender will be received unless it be made on one of the forms provided for the purpose. The Council does not pledge itself to accept the lowest or any Tender. If required the Contractor must provide two sureties for the due execution of the Contract.

D. A. NICHOLL,
Town Clerk.

Council House,
Wandsworth, S.W.
February 13, 1913.

FRIERN BARNET URBAN DISTRICT COUNCIL.

ROAD IMPROVEMENT.

The above-named Council invite Tenders from experienced Road Contractors for Works required to be done in widening a length of the Colney Hatch-Lane, including Fencing, Kerbing, Channelling, Surface-water Gullies, Forming Footpath and Carriageway, &c.

Forms of Tender and full particulars can be obtained from Mr. E. J. Reynolds, ASSOC.M.INST.C.E., the Council's Engineer and Surveyor.

Sealed Tenders should be delivered to me at or before noon on Thursday, the Twenty-seventh day of February, 1913.

The Council does not bind itself to accept the lowest or any Tender.

(By order)
EDWIN GOODSHIP,
Clerk of the Council.

Council Offices,
The Priory,
Friern Barnet, N.
February 12, 1913.

LYTHAM URBAN DISTRICT COUNCIL.

HARDWOOD BLOCKS.

The Lytham Urban District Council invite Tenders for the delivery at Lytham of 32,000 Jarrah Wood Blocks. Specifications and Form of Tender may be had from the Surveyor to the Council, Mr. A. J. Price. Tenders, endorsed "Wood Blocks," to be delivered at the Office of the undersigned on or before Monday, the 24th instant.

(Signed) CHAS. A. MYERS,
Clerk to the Council.

February 12, 1913.

THE RURAL DISTRICT COUNCIL OF UTTOXETER.

The Rural District Council invite Tenders for the Supply of Broken Granite, Limestone, and Cold-blast Slag, for the year ending March 31st, 1914.

Forms of Tender may be obtained from the Council's Surveyor, Mr. W. Walker, Carter-street, Uttoxeter.

Sealed Tenders, endorsed "Materials," must be sent in to me not later than Monday, February 24th.

The Council do not bind themselves to accept the lowest or any Tender.

F. S. HAWTHORN,
Clerk to the Council.

Market-place,
Uttoxeter.
February 11, 1913.

GENTLEMAN having excellent connection among Surveyors in London, the Midland, Eastern, Southern and Western Counties will be pleased to accept additional agencies from specialist firms.—H. T., office of THE SURVEYOR, 24 Bride-lane, Fleet-street, E.C.

DROXFORD RURAL DISTRICT.

SUPPLY OF GRANITE OR HARD STONE.

The Rural District Council of Droxford invite Tenders for the Supply and Delivery of about 2,300 tons of Granite or Hard Stone.

Forms of Tender may be obtained of Mr. A. V. Carter, Surveyor, Droxford, near Bishop's Waltham, Hants.

Tenders must be delivered to me in an envelope, sealed and endorsed "Tender for Granite," not later than Monday, the 3rd March, 1913.

The Council do not bind themselves to accept the lowest or any Tender.

(By Order)
H. GODFREY PEARSON,
Clerk.

Bishop's Waltham, Hants.
February 12, 1913.

URBAN DISTRICT OF FINCHLEY.

GRIT FOR TAR-PAINTING.

The Council of the above-named District invites Tenders for the Supply and Delivery on rail, at the following stations on the High Barnet Branch of the Great Northern Railway—viz., East Finchley, Finchley (Church End), Woodside Park, and Totteridge, and the following station on the Great Northern Railway Main Line—viz., New Southgate—of 1,000 tons of Gritting Material, ranging from dust to $\frac{5}{8}$ of an inch, at such times, at such stations, and in such quantities as the Engineer may direct.

The Council also to have the right to order up to 1,600 tons without any increase in the price per ton quoted.

Specification and Form of Tender may be obtained on application to the Council's Engineer, Mr. C. J. Jenkin, M.INST.C.E., at the Council Offices, Church End, Finchley.

Sealed Tenders, on the prescribed Form, endorsed "Grit for Tar-painting," to be delivered to the undersigned not later than 4 p.m. on the 4th March, 1913.

The Council does not bind itself to accept the lowest or any Tender.

E. H. LISTER,
Clerk of the Council.

Council Offices,
Church End,
Finchley, N.
February 12, 1913.

ESSEX COUNTY COUNCIL.

HIGHWAYS COMMITTEE.

WIDENING OF HEYBRIDGE, MALDON.

Tenders are invited for the execution of the necessary works involved in widening Heybridge at Maldon.

The greater part of the work will be in brickwork and concrete to match the existing structure.

Drawings may be seen, and Bills of Quantities obtained, upon application to the County Surveyor of Essex at Chelmsford.

Tenders are to be delivered to this Office not later than Monday, February 24th, 1913.

PERCY J. SHELDON, M.INST.C.E.,
County Surveyor.

County Surveyor's Office,
Chelmsford.
February 12, 1913.

BUILDING BY-LAWS.

SKEGNESS SURVEYOR'S REPORT.

New building by-laws have recently been approved by the Urban District Council of Skegness, Lincs., and submitted to the Local Government Board, and the surveyor to the local authority, Mr. R. H. Jenkins, has prepared the following statement as to the more important differences between the proposed set and the by-laws at present in force within the district:—

(1) The corners at the junction of any new front street with another street to be rounded at a radius of 8 ft.

(2) Front streets to be 36 ft. in width at least, and if exceeding 300 yds. in length to be not less than 40 ft. in width. Streets to be used as secondary means of access to be 20 ft. in width at least.

(3) Coal houses, garden-tool houses or cycle sheds exempted from the operations of the by-laws, if not above 600 cub. ft. capacity, or if above that capacity 10 ft. away from any other building.

(4) Sites of domestic, public and warehouse buildings to be covered with 4 in. Portland cement concrete (7 -1) rammed solid and properly grouted.

(5) Walls may be built of hollow blocks of concrete; and timber-framed walls are allowed under certain conditions.

(6) Walls of public and warehouse buildings may be constructed with steel or iron framework if sufficiently strong and filled in with hard and incombustible materials.

(7) Party walls need not be above 9 in. thick (unless any storey is above 12 ft. in height) whatever the length or height but the foundations must be of the same dimensions as if the wall were subject to the by-laws as to thickness.

(8) Thickness of external and cross walls reduced in certain instances.

(9) Footings to 9-in. walls may be dispensed with if good cement concrete 9 in. thick and 18 in. wide is provided.

(10) Dampcourses to be of sheet lead, two courses of slates laid in cement or sound blue bricks well laid and grouted in cement.

(11) Timber joists may be taken into party walls if the ends are encased in 4½ in. of brickwork or other incombustible material, and do not extend beyond the centre line of the party wall.

(12) Outbuildings not above a certain size may be built of brickwork 4½ in. thick if laid in cement mortar.

(13) Provisions as to the strength required of timber used in the construction of new buildings inserted.

(14) 100 super. ft. of impervious paving to be provided to each dwelling house.

(15) Every dwelling-house to be provided with a properly lighted and ventilated larder.

(16) Pipes for sewage drains to be of best glazed stoneware; iron pipes only to be used under buildings.

(17) When drains are connected to the sewers the insertion of the intercepting trap is made optional. If no chamber is provided near the sewer, an inspection shaft is to be provided with a proper cover.

(18) If a chamber is constructed in connection with an intercepting trap the invert is to be covered with a watertight cover.

(19) All manholes on drains are to be constructed of 9-in. brickwork laid in cement mortar.

(20) The fresh-air inlet is not required, and ventilators at the top of the drain and soil pipes to be of heavy soil pipe pattern iron pipes with yarn, and caulked lead joints or lead with properly wiped joints.

(21) No provision is made for fixed ashpits.

(22) Habitable rooms to be of a minimum height of 8 ft., and where wholly or partly in the roof, no part to be less than 5 ft. high.

(23) All plans to be submitted in duplicate.

(24) Notice is required to be given when the site of a building is concreted.

(25) A certificate of completion is required to be given before a house may be occupied.

The intention of the Roads and Buildings Committee throughout the course of their work has been: (1) To save unnecessary expense in building operations; (2) to protect the town, as far as possible, from "jerry-building"; (3) to give more latitude to intending builders; (4) to improve and safeguard the health of all who occupy the buildings.

INSTITUTION OF MUNICIPAL AND COUNTY ENGINEERS.

President—Mr. R. J. THOMAS, M.INST.C.E., County Surveyor, Buckinghamshire.

EAST MIDLAND DISTRICT.

An East Midland District meeting will take place at Newark to-morrow (Saturday).

SOUTHERN DISTRICT MEETING.

A meeting of the Southern District will be held at Southampton on Saturday, February 22nd.

NORTH-EASTERN DISTRICT.

A meeting of the members of the North-Eastern District will be held in Leeds on Saturday, March 8th.

A meeting of the institution will be held in the North-Eastern District at Newcastle-on-Tyne on May 2nd and 3rd next.

ANNUAL MEETING AND TOWN-PLANNING CONFERENCE.

The Fortieth Annual General Meeting and Conference with delegates from local authorities on Housing and Town Planning will be held at Great Yarmouth on July 23rd, 24th, 25th and 26th next. Those desirous of reading papers at either of these meetings are requested at once to communicate with me.

By order of the Council,

THOMAS COLE,
11 Victoria-street, S.W. *Secretary.*

INSTITUTION OF MUNICIPAL ENGINEERS.

President—Mr. FRANK LATHAM, M.INST.C.E.I., F.S.E., Borough Engineer and Surveyor, Penzance.

COUNCIL MEETINGS.

The following council meetings have been arranged: February 22nd, Newcastle-on-Tyne; March 26th, London; April 30th, London; May 31st, Manchester; June 28th, London; July 30th, London.

GENERAL MEETING.

A visit will be paid to the Building Exhibition at Olympia on April 12th, by kind permission of the promoters. Full particulars will be issued later.

NORTHERN DISTRICT.

A meeting of this district (of which particulars will be given later) will be held at Newcastle-on-Tyne on the date of the council meeting, February 22nd.

EXAMINATIONS.

The next examination will be held in London and other centres during the week ending May 17th next. Copies of syllabus and forms of application to sit may be obtained from the secretary. Intending entrants are requested to make early application.

B. WYAND,
39 Victoria-street, S.W. *Secretary.*

ROYAL SANITARY INSTITUTE.

SOUTH AFRICAN BRANCH CONGRESS.

The second congress of the South African Branch of the Royal Sanitary Institute is to be held in Johannesburg from March 10th to 12th next.

E. WHITE WALLIS,
Secretary.

SEA-COAST EROSION.—For a very complete and inexpensive library on the cause, prevention and repair of coast erosion the following three works are recommended: "Coast Erosion and Foreshore Protection," by John S. Owens, M.D., Assoc.M.Inst.C.E., F.R.C.S., and Gerald O. Case (price 7s. 6d., post free 7s. 10d.), with numerous illustrations and diagrams; "Sea-Coast Erosion and Remedial Works," by R. C. Allanson-Winn, M.Inst.C.E.I. (price 1s., post free 1s. 1d.); and "Erosion of the Coast and its Prevention," by F. W. S. Stanton, Assoc.M.Inst.C.E., F.S.I. (price 3s., post free 3s. 2d.), with numerous maps and other illustrations. The publishers are the St. Bride's Press, Limited, 24 Bride-lane, Fleet-street, London, E.C.

APPOINTMENTS VACANT.

Official and similar advertisements received up to 4.30 p.m. on Thursdays will be inserted in the following day's issue, *but these responsible for their despatch are recommended to arrange that they shall reach* The Surveyor *office by noon on* Wednesdays *to ensure their inclusion in the weekly list of summaries. Such advertisements may, in cases of emergency only, be telephoned (No. 1359 Holborn), subject to later confirmation by letter.*

INSPECTOR OF MAIN ROADS.—February 15th.—Warwickshire County Council. £175—£210 per annum. —Mr. John Wilmot, county surveyor.

CLERK OF WORKS.—February 15th.—Chatham Education Committee. £3 3s. per week.—Mr. J. Thompson, secretary, Town Hall.

ASSISTANT SURVEYOR.—February 17th.—Worcestershire County Council £175 per annum.—Mr. S. Thornley, clerk.

CLERK OF WORKS.—February 17th.—Corporation of Manchester. £3 3s. per week.—Mr. Thomas Hudson, town clerk.

OUTDOOR ENGINEERING ASSISTANT.—February 17th.—Corporation of Manchester. £200 per annum.—Mr. Thomas Hudson, town clerk.

DRAUGHTSMAN.—February 17th.—South Australian Government Railways. £250 per annum.—Agent-General for South Australia, 85 Gracechurch-street, London, E.C.

ARCHITECTURAL ASSISTANT.—February 17th.—Staffordshire Education Committee. £110—£150.—Director, County Education Offices, Stafford.

WATER INSPECTOR. — February 17th. — Bridgwater Rural District Council. 32s. per week.—Mr. W. A. Collins, engineer, 56A Eastover, Bridgwater.

ARCHITECTURAL ASSISTANT.—February 18th. —Corporation of Burnley. £2 15s. per week.—Mr. Peregrine Thomas, town clerk.

SANITARY SURVEYOR AND INSPECTOR OF NUISANCES.—February 18th.—St. Austell Rural District Council. £150—£200.—Mr. John Stephens, clerk.

ASSISTANT BOROUGH SURVEYOR.—February 19th.—Corporation of Richmond (Surrey). £250 per annum.—Mr. Henry Sagar, town clerk.

ASSISTANT INSPECTOR.—February 19th.—Durham Rural District Council. 30s. per week.—Mr. J. Chambers, clerk, 40 Saddler-street, Durham.

INSPECTOR OF NUISANCES.—February 20th.—Croydon Rural District Council. £130 per annum.—Mr. E. J. Gowen, clerk, Council Offices, Katherine-street, Croydon.

ENGINEER. — February 21st. — Wick Harbour Trustees. £250 per annum.—Mr. D. W. Georgeson, harbour secretary, Wick.

WORKING ROAD FOREMAN.—February 21st.—Derbyshire County Council. 30s. per week.—Mr. J. W. Horton, county surveyor, County Offices, St. Mary's-gate, Derby.

SURVEYOR, INSPECTOR, COLLECTOR, AND GAS MANAGER.—February 21st.—Croston Urban District Council. £90 per annum.—Messrs. Forshaw Parker & Co., clerks, 9 Cannon-street, Preston.

JUNIOR SURVEYOR AND DRAUGHTSMAN.—February 24th.—East Sussex County Council. £65 per annum.—Mr. F. J. Wood, county surveyor.

ROAD AND GENERAL FOREMAN.—February 24th.—Corporation of Hartlepool. 35s. per week.—Mr. A. P. Horsley, borough engineer and surveyor.

ARCHITECT.—February 25th.—Corporation of Swansea. £500 per annum.—Mr. H. Lang Coath, town clerk.

ROAD FOREMAN.—February 27th.—Merton Urban District Council £2 per week.—Mr. G. Jerram, surveyor, Council Offices, Kingston-road, Merton.

ASSISTANT EXAMINER OF TECHNICAL ACCOUNTS.—March 1st.—For His Majesty's Office of Works. £150—£300.—The Secretary, H.M. Office of Works, Storey's-gate, London, S.W.

CLERK OF WORKS.—March 1st.—Cardiff Education Committee. £3 10s. per week.—Mr. J. J. Jackson, Education Offices, City Hall.

ASSISTANT ENGINEERS. — May 1st.—Indian Public Works and State Railway Departments.—Secretary, Public Works Department, India Office, London, S.W.

THIRD CLASS CLERK.—Wanted at once, in the county surveyor's department, Essex County Council. £60—£90.—County Surveyor, Chelmsford.

CLERK OF WORKS.—Wexford County Council. Mr. W. F. Barry, county surveyor.

MUNICIPAL COMPETITIONS OPEN.

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LLANGOLLEN.—February 26th.—Designs for laying out a pleasure garden, for the Llangollen Urban District Council. A prize of 2 guineas is offered.—Mr. J. W. Hughes, surveyor.

RANGOON.—March 1st.—Designs for municipal buildings. Premiums are offered of £300, £200, and £100.—The Clerk to the Rangoon Municipality.

WINNIPEG.—March 1st.—Designs for city hall. Limited to British architects in Canada. Premiums are offered of 5,000 dols., 3,000 dols., and 2,000 dols.—The Clerk.

IPSWICH.—March 31st.—Designs for laying out 26 acres as a working-class suburb on the lines of a modified garden city. Premiums of 50 guineas, 30 guineas, and 20 guineas are offered.—Mr. W. Bantoft, town clerk.

BARNET.—April 29th.—Designs for schemes for the erection of new municipal offices, at a cost not exceeding £4,000, for the Barnet Urban District Council. Premiums of £25, £15, and £10 are offered. —Mr. H. W. Poole, clerk 40 High-street, Barnet.

TIVERTON.—No date.—Plans and specifications for laying out a site for working-class dwellings, for the corporation. Competition limited to residents in Devon and Somerset.—Borough Surveyor.

MUNICIPAL CONTRACTS OPEN.

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Buildings.

CARNARVON.—February 17th.—For the erection of twenty-five artisans' dwellings, for the corporation.—Mr. E. Hall, borough surveyor.

BARROW-IN-FURNESS.—February 17th.—For the erection of an infants' school, for the corporation.—Borough Engineer and Surveyor.

BIRMINGHAM.—February 17th.—For the erection of weights and measures offices, for the corporation.—Mr. Henry E. Stilgoe, city engineer and surveyor.

EDINBURGH.—February 17th.—For alteration of the offices of the Edinburgh and District Water Trust.—Mr. W. Boyd, clerk, 12 St. Giles-street.

WIGTON.—February 17th.—For the construction of a concrete retaining wall, for the rural district council.—Mr. J. F. W. Ritson, clerk.

BRADFORD.—February 18th.—For the erection of eight workmen's dwellings, for the corporation.—Mr. F. Stevens, town clerk.

GELLYGAER.—February 18th.—For the erection of fence walls, iron railings, alterations at council offices, and other works, for the urban district council.—Mr. F. T. James, clerk.

BARKING.—February 18th.—For the erection of workmen's dwellings, for the urban district council. —Mr. H. Hargreaves, clerk.

DARWEN.—February 19th.—For the erection of dwellings, for the corporation.—Mr. R. W. Smith-Saville, borough surveyor.

BURY.—February 19th.—For the erection of shed, messroom, and stores, for the corporation.—Town Clerk.

NOTTINGHAM. — February 20th.—For builders' work and ironwork in connection with the extension of the power station, for the corporation.—Mr. W. J. Board, town clerk.

WEST RIDING.—February 21st.—For the erection of a school, for the Education Committee.—The Clerk of the County Council, Wakefield.

BRITON FERRY.—February 22nd.—For the erection of sixty-two houses in rows of 9, 10, 11, 12 and 20 houses respectively, for the urban district council.—Mr. H. Alex. Clarke, architect and surveyor.

WEST RIDING.—February 22nd.—For the supply of masonry and steelwork affecting Glasburn Bridge,

for the Highways Committee.—Mr. F. G. Carpenter, West Riding surveyor, County Hall, Wakefield.

BIRKENHEAD.—February 22nd.—For the construction of a covered service reservoir and ancillary works, for the corporation.—Mr. James Fearnley, town clerk.

ROCHESTER.—February 24th.—For the erection of engine-house and gas-producer house at waterworks, for the corporation.—Mr. W. Banks, city surveyor.

RHONDDA.—February 25th.—For the erection of refuse destructor and electrical generating works, for the urban district council.—Mr. W. P. Nicholas, clerk.

SOUTHGATE.—February 25th.—For the extensions and alterations of the municipal offices, for the urban district council.—Mr. W. M. Ellenor, clerk.

WEXFORD.—February 26th.—For the erection of a reinforced concrete bridge at Deeps, for the county council.—Mr. W. F. Barry, county surveyor.

CARDIFF.—March 1st.—For the erection of a technical institute, for the Education Committee.—Director of Education, Education Offices.

CHELMSFORD.—March 3rd.—For the erection of new offices, for the rural district council.—Mr. Arthur S. Duffield, clerk.

BIGGLESWADE.—March 3rd.—For the erection of a filter-house, for the Water Board.—Mr. A. Chaundler, clerk.

WILTS.—March 4th.—For the erection of new county offices and other works, for the county council.—Mr. J. G. Powell, county surveyor, Trowbridge.

FALMOUTH.—March 5th.—For the erection of twenty-two houses, with alternative prices for forty-four, for the corporation.—Borough Engineer.

Iron and Steel.

WEDNESBURY.—February 17th.—For the supply and fixing of iron railings and gates, for the corporation.—Mr. E. Martin Scott, borough surveyor.

LANCHESTER.—February 18th.—For laying cast-iron pipes and syphon valves, for the rural district council.—Mr. W. H. Ritson, clerk.

MACCLESFIELD.—February 21st.—For the supply of cast-iron pipes and connections for a water main, for the corporation.—Mr. F. R. Oldfield, town clerk.

BARRY.—February 21st.—The council offer for sale 300 second-hand treeguards.—Mr. J. C. Pardoe, surveyor.

BRADFORD.—February 22nd.—For the supply of tram rails and steel poles, for the corporation.—Mr. F. Stevens, town clerk.

WANTAGE.—February 28th.—For supplying and laying about 550 yds. of 2-in. and 3-in. cast-iron mains, the construction of service reservoir, syphon chamber, and brickwork to adits, for the rural district council.—Mr. E. B. Ormond, clerk.

CHEPPING WYCOMBE.—March 5th.—For the supply of cast-iron pipes, wrought-iron tubing, and brass fittings, for the corporation.—Mr. T. J. Rushbrooke, borough surveyor and water engineer.

WIRKSWORTH.—March 7th.—For the supply of cast-iron manhole and lamphole covers, cast-iron pipes, ventilating columns, disc valves and other ironwork, and the supply and erection of three revolving sprinklers, for the urban district council.—Mr. J. Gratton, clerk.

BOMBAY.—March 25th.—For supplying and laying about 19 miles of 50-in. diameter steel main, for the municipality.—Mr. H. J. Trivess Smith, hydraulic engineer, Municipal Offices, Bombay.

Roads.

MAIDSTONE.—February 15th.—For the supply of road materials, for the rural district council.—Mr. R. Hoar, clerk.

ROTHERHAM.—February 15th.—For making up a certain street, for the corporation.—Mr. C. L. Des Forges, town clerk.

WORSLEY.—February 15th.—For making up certain streets, for the urban district council.—Mr. J. F. Monks, clerk.

WISBECH.—February 15th.—For the supply of granite, ironstone slag, gravel, ragstone and clunch, for the rural district council.—Mr. A. G. Catling, highway surveyor.

WIRRAL.—February 15th.—For making up certain roads, for the rural district council.—Mr. William Henry Churton, clerk.

SURBITON.—February 17th.—For the supply of road materials, brooms, and horse-sweeping brooms, for the urban district council.—The Clerk.

SEVENOAKS.—February 17th.—For the supply of 8,000 gallons of refined tar and 20,000 gallons of crude tar, for the urban district council.—Mr. P. Darbyshire, clerk.

WEST SUFFOLK.—February 17th.—For the supply of broken material, for the county council.—Mr. W. Lionel Jenkins, county surveyor, Bury.

CHERTSEY.—February 17th.—For making up certain streets, for the rural district council.—Mr. H. E. Paine, clerk.

FINCHLEY.—February 17th.—For the supply of 30,000 gallons of tar, for the urban district council.—Mr. E. H. Lister, clerk.

FORMBY.—February 17th.—For making-up certain streets, for the urban district council.—Mr. E. H. Bond, clerk.

LOUTH.—February 17th.—For the supply of granite and slag, for the rural district council.—Mr. F. C. Chard, clerk.

BLACKBURN.—February 17th.—For making up a certain road, for the corporation.—Mr. W. Stubbs, borough engineer.

EAST SUFFOLK.—February 17th.—For work of steam rolling, for the county council.—Mr. A. Townshend Cobbold, clerk, Ipswich.

MACCLESFIELD.—February 17th.—For the supply of road stone, setts, edging stones, walling rubble from local quarries, and copper slag, for the rural district council.—Mr. F. Harrison, assistant clerk.

PLYMOUTH.—February 17th.—For making up certain roads, for the corporation.—Mr. J. Paton, borough engineer.

GLASGOW.—February 17th.—For paving works with compressed rock asphalt and tar-macadam, for the corporation.—Mr. J. Lindsay, town clerk.

LONG SUTTON (Lincs).—February 18th.—For the supply of broken granite, broken slag, slag screenings and tar macadam, for the urban district council.—Mr. S. S. Mossop, clerk.

LEIGH-ON-SEA.—February 18th.—For making up several streets, for the urban district council.—Mr. E. P. Wheatley, clerk.

NEARNE.—February 18th.—For the supply of dross, screenings, granite and tar, for the rural district council.—The Clerk.

ELY.—February 18th.—For the supply of 4,210 tons of granite and 1,010 tons of gravel, for the rural district council.—Mr. E. B. Claxton, clerk.

MARGATE.—February 19th.—For the supply of Kent rag asphalt, hardcore, and pit flints, for the corporation.—Mr. E. Brooke, town clerk.

MUTFORD AND LOTHINGLAND.—February 19th.—For the supply of granite, flint, gravel, and path shingle, for the rural district council.—Mr. E. S. Norton, clerk.

ARGYLL.—February 19th.—For road diversion, for the county council.—Mr. Richard Callen, road surveyor, Dunoon.

TURTON.—February 19th.—For the reconstruction of a main road, for the urban district council.—Mr. J. B. Goulburn, clerk, Bromley Cross, near Bolton.

LEIGH-ON-SEA.—February 19th.—For the supply of road materials, for the urban district council.—Mr. F. P. Wheatley Down, clerk.

HORBURY.—February 20th.—For the supply of tarmac, granite, whinstone, limestone, dross, flags, kerbs, and setts, for the urban district council.—Mr. W. Sugars, engineer and surveyor.

NEWBURN.—February 20th.—For the supply of road materials and haulage, for the urban district council.—Mr. George Wilkinson, clerk.

LUTON.—February 20th.—For works of private street improvement, for the corporation.—Mr. W. Smith, town clerk.

THAKEHAM.—February 20th.—For the supply of road material, for the rural district council.—Mr. Percy Ayling, clerk, Council Offices, Storrington.

FLAXTON.—February 20th.—For the supply of whinstone and slag, for the rural district council.—The Clerk.

HAMPSTEAD.—February 20th.—For providing and laying creosoted deal wood-paving blocks in Fortune Green-road, and asphaltic macadam in Broadhurst-gardens and Adelaide-road, for the borough council.—Mr. Arthur P. Johnson, town clerk.

SPALDING.—February 20th.—For the supply of granite and slag, for the rural district council.—Mr. H. S. Maples, clerk.

KETTERING.—February 20th.—For the supply of granite, slag and tar-macadam, for the rural district council.—Mr. W. Hadley Darby, surveyor.

DONCASTER.—February 20th.—For the supply of dross and granite, for the rural district council.—Mr. H. M. Marshall, clerk.

HODDESDON.—February 21st.—For watering the streets, for the urban district council. Chairman of the Highways Committee.

BACUP.—February 21st.—For work of sewering and paving, for the corporation. Mr. J. Entwistle, town clerk.

CHELMSFORD.—February 21st.—For the supply of road materials and labour haulage, for the rural district council.—Mr. F. E. H. Powell, surveyor of highways.

LEYLAND.—February 21st.—For the supply of broken granite, slag, limestone, tar-macadam, kerbs, setts, rubble, and concrete and other flags, for the urban district council.—Mr. M. H. Wilkinson, surveyor.

SOUTH SHIELDS.—February 22nd.—For providing and laying *in situ* concrete for footways and back streets, for the corporation.—Mr. J. Moore Hayton, town clerk.

COSFORTH.—February 22nd.—For the supply of Northumberland whinstone, setts, cubes, chips, granite kerb, cement, cement concrete flags and steam rolling, for the urban district council.—Mr. R. S. Holmes, clerk.

BELVOIR.—February 22nd.—For the supply of materials, cartage, and manual labour, for the rural district council.—Mr. A. E. Pearson, clerk for highway purposes, 4 St. Peter's-hill, Grantham.

SIBSEY.—February 22nd.—For the supply of broken granite, for the rural district council.—Mr. J. M. Simpson, clerk, 28 Wide-bargate, Boston.

BILLESDON.—February 22nd.—For the supply of broken granite and cement chippings, for the rural district council.—Mr. W. E. Richardson, clerk.

PONTYPRIDD.—February 22nd.—For making up certain streets, for the urban district council.—Mr. J. Colenso Jones, clerk.

BEDFORDSHIRE.—February 22nd.—For the supply of broken granite, slag, flints, gravel, and cartage, for the county council.—Mr. W. W. Marks, clerk, Shire Hall, Bedford.

CLAYPOLE.—February 24th.—For the supply of granite and slag, for the rural district council.—Mr. A. J. Franks, clerk.

BOTHWELL.—February 24th.—For paving 1,300 sq. yds. of paving, for the urban district council.—Mr. W. Dodgson, clerk.

EPSOM.—February 24th.—For the supply of road materials and road watering, for the rural district council.—Mr. Arthur R. Cotton, clerk.

LITTLE HULTON.—February 24th.—For the supply of broken granite, grit setts, granite setts, granite and limestone chippings, and grit kerbs, for the urban district council.—Mr. J. H. Heyes, clerk.

SEATON DELAVAL.—February 25th.—For the supply of tarred whinstone, tarred slag, hire of steam roller, and team labour, for the urban district council.—Mr. Anthony Dodds, surveyor.

EPSOM.—February 25th.—For making-up Woodcote Park-road, for the urban district council.—Mr. E. G. Wilson, clerk.

AYLLSBURGH.—February 25th.—For the supply of flints, granite, marl, beach stones, clay, and team labour, for the rural district council.—Mr. Fairrax Barnes, clerk.

WOODFORD.—February 25th.—For the supply of road granite, chippings, tar, pitch, and creosote oil, for the urban district council.—Mr. W. Farrington, surveyor, Woodford Green.

BALLING.—February 25th.—For the supply of gravel, basalt or granite, for the rural district council.—Mr. T. J. Alcock, clerk.

HULL.—February 26th.—For the supply of 8,000 tons of stone for macadamising, for the corporation.—Mr. A. E. Wells, city engineer.

HAMPTON.—February 27th.—For the supply of hand-broken granite chippings, Kentish brown flints, and Derbyshire limestone marble tar-paving material, for the urban district council.—Mr. S. H. Chambers, surveyor.

BELPER.—March 1st.—For the supply of highway materials, for the rural district council.—Mr. R. C. Cordon, engineer and surveyor, Duffield, near Derby.

EAST RIDING.—March 1st.—For the supply of 7,000 tons of stone for macadamising the main roads, for the county council. Clerk, County Hall, Beverley.

EAST RETFORD.—March 1st.—For the supply of broken granite and slag, for the rural district council. Mr. C. B. Smith, clerk.

REPTON.—March 1st.—For the supply of broken granite, limestone, slag, broken boulders, and local gravel, for the rural district council. Mr. T. R. Sidgwick, surveyor, Willington, Derby.

CHERTSEY.—March 3rd.—For the supply of Guernsey and Leicester granite, Hungry Hill flints, Farnham shingle and gravel, Mendip stone, chalk and macadam, for the rural district council.—Mr. Herbert Benney, surveyor.

DROXFORD.—March 3rd.—For the hire of steam rollers and scarifiers, for the rural district council.—Mr. H. Godfrey Pearson, clerk.

WALTHAM.—March 3rd.—For the supply of granite, flints, gravel, hoggin, ballast, sand, tar-macadam and tar, for the urban district council.—Mr. F. C. E. Jessopp, clerk, Waltham Abbey.

HIPPERHOLME.—March 3rd.—For the supply of macadam, for the urban district council. Mr. G. Wharton Thompson, engineer and surveyor.

DRIFFIELD.—March 8th.—For the supply of 7,000 tons of whinstone, 2,500 tons of broken slag, 600 tons of sea cobbles, 300 tons of sea gravel, and 150 tons of tarred chippings, for the rural district council.—Mr. T. Casson Beaumont, surveyor.

KING'S LYNN.—March 10th.—For the supply of road material, for the corporation.—Mr. Alfred J. Smith, borough surveyor.

TANGIER.—April 10th.—For the construction of a sewer and a road, for the Special Committee of Public Works, Commercial Intelligence Branch of the Board of Trade, 73 Basinghall-street, E.C.

HAMPSHIRE.—For executing certain road improvements, for the county council. Mr. H. Barber, clerk, The Castle, Winchester.

Sanitary.

WINDERMERE.—February 15th.—For laying and jointing stoneware pipe sewers and cast-iron pipe sewers, and constructing manholes, lampholes, sedimentation tanks, bacteria beds, effluent tanks, sludge lagoons, engine houses, pump wells and roads, for the urban district council.—Mr. J. T. Bownass, clerk.

GLASGOW.—February 15th.—For the erection of a public convenience, for the corporation.—Mr. J. Lindsay, town clerk.

COLCHESTER.—February 15th.—For cleansing the cattle market, for the corporation.—Mr. H. Goodyear, borough engineer and surveyor.

BALBY-WITH-HEXTHORPE.—February 17th.—For the construction of detritus tank, sewage tank, percolating filters, humus tanks, sand filters, and other works, for the urban district council.—Mr. Frank Allen, clerk.

MANCHESTER.—February 17th.—For the construction of main drainage work No. 8 new intercepting sewer, for the corporation. Mr. Thomas Hudson, town clerk.

MACCLESFIELD.—February 17th.—For laying sewers, manholes, and flushing tanks, for the rural district council.—Mr. F. May, clerk.

NORTHWICH.—February 17th.—For the removal of nightsoil, for the urban district council.—Mr. J. A. Cowley, clerk.

PORTHCAWL.—February 17th.—For the construction of surface-water drain and manholes, for the urban district council.—Mr. A. S. Lilley, engineer and surveyor.

LANCHESTER.—February 17th.—For alterations to sewage disposal works, for the rural district council.—Mr. W. H. Ritson, clerk.

STOCKPORT.—February 17th.—For the supply of sludge filter press cloths, lubricating oils and axle grease, petroleum, cotton waste, ironmongery goods, drysaltery and engine packing, for the Sewage Outfall Committee.—Mr. Robert Hyde, town clerk.

DUMBARTON.—February 18th—March 1st.—For work of scavenging, for the Sub-committee of Manage-

ment.—Mr. D. Dunbar, sanitary inspector, 24 George square, Glasgow.

LIVERSEDGE.—February 19th.—For the construction of sewage disposal works, for the urban district council.—Mr. T. Mitcheson, clerk.

KNOTTINGLEY.—February 19th.—For excavating and draining works, for the urban district council. Mr. A. Hartley, consulting surveyor.

LEWISHAM.—February 19th.—For the construction of a pipe and concrete sewer, for the borough council.—Surveyor's Department.

BURNLEY.—February 19th.—For the removal of ashpit and other refuse, for the corporation.—Mr. P. Thomas, town clerk.

LANARK.—February 19th.—For the construction of outfall and intercepting sewers and sewage tanks, for the District Committee of the Middle Ward. Mr. J. T. T. Brown, 97 West Regent-street, Glasgow.

CROYDON.—February 20th.—For emptying cesspools, for the rural district council. Mr. E. J. Gowen, clerk.

DUMFRIES.—February 21st.—For relaying section of main drain, for the corporation.—Mr. John Barker, burgh surveyor.

STAFFORD.—February 22nd.—For the construction of a sewer, for the corporation.—Mr. R. Battle, town clerk.

WALTON-LE-DALE.—February 22nd.—For cleaning pails and removing nightsoil, for the urban district council.—Mr. W. S. Woodcock, clerk.

BROMLEY.—February 22nd.—For the removal of refuse, for the rural district council.—Mr. E. Haslehurst, clerk.

RUGBY.—February 22nd.—For the removal of house refuse, for the rural district council.—Mr. J. W. Pendred, clerk.

LEYTON.—February 25th.—For the removal of house refuse, and the construction of a sewer, for the urban district council.—Mr. E. H. Essex, surveyor.

EPSOM.—February 25th.—For the removal of house refuse, and the supply of horses and men, for the rural district council.—Mr. W. T. Wooldridge, surveyor.

PORTSMOUTH.—February 26th.—For laying storm drains with manholes, for the corporation.—Mr. G. Hammond Etherton.

MACCLESFIELD.—February 26th.—For sewering work in two roads, for the corporation.—Mr. S. C. Baggott, deputy borough engineer.

PORT SAID.—March 1st.—For the construction of drainage works, for the municipality.—Mr. A. L. Webb, C.M.G., Queen Anne's Chambers, Broadway, Westminster.

SPRINGHEAD.—March 1st.—For the construction of sewage disposal works, for the urban district council.—Mr. R. Kilner, 25 Queen-street, Oldham.

WIRKSWORTH.—March 7th.—For the construction of about 12,000 lin. yds. of 15, 12, 10, 8 and 6 in. earthenware pipe sewers with manholes, settling tanks, storm-water tanks, filters, sludge beds, road making, and other works, for the urban district council.—Mr. J. Gratton, clerk.

Stores.

NORTHAMPTON.—February 15th.—For the supply of broken granite, granite kerb, setts, artificial stone paving, stoneware pipes, gullies, Portland cement, ironmongery, tar paving, tar-macadam, blue bricks, brooms, coal, iron castings, timber, and team labour, for the corporation.—Mr. Herbert Hankinson, town clerk.

HALIFAX.—February 17th.—For the supply of stores required in the electricity department, for the corporation.—Mr. Percy Saunders, town clerk.

RICHMOND (Surrey).—February 17th.—For the supply of ironfounder's work, brooms, forage, road materials, harness, and team labour, for the corporation.—Mr. Henry Sagar, town clerk.

LEEDS.—February 17th.—For the supply of requisites for the tramway department.—Mr. J. B. Hamilton, general manager.

FROME.—February 17th.—For the supply of scavenging brushes, cement, limestone, tools, kerbing, channelling, pennant and concrete flagging, for the urban district council.—Mr. H. E. Ames, clerk.

ECCLES.—February 18th.—For the supply of setts, flags, kerbs, broken rubble, granite and macadam chippings, prepared tar limestone, limestone cube chippings, gravel, cinders, castings, pitch, creosote, tar, Simpson's patent street gullies, stoneware-pipe gullies, stoneware pipes, bends, junctions, mortar, and channel stones, for the corporation.—Mr. Edwin Parkes, town clerk.

GOOLE.—February 19th.—For the supply of road metal (Guernsey granite and chippings), granite setts, slag, hardcore, concrete flags, York flags, kerb, channel, stoneware pipes, Portland cement, tar-macadam, brough gravel, coal and bricks, for the urban district council.—Mr. C. G. Bradley, engineer and surveyor.

LEEDS.—February 19th.—For the supply of requisites for the electricity department.—Mr. Robert E. Fox, town clerk.

RATHMINES AND RATHGAR.—February 19th.—For the supply of general articles for the ensuing year, for the urban district council.—Mr. F. P. Fawcett, clerk, Town Hall, Rathmines.

LEEDS.—February 20th.—For the supply of cement, earthenware drain pipes, sewer ironwork, galvanised dirt-boxes, and sewer ventilating columns, for the corporation.—Mr. W. T. Lancashire, city engineer.

GREENWICH.—February 20th.—For the supply of general stores and materials, for the borough council. Mr. Francis Robinson, town clerk.

WESTMINSTER.—February 20th.—For the supply of ballast, sand, bricks, brooms, road repairs, cement, lime, coal, disinfectants, drysaltery, flags, broken granite, setts, kerb, channels, stoneware gullies, iron castings, sewerage and drainage works, tarpaulin, and wood blocks, for the corporation.—Mr. John Hunt, town clerk.

CROYDON.—February 20th.—For the supply of road materials, Portland cement, cartage, brooms, and stoneware pipes, for the rural district council.—Mr. Ernest John Gowen, clerk.

BELFAST.—February 24th.—For the supply of earthenware sewer pipes, timber, slates, hardwood, iron castings, plumbers' nails, iron, steel, paints, oils, glazing, mill furnishings, shovels, spades, graipes, buckets, scavenging brushes, glazed bricks, artificial flags, lime, pitch, felt, tar, sea sand, sea gravel, Lough Neagh sand, cement uniform clothing and hats, for the corporation.—Mr. R. Meyer, town clerk.

CAMBRIDGE.—February 25th.—For the supply of timber, stoneware pipes, Portland cement, gravel, sand, brooms, paint, haulage, and horses, for the corporation.—Mr. J. E. L. Whitehead, town clerk.

MANSFIELD.—February 26th.—For the supply of granite, slag, tar-macadam, natural flags, kerbing, channelling and concrete flags, Portland cement, stoneware pipes, junctions, bends, timber, sewer ironwork and castings, coal, ironmongery and general stores, paints, oils, brooms, brushes, disinfectants, and harness, for the corporation.—Mr. J. Harrop White, town clerk.

SOUTHEND-ON-SEA.—February 26th.—For the supply of stoneware pipes, bends, flints, bricks, gravel, timber, ironmongery, paints, cement, team labour, forage, tar paving, tar-macadam, iron castings, granite kerb, channel, broken Guernsey granite, broken granite, pitch, harness, brooms, iron and steel, disinfectants, for the corporation.—Mr. H. J. Worwood, town clerk.

WINCHESTER.—February 27th.—For the supply of broken granite chippings, bass brooms, Portland cement, coal, coke, stoneware drain pipes, and concrete paving slabs, for the corporation.—Mr. Thomas Holt, town clerk.

AUCKLAND.—February 27th.—For the supply of road, sanitary and general stores, for the rural district council.—Mr. Sam Adams, clerk.

HAMPTON.—February 27th.—For the supply of hand-broken granite, granite chippings, broken Kentish brown flints, Derbyshire limestone, marble, tar-paving material, forage, coal, coke, and bass brooms, for the urban district council.—Mr. Sydney H. Chambers, surveyor.

SOUTH SHIELDS.—March 1st.—For the supply of Northumberland whinstone, Fifeshire whinstone, Aberdeen and Norwegian granite, slag, granite chippings, Caithness flags, Portland cement, cement concrete flags, cast ironwork, shovels, scavenger brooms and machine brooms, coal, coke, disinfectants, leather hose, sewer boots, jackets, sanitary pipes, paints, paint oils, glass, timber, iron, horseshoe nails, cart axles, springs, tar, pitch, oils, and general stores, for the corporation.—Mr. J. Moore Hayton, town clerk.

MIDDLETON.—March 1st.—For the supply of macadam, flags, setts (flag rock), kerbs, pipes, tipler closets, brushes, lime, alumino-ferric, press cloths, castings, pitch and oil, for the corporation.—Mr. Frederick Entwistle, town clerk.

EALING.—March 3rd.—For the supply of limes, pipes, cement, ironmongery, iron castings, paints, granite, gravel, disinfectants, refined tar, wood-paving repairs and slab laying, for the corporation.—Mr. Geo. E. Brydges, town clerk.

DERBY.—March 3rd.—For the supply of bar iron, bricks, brushes, castings, cement, lime, disinfectants, earthenware, freestones, gritstones, granite, hardware, ironmongery, glass, limestone, paints, oils, pitch, tar, slag, soap, soda, and timber, for the corporation.—Mr. John Ward, borough surveyor.

GUILDFORD.—March 5th.—For the supply of broken granite, chippings, granite setts, Durax cubes, brooms, brushes, cast-iron pipes, flints, galvanised steam tubes, disinfectants, horse hire, cartage, iron castings, ironmongery, oils, pitch, tar, Portland cement, lias lime, stoneware pipes, and shoeing, for the corporation.—Mr. A. D. Jenkins, town clerk.

SUTTON COLDFIELD.—March 8th.—For the supply of granite macadam and kerb, limestone macadam and setts, gravel and broken pebble stones, Yorkshire or pennant kerb, Rowley setts, earthenware pipes, cement, lime, iron castings, iron, steel, timber, hardware, oils, paints, and bass brooms, for the corporation.—Mr. W. A. H. Clarry, borough engineer and surveyor.

Miscellaneous.

LONDON.—February 17th.—For the cartage of import and export goods, and the supply of vans, carts, and trolleys, for the Port Authority.—Mr. F. Ayliffe, secretary, 109 Leadenhall-street, E.C.

WESTMINSTER.—February 19th.—For internal and external painting works at the Great Smith-street baths, for the city council.—Mr. John Hunt, town clerk.

TENDERS FOR MUNICIPAL WORKS OR SUPPLIES.

The Editor invites the co-operation of Surveyor readers with a view to making the information given under this head as complete and accurate as possible.

* Accepted. † Recommended for acceptance.

CAMBERWELL.—For electric lighting extension at the school of arts and crafts, for the London County Council:—

C. H. Cathcart & Co., Salisbury-square	£1,245
E. Lawrance & Sons, Limited, City-road	1,061
G. Weston & Sons, Limited, Fenchurch-street	998
Tredegar & Co., Westminster	912
A.E.G. Electric Company, Limited, Oxford-street*	902

CANNOCK.—For the supply and laying of 8,000 yards of 12-in., 9-in., and 6-in. stoneware pipe sewers, and construction of manholes and flushing chambers, for the rural district council:—

J. Nevitt, Stafford	£6,880
H. Holloway, Wolverhampton	5,422
J. Owens, Wolverhampton	5,051
Martin & Element, Birmingham*	5,040

CHELSEA.—For installing heating apparatus at Cook's-ground school, Chelsea, for the London County Council:—

Palowkar & Sons, Queen-street	£1,320
Brightside Foundry & Engineering Company, Limited, Westminster	967
G. Davis, Kensington	960
W. G. Cannon & Sons, Limited, Southwark	960
J. Yetton & Co., Limited, Limehouse	946
J. & F. May, Lincoln's Inn-fields	893
Cannon & Hefford, Peckham	879
H. J. Cash & Co., Limited, Westminster*	848

Architect's estimate, £905.

GRIMSBY.—Ventilation of sewers of Victoria and Alexandra Wards.—Mr. H. Gilbert Whyatt, borough engineer and surveyor:—

24 Ventilating Columns.

Bayliss, Jones & Bayliss, Wolverhampton	£229
Wellington Tube Works, Limited, Great Bridge	207
W. E. Farrer, Birmingham	204
Tuke & Bell, London	201
S. Pontifex & Co., London	189
F. Bird & Co., London	188
J. Duke, Limited, Grimsby	186
J. Spencer, Limited, Wednesbury*	180

90 Vent Shafts.

T. B. Redshaw, Grimsby	395
W. Cooper, Grimsby	380
D. J. Dolby, Grimsby	359
J. Duke, Limited, Grimsby	331
Earnshaw & Brummond, Grimsby*	295

KENNINGTON.—For an electric lighting installation at Vauxhall-street school, for the London County Council:—

British Economical Lamp Company, Limited, Old Bailey	£770
C. H. Cathcart & Co., Salisbury-square	570
E. Lawrance & Sons, Limited, City-road	530
W. C. Tackley & Co., Limited, Kensington	499
A.E.G. Electric Company, Limited, Oxford-street	484
G. Weston & Sons, Limited, Fenchurch-street	454
Tredegar & Co., Westminster*	434

KESTEVEN.—For steam-rolling work, for the county council.—Mr. W. B. Purser, County Surveyor, Grantham:—

	Per day. £ s. d.
F. W. Wheeler, Bath	1 7 6
Barnes Brothers, Trowbridge	1 6 6
Oxford Steam Plough Company, Oxon	1 6 0
Houghton & Cowman, Limited, Melton Mowbray	1 4 9
E. E. Foley, Bourne	1 3 11
Eddison Steam Rolling Company, Limited, Dorchester	1 3 6
Cole Brothers, Sleaford	1 3 0
W. Wear & Co., Northumberland*	1 1 0

GRIMSBY.—(*a*) Conversion of premises, No. 61 Nelson-street, into a public convenience for both sexes; (*b*) Supply and delivery of 14 urinal stalls.—Mr. H. Gilbert Whyatt, borough engineer and surveyor:

Public Convenience.

W. Gilbert, Grimsby	£567
G. H. Hipkin, Grimsby	539
Wilkinson & Houghton, Cleethorpes	528
B. Johnson, Grimsby	525
S. E. Emerson, Grimsby	517
Edwards & Raynor, Grimsby	515
Hewins & Goodhand, Grimsby	492
E. Smith, Grimsby	492
J. W. Richardson, Grimsby	489
Thompson Brothers, Grimsby	485
Swaby & Walsham, Grimsby*	462
Borrill & Cheesman, Grimsby (withdrawn)	425

14 Urinal Stalls.

W. P. Corby & Son, London	£80
G. Howson & Sons, Hanley	72
W. P. Pickup & Co., Horwich	70
G. Jennings, Limited, London	70
Doulton & Co., Limited, London	68
E. R. Palmer, London	65
Morrison, Ingram & Co., Manchester	65
Mellowes & Co., London	61
F. Winkle & Co., Stoke-on-Trent	60
T. A. Harris, London	60
Twyfords, Limited, Hanley	60
Baxendale & Co., Manchester	59
W. E. Farrer, Birmingham	58
Oates & Green, Halifax	56
J. Duke, Limited, Grimsby	54
Adamsez, Scotswood-on-Tyne*	49

NORTHAMPTONSHIRE.—Accepted for the supply of broken granite, for the county council.—Mr. C. S. Morris, county surveyor:—

	Tons.
Whitwich Granite Company, Leicester	5,370
Enderby & Stoney Stanton Granite Company, Leicester	4,470
B. J. Forder & Son, London	3,240
Forest Rock Granite Company, Leicester	2,780
W. L. Ireland, Atherstone	2,120
Groby Granite Company, Leicester	1,625
Ellis & Everard, Leicester	1,140
Charnwood Granite Company, Loughborough	995
Clee Hill Granite Company, Salop	645
Cliffe Hill Granite Company, Leicester	590
Mountsorrel Granite Company, Loughborough	505
Midland Quarry Company, Nuneaton	440
Judkins, Limited, Nuneaton	340
Prestwich & Sons (tar-macadam), Dronfield	295
Abdon Clee Granite Company, Salop	290
C. Abell & Co., Atherstone	180
Jees Hartshill Granite Company, Atherstone	180
W. Boon & Sons, Nuneaton	120
Total	25,325

Slag.

	Tons.
W. Prestwich & Son, Derbyshire	995
T. Butler & Co., Wellingborough	570
New Craneley Iron Company, Kettering	260
Total	1,825

WANDSWORTH.—For the provision of an art room and offices at the Elliott Central School, Wandsworth, for the London County Council:—

H. H. Hollingsworth, Peckham	£1,325
W. V. Goad, Camberwell-road	1,260
Rice & Son, Stockwell-road	1,250
J. Garrett & Son, Balham-hill	1,200
W. King & Son, Vauxhall-bridge-road	1,113
J. & C. Bowyer, Limited, Upper Norwood	1,085
A. Roberts & Co., Limited, Earl's Court-road	1 080
R. A. Jewell, Wandsworth	1,020
F. W. Fletcher, Tooting*	1,017

Architect's estimate, £1,080.

WANDSWORTH.—The following tenders have been accepted by the borough council.—Mr. P. Dodd, borough engineer:—

Artificial Stone.—Alexandra Stone, Abell & Cammell; Victoria Indurated, Patent Victoria Stone Company, Limited; Aberdeen Adamant, Adamant Stone & Paving Company, Limited; Croft Adamant, Croft Granite Brick & Concrete Company, Limited; Penmaenmawr Adamant Granite Concrete; North Wales Paving Company, Limited; Hard York Nonslip, Hard York Nonslip Stone Company.
Blue Bricks.—West Brothers.
Cement.—Dawson & Co., Limited.
Coal.—Rickett, Cockerell & Co., Limited; Charrington, Sells, Dale & Co.; W. Board.
Coke.—Charrington, Sells, Dale & Co.
Granite Kerb and Setts (on roads and at depots).—Aberdeen, A. & F. Manuelle; Cornish, W. Griffiths & Co., Limited; Norway, A. & F. Manuelle.
Gravel and Flints.—J. Horsford & Co., Limited; S. West, Limited; W. Hampton, Limited; Barnes & Sons; Hall & Co. (Croydon), Ltd.; W. Pearce.
Horse Hire.—J. Cronk; H. Clarkson & Sons; W. Hampton, Limited; E. King; J. Emerton.
Lime, Bricks, &c.—Grey lime, firebricks and fireclay, A. H. Lavers & Co.; stock bricks and sewer bricks, West Brothers.
Oilman's Goods.—Rownson, Drew & Clydesdale, Limited.
Scavengers' Brooms.—R. J. Clarke & Co.
Sewermen's Clothing.—G. C. Clark; G. Byford & Co.
Signwriting.—G. L. Hurrell.
Slag or Scoria Paving Blocks.—Cleveland Slag Block Company, Limited.
Sweepers' Hats.—E. Grove.
Thames Ballast.—H. Covington & Sons, Limited.
Thames Sand.—W. R. Cums, Limited.
Wood Paving Blocks.—Creosoted soft wood, J. B. Lee & Sons, Limited; Hardwood (Jarrah), W. Griffiths & Co., Limited.

MEETINGS.

Secretaries and others will oblige by sending early notice of dates of forthcoming meetings.

FEBRUARY.

14.—Institution of Mechanical Engineers: Annual General Meeting. 8 p.m.
14.—Chadwick Trust Lecture: Mr. H. Percy Boulnois, M.INST.C.E., on "The Hygiene of the Home," Royal Sanitary Institute, 90 Buckingham Palace-road, S.W. 8.15 p.m.
15.—Institution of Municipal and County Engineers: East Midland District Meeting at Newark.
15.—Junior Institution of Engineers: Annual Dinner, Hotel Cecil. 6.30 p.m.
17.—Institution of Civil Engineers (Students' Meeting): Vernon Harcourt Lecture on "Canals and Canalised Rivers," by Mr. J. A. Saner, M.INST.C.E. 8 p.m.
17.—Institute of Sanitary Engineers: Paper by Mr. A. J. Martin, M.INST.C.E., F.G.S., "A Plea for Scientific Research in the Field of Sewage Purification."
17.—Royal Institute of British Architects: Messrs. A. Saxon Snell and Wm. Milburn, on "Modern Hospitals." 8 p.m.
21.—Chadwick Trust Lecture: Mr. H. Percy Boulnois, M.INST.C.E., on "The Hygiene of the Home," Royal Sanitary Institute, 90 Buckingham Palace-road, S.W. 8.15 p.m.
22.—Institution of Municipal and County Engineers: Meeting at Southampton.
24.—Surveyors' Institution: Annual Dinner, Whitehall Rooms. 7 p.m.

MARCH.

3.—Society of Engineers: Presidential Address.
8.—Institution of Municipal and County Engineers: North Eastern District Meeting at Leeds.

APRIL.

23.—Royal Sanitary Institute: Ordinary General Meeting. 4 p.m.

MAY.

14-18.—Royal Institute of Public Health: Annual Congress in Paris.

APPOINTMENTS OPEN.

Official and similar advertisements received up to 4.30 p.m. on Thursdays will be inserted in the following day's issue, *but those responsible for their despatch are recommended to arrange that they shall reach* THE SURVEYOR *office by noon on* **Wednesdays** *to ensure their inclusion in the weekly list of summaries. Such advertisements may, in cases of emergency only, be telephoned* (*No.* 1359 *Holborn*), *subject to later confirmation by letter.*

COUNTY OF WEXFORD.

WEXFORD COUNTY COUNCIL.

DEEPS BRIDGE.

CLERK OF WORKS OR RESIDENT ENGINEER.

The Wexford County Council invite applications from fully qualified persons to act as Resident on the Works of the New Bridge about to be built at The Deeps, on the River Slaney, County Wexford.

Salary will be at the rate of £3 per week, inclusive.

Full particulars of duties may be obtained on application to me by letter at my Office, Courthouse, Wexford.

(Signed) W. F. BARRY, ASSOC.M.INST.C.E.,
County Surveyor

County Surveyor's Office,
Courthouse, Wexford

THE COMMISSIONERS OF HIS MAJESTY'S WORKS AND PUBLIC BUILDINGS

give notice that seven vacancies will occur shortly in the Staff of Assistant Examiners of Technical Accounts in His Majesty's Office of Works. Application for nomination to compete at the Examination to be held by the Civil Service Commissioners for these posts must be made in the first instance by letter addressed to the Secretary, H.M. Office of Works, Storey's-gate, London, S.W., before the 1st March next.

The salary is £150 per annum, rising by annual increments of £10 to £300 per annum.

Candidates must be between the ages of 23 and 30, and will be required to show what technical education and practical training they have undergone to qualify themselves for a situation of this nature.

They must forward testimonials, and show (1) that they have served for at least five years in a public or private office under an Architect, Builder or Surveyor, and (2) that the works on which they have been engaged during those years were such as to afford them the opportunity of gaining a satisfactory knowledge of their profession.

If such evidence should prove satisfactory the Commissioners will consider whether they should receive nomination to compete at the examination, full particulars of which can be obtained on application.

CROSTON URBAN DISTRICT COUNCIL.

SURVEYOR, INSPECTOR OF NUISANCES, COLLECTOR AND GAS MANAGER.

The Council invite applications for the above combined appointment. Candidates must have a thorough knowledge of road maintenance, water supply, sewerage and sewage disposal, be able to prepare plans, specifications and estimates of works, and keep the prescribed accounts, and must also be experienced in gas manufacture and distribution, the collection of rates and the keeping of the books in relation thereto. The duties as Inspector of Nuisances will include those prescribed by the Public Health Act, 1875, other Acts in relation thereto, the various Orders of the Local Government Board, and such others as the Council or the Local Government Board may at any time direct. Candidates must hold the certificate of the Royal Sanitary Institute or other competent body recognised by the Local Government Board.

The salary for the combined offices will be at the rate of £90 per year, and the official appointed will be allowed to act as Secretary to the Higher Education Committee at an additional salary of £5 per year.

Applications, endorsed "Surveyor," in candidate's own handwriting, stating age, &c., accompanied by copies of three recent testimonials, to be sent in to the undersigned by 21st February, 1913.

FORSHAW PARKER & CO.,
Clerks to the Council.

9 Cannon-street,
Preston.

DERBYSHIRE COUNTY COUNCIL.

WORKING ROAD FOREMAN.

Wanted, Competent Man with experience in Steam Rolling, Surface Tarring, Mixing and Laying Tarmacadam, Setting Kerb, &c. Wages to commence at 30s. per week. The Foreman will be required to reside in the Derby or Southern District of the County. Applications (which must be on the Special Form to be obtained at my Office), in candidate's own handwriting, stating age, experience, &c., with copies of not more than three recent testimonials, to be sent to me not later than Friday, February 21st, 1913.

J. W. HORTON,
County Surveyor.

County Offices, St. Mary's Gate, Derby.
February 10, 1913.

ESSEX COUNTY COUNCIL.

COUNTY SURVEYOR'S DEPARTMENT.

Wanted, at once, in the above Department, a Clerk (third class). Salary £60, rising by annual increments of £7 10s. to £90. Selected applicants will be subjected to tests in Shorthand and Typewriting.

Applications, in own handwriting, should be addressed to the County Surveyor, Chelmsford.

PUPIL.—The Borough and Waterworks Engineer of Leamington (A.M.I.C.E.) has a vacancy in his office for a Pupil.—Address, Town Hall.

COMPETITIONS OPEN.

TO ARCHITECTS AND SURVEYORS IN DEVON AND SOMERSET.

The Town Council of the Borough of Tiverton, having agreed to purchase a Site of about six acres for a Housing Scheme, invite Plans and Specifications for Laying Out the Site and Building Dwellings for the Working Class thereon. Competition limited to residents in Devon and Somerset. Conditions may be had on application to the Borough Surveyor, Tiverton.

EX-PUPILS AND ASSISTANTS.

ASSISTANT (24), with all-round experience in Urban and Rural Districts, seeks appointment. Good Draughtsman and Surveyor; experience in Road and Building Construction, Sewerage and Water Supply, and all work incidental to a Municipal Office. Good credentials.—Box 1,222, office of THE SURVEYOR, 24 Bride-lane, Fleet-street, London, E.C.

(Continued on p. xxvi.*)*

MISCELLANEOUS.

COPIES of The Surveyor, unbound, 1904-1912. Minutes of Proceedings, Inst. of C.E., 1908-1912; Water Supply of Hampshire; Modern House Construction, by Sutcliffe; Hydraulic Machinery, by Blaine; Applied Mechanics, by Jamieson (vol. i. and ii.); Waterworks Law, by Griffiths; Sanitary Engineering, by Latham. All in excellent condition. - Offers to Box No. 1,221, office of The Surveyor, 24 Bride-lane, Fleet-street, E.C.

TENDERS WANTED.

WIRKSWORTH URBAN DISTRICT COUNCIL.

SEWERAGE AND SEWAGE DISPOSAL WORKS.

CONTRACT No. 1.

The above Council desire to receive Tenders for the Construction of about 12,000 lineal yards of 15, 12, 10, 8 and 6 in. Earthenware Pipe Sewers, with Manholes, &c.; also Settling Tanks, Storm-water Tanks, Filters, Sludge Beds, Road-making and other Works.

Drawings may be seen, and Specification and Quantities, with Form of Tender, obtained, at the Office of the Engineer, Mr. H. A. Johnson, M.Inst.C.E., 15 The Exchange, Bradford, or at the Office of the undersigned, on payment of a deposit of Ten Guineas, which will only be returned on a *bonâ-fide* Tender being sent in in accordance with the Specification.

Sealed Tenders, marked "Sewerage," to be sent to me not later than noon on Friday, the 7th day of March, 1913.

The lowest or any Tender will not necessarily be accepted.

J. GRATTON,
Clerk to the Council.

Wirksworth,
Derbyshire.
February 10, 1913.

WIRKSWORTH URBAN DISTRICT COUNCIL.

SEWERAGE AND SEWAGE DISPOSAL WORKS.

CONTRACT No. 2.—IRONWORK.

The above Council desire to receive Tenders for the Supply of certain Cast-iron Manhole and Lamphole Covers, Cast-iron Pipes, Ventilating Columns, Disc Valves and other Ironwork; also for the Supply and Erection of 3 Revolving Sprinklers required for these Works.

Drawings and Specification may be seen, and Quantities with Form of Tender, obtained, at the Office of the Engineer, Mr. H. A. Johnson, M.Inst.C.E., 15 The Exchange, Bradford, or at the Office of the undersigned, on payment of a deposit of Two Guineas, which will only be returned on a *bonâ-fide* Tender being sent in in accordance with the Specification.

Sealed Tenders, marked "Sewerage Ironwork," to be sent to me not later than noon on Friday, the 7th day of March, 1913.

The lowest or any Tender will not necessarily be accepted.

J. GRATTON,
Clerk to the Council.

Wirksworth,
Derbyshire.
February 10, 1913.

THE Corporation of Middleton invite Tenders for the following Materials required in the Borough Surveyor's Department for the year ended March 31st, 1914—viz.: Macadam, Flags, Setts (Flag Rock), Kerbs, Pipes, &c., Tipler Closets, Brushes, Lime, Aluminoferric, Press Cloths, Castings, Pitch and Oil.

Further particulars and Form of Tender, which will contain a fair wages clause, may be obtained on application to Mr. W. Welburn, Borough Surveyor, Town Hall, Middleton.

Tenders, endorsed "Materials," must be delivered at my Office not later than the 1st March next.

FREDERICK ENTWISTLE,
Town Clerk.

Town Hall,
Middleton.

BOROUGH OF MANSFIELD.

The Corporation of Mansfield invite Tenders for the supply of the following Materials for a period of twelve months ending 31st March, 1914:—

1.—Granite, Slag and Tar-macadam.
2.—Natural Flags, Kerbing, Channelling and Concrete Flags.
3.—Portland Cement.
4.—Stoneware Pipes, Junctions, Bends, &c.
5.—Timber.
6.—Sewer Ironwork and Castings.
7.—Coal.
8.—Ironmongery and General Stores.
9.—Paints, Oil, Varnish, &c.
10.—Brooms and Brushes.
11.—Disinfectants.
12.—Supply and Repair of Harness.
13.—Supply of Groceries, Drysaltery, Soaps and Sundries.
14.—Butcher, Fishmonger, Baker, &c.

Specification, Schedules and Forms of Tender may be obtained on application to Mr. Thos. P. Collinge, Assoc.M.Inst.C.E., Borough Engineer and Surveyor, Exchange-row, Mansfield.

No Tender will be accepted from any person or firm paying to any workmen employed by him or them, whether on work for the Corporation or any other person, less than the standard rate of wages, or not complying with the recognised conditions of labour in the Borough.

Sealed Tenders, endorsed "Tender for Stores," addressed to the undersigned, to be delivered on or before 12 o'clock noon on Wednesday, 26th February, 1913.

J. HARROP WHITE,
Town Clerk.

Mansfield.
February 5, 1913.

BEDFORDSHIRE COUNTY COUNCIL.
TENDERS FOR ROAD MATERIAL AND CARTAGE.

The Bedfordshire County Council invite Tenders for the Supply of the following:—

1. Broken Granite.
2. Slag.
3. Flints.
4. Gravel.

And for the Cartage of Road Materials.

Particulars and Forms of Tenders may be obtained at the Office of the County Surveyor, Shire Hall, Bedford, on and after the 15th February, 1913.

Sealed Tenders, endorsed "Tender for Road Materials" or "Tender for Cartage," must be delivered at the County Surveyor's Office not later than 12 o'clock noon on Saturday, the 22nd February, 1913.

Samples must accompany the Tenders for Road Materials.

The County Council do not bind themselves to accept the lowest or any Tender.

W. W. MARKS,
Clerk of the County Council.

Shire Hall, Bedford.
February 11, 1913.

BOROUGH OF HAMPSTEAD.
TO PAVING CONTRACTORS.

The Borough Council invite Tenders for the following works—viz.:—

(1) Providing and Laying Creosoted Deal Wood Paving Blocks in Fortune Green-road; area, 7,480 super. yards.

(2) Providing and Laying Asphaltic Macadam in:

A. Broadhurst-gardens; area, 1,143 super. yards.
B. Adelaide-road; area, 1,290 super. yards.

Specifications for the wood-paving work can be seen on application to Mr. O. E. Winter, M.Inst.C.E., Town Hall, Haverstock Hill, N.W., from whom Forms of Tender, with full conditions, can be obtained.

Tenders to be delivered to me not later than 4 p.m. on Thursday, 20th February.

The Council do not bind themselves to accept the lowest or any Tender.

(By order)
ARTHUR P. JOHNSON,
Town Clerk.

Town Hall,
Haverstock Hill, N.W.
February 11, 1913.

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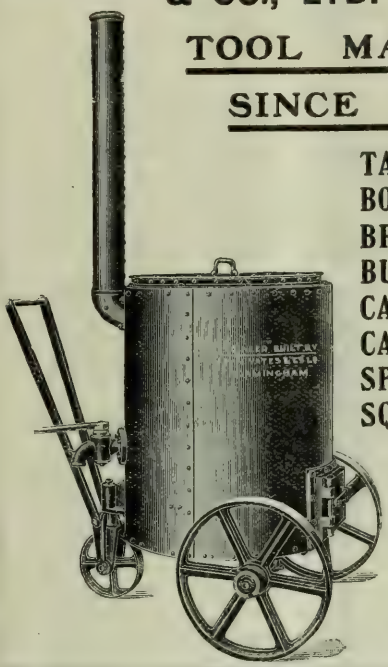

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BOROUGH OF SUTTON COLDFIELD.
ANNUAL CONTRACTS.

The Corporation are prepared to receive Tenders for the Supply of the following Materials during the year ending March 31st, 1914:—

Form No. 1. Granite Macadam and Kerb.
2. Limestone Macadam and Setts.
3. Gravel and Broken Pebble Stones.
4. Yorkshire or Pennant Kerb.
5. Rowley Setts.
6. Earthenware Pipes.
7. Cement and Lime.
8. Iron Castings.
9. Iron and Steel.
10. Timber.
11. Hardware.
12. Oils and Paints.
13. Bass Brooms.

Conditions of Contract and Forms of Tender may be obtained on application to the undersigned.

Sealed Tenders, only on the Forms supplied, to be sent in not later than Saturday, March 8th, 1913, endorsed "Tender for Materials."

The Corporation do not bind themselves to accept the lowest or any Tender.

W. A. H. CLARRY, ASSOC.M.INST.C.E.,
Borough Engineer and Surveyor.

The Council House,
Sutton Coldfield.
February 10, 1913.

CITY OF HULL.
TO QUARRY OWNERS AND OTHERS.

The Corporation are prepared to receive Tenders for the Supply of about 8,000 tons of Stone for Macadamising during the twelve months commencing 1st April, 1913.

Also for the Supply of about 3,000 tons of Granite or Whinstone Setts, 3 in. by 6 in., and 200 tons Special Dressed Setts, 4 in. by 6 in., for crossings.

Forms of Tender and other particulars may be obtained at the City Engineer's Office.

Tenders, endorsed as directed on the Forms of Tender, are to be addressed to the chairman of the Works Committee, and delivered at the Town Clerk's Office before noon on Wednesday, 26th February, 1913.

Samples to be delivered to the City Engineer on the same date, unless previous samples can be referred to.

The Corporation do not bind themselves to accept the lowest or any Tender.

(By order)
A. E. WHITE, M.INST.C.E.,
City Engineer.

Guildhall, Hull.
February 11, 1913.

WANTAGE RURAL DISTRICT COUNCIL.
EAST CHALLOW WATER SUPPLY.

The Wantage Rural District Council invite Tenders for carrying out the above work, comprising the Supplying and Laying of about 550 yards of 2-in. and 3-in. Cast-iron Mains, the Construction of Service Reservoirs, Well, Syphon Chamber, and Brickwork to Adits.

Drawings and Specifications for the work may be seen, and Forms of Tender and Bills of Quantities obtained, at the Council Offices, Wantage, Berks, or of Mr. John William Harris, Engineer and Surveyor, East Challow, Wantage, on payment of a deposit of Two Guineas, which will be returned to *bonâ-fide* tenderers on the letting of the Contract.

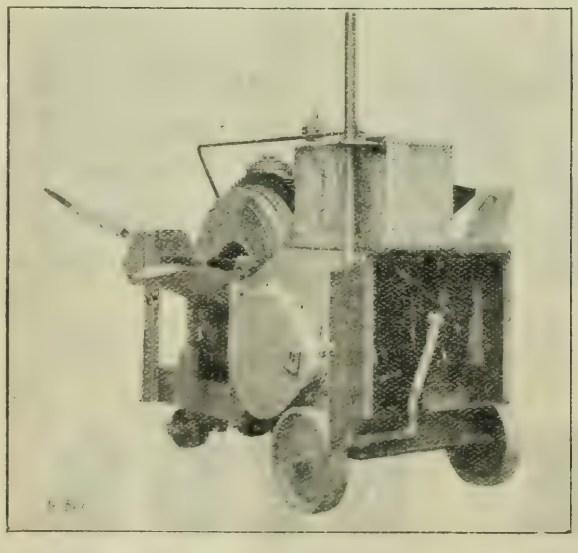
Sealed Tenders, endorsed "Challow Water Supply," must be delivered to me on or before Friday, the 28th day of February, 1913.

The Council do not bind themselves to accept the lowest or any Tender.

(By order of the Council)
EDWD. B. ORMOND,
Clerk.

Council Offices,
Wantage,
Berks.
February 12, 1913.

RANSOME CONCRETE MIXERS



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The Surveyor

And Municipal and County Engineer.

Vol. XLIII. FEBRUARY 21, 1913. No. 1,101.

Minutes of Proceedings.

State Control of Highways: Some Vital Considerations.

It is worthy of note that, although much has been said and written concerning systems of State control of highways, very little attention has been directed to the fact that the significance of the terms "State Control" and "State Management" depends so much upon the size of the area in question and its population that the words have quite different meanings in different countries. This consideration is distinct from those which arise from studies of the manner in which State control is exercised and the extent to which it takes the form of general supervision, of financial control, or of direct management. It is true that a system of State control may be efficient and desirable, or inefficient and undesirable, according to whether these parts of the machinery are well or badly proportioned. Similarly, it might be pointed out that the degree of State control which is desirable and the manner in which it should be exercised depend upon other factors, such as the occupations of the inhabitants, the national temperament, and the average level of intelligence and education. While, however, such considerations may properly be put forward in connection with specific proposals affecting a given area, it is possible and necessary to make some general comparisons which involve only the two main factors—area and population—in order that it may be realised that State control in one case may be a very different thing from State control of a similar kind in another case.

With the issue thus narrowed, let us glance at a few notable examples of State administration of highways, and consider how little they have in common as regards the area and population affected. What is called "State" control may apply to an area not many times greater than an English county with a fairly dense population, as in the case of a German province, or a small Eastern State in America. It may apply to an area which, from the present point of view, is similar as regards density of population but many times greater in area, such as France or Italy. It may apply to a State with a population only a tenth or a twentieth that of one of these countries but about the same in area, or to an Indian province similar in size but with a population reckoned in tens of millions. It is clear, then, that if we are to look for precedents with a view to studying the question of State control in the United Kingdom, we must subject every system brought to our notice to this primary test before we reckon it worthy of closer scrutiny. The fact that the Californians have voted a large sum of money for the immediate construction of a system of main roads has no bearing on the case of a thickly-settled country where a similar sum is spent every year in maintenance. The advantages that attend the gradual building up of a main road system in Massachusetts furnish no evidence that the method would give good results in the very much larger area of the United Kingdom, with its wide range of activities. It has, however, been suggested in these pages that the Massachusetts principle might be applied to Ireland, a country only about four times the area of Massachusetts. Turning to Germany, State control in that country means in most cases provincial control over areas many of which are only a few times larger than our largest English counties, and resembling on the whole such areas as East Anglia, Mercia, or Wessex. The case of France seems at first sight to furnish a precedent, and we must go a little further to see how different the conditions really are. France is one area, not three; it has no Border country and no Irish Channel. It has seaports on two sides only. It is not divided climatically, as is Great Britain, into East and West, as well as into North and South. It may, however, be suggested that the example of France should be studied as possibly furnishing a useful precedent for Ireland.

* * *

Road Administration in German States.

Reference has already been made to the German States, which are divided into provinces, in each of which a system of provincial highways was established, the remainder of the roads being managed by the local authorities, except for a small proportion of estate roads. Without suggesting that the system has been other than a complete success as regards the establishment of a network of main roads, it must be pointed out that in many of these provinces the management of the provincial roads has been or is being handed over to the local authorities. As will be seen by referring to an article which will be found in another part of this issue, the arrangements differ much in the various provinces, and even in parts of provinces, both as regards the extent of the road system maintained by the provincial authorities and with respect to the manner in which the State exercises control and provides technical assistance. Nor is the relation between the authority corresponding to our district council and that which is equivalent to our parish council by any means uniform. Road administration in Germany is, in fact, in a condition of development, the main features of which are a gradual transference of the duties of road maintenance to a local authority which stands midway between the State and the parishes. It does not follow, however, that the provincial roads are all destined to be managed by the local authorities, and it is probably the intention of some of the Governments concerned to maintain an effective system of provincial roads indefinitely. On the whole these glimpses of what is occurring in Germany suggest that we are considerably ahead of our German cousins in the matter of highway maintenance, as, indeed, we ought to be, and that a large English county is a very good unit for road maintenance purposes, but suggest further that the cost of the part of the greater main road system traversing the county should be partly or wholly borne by the State. In this connection the figures relating to mileages and to costs per mile of the roads transferred from the provinces to the local authorities in Germany are significant. On the whole it seems to be more to the point to study

what is happening now in Germany than it is to look closely into a system devised many years ago for France, though the practical results of the French system deserve close attention.

* * *

London Wells. The latest publication of the Geological Survey giving records of wells in the London district —noted elsewhere in this issue—contains a bold and striking suggestion. Sufficient evidence and proof are given to support the fact that it is possible to replenish, by artificial means, the vast underground reservoir which exists in the chalk underlying the whole of the London district; and it is definitely suggested that steps should be taken which would result in the raising of the water level in the wells throughout that district. Within London itself there is no possibility of using any of the rainfall for the purpose of artificially replenishing the underground store, but on the outskirts there is a vast amount of water which could be used if it were collected and drained into dumb wells sunk to the Thanet sand. It has long been observed that, owing to the enormous amount of water which is pumped from the chalk, the water level is being steadily lowered; for instance, the wells which supply the fountains in Trafalgar-square once supplied the public offices in Whitehall, Millbank Prison, and the Houses of Parliament. In the year 1847 the water level was 78 below sea level, and the yield amounted to 580,000 gallons a day. The water level has now fallen to 195 below sea level, and the yield is only 8,000 gallons an hour, the supply being used only for the fountains. This instance, we are told, is typical. It may be thought that it would be impossible to produce any impression upon the water level in the chalk by artificial means; but it is to be noted first that the abstraction of a definite quantity by pumping has lowered the level considerably, and next that this level has again actually been raised artificially in places. This has been proved at Lea Bridge, where the chalk has been for years filled up with water during wet winters by Mr. Bryan, the chief engineer to the Metropolitan Water Board. Mr. Bryan poured a vast quantity of filtered water from the Lea into the great galleries in the chalk at Lea Bridge, which had the desired effect of keeping the water level up, and of raising it for a considerable period in spite of increased pumping.

Space does not permit us to give the other proofs which, taken together, are entirely convincing of the fact that the water level in the chalk can be restored. As to the supply available for replenishing the underground storage, such facts as the following are sufficient. It is shown that no water can enter the ground south of a line drawn through Hertford, Potter's Bar, Bushey, Harefield and Uxbridge. This area amounts, roughly, to 200 square miles, and in a moderately wet season some 15,000 million cub. ft. of rain falls on it. None of this, however, is able to flow into the great subterranean reservoir under London, and little or no use is made of it for domestic purposes. On the other hand, we have such a case as the Swallow Holes, between Dorking and Leatherhead, where a large quantity of water enters the chalk. In this and in other similar cases the water level is high, and it is clear that the same result could be produced artificially elsewhere. Considering the great number of private wells in the London district, and the manner in which the supply is failing, the suggestion made in the memoirs of the Geological Survey become very important.

* * *

London Street Paving. The Metropolitan Paving Committee, whose report for the year 1911-1912 is summarised on another page, is fully alive to recent traffic developments, and to the significance of the results obtained during the past few years with different kinds of paving. The friendly rivalry between different boroughs has led to excellent results, and the great variety of traffic conditions in different parts of the area points to the importance of maintaining a system which makes it possible for highly skilled engineers to give each his close attention to the problems of one area. As regards the materials in use, the results of last year's experience are very definite. Wood paving continues to give satisfaction, and in most parts of London this is the pavement most largely employed for really heavy traffic, though in the City, and in some other parts, asphalt holds the first place. Under heavy traffic, Jarrah blocks, recently replaced, had been down for eleven years or more, and sectional Jarrah blocks have worn smoothly and evenly after seven years of such traffic. Under "considerable" traffic Jarrah has lasted sixteen years, and under "limited" traffic deal has lasted nineteen years. When replaced recently by creosoted deal, Jarrah blocks had been in service nineteen years under limited traffic in St. Pancras. It has been found necessary, in many cases, to increase the thickness of foundations in streets carrying heavy traffic. As already suggested in these pages, it is difficult to believe that it can be economical to make a Portland cement concrete foundation more than 6 in. thick, except in unusual circumstances. Depth there must be; but the fact that the stresses in the lower part of a thick crust are much less than those near the surface points to various possibilities in the direction of economy of expensive materials. In any case, a lower modulus of elasticity in the foundation as a whole would sometimes be a great advantage.

With respect to heavy motor traffic, the danger of making sweeping generalisations is evident from a comparison of the reports from the different boroughs. In Fulham the change to motor traffic seems to have decreased rather than increased the cost of maintenance of wood paving, possibly because the weak places are found out so quickly by the heavy motor vehicles, and repaired so soon after the pavement is laid, that the patches do not present that contrast with the older part of the pavement which was no doubt a cause of somewhat rapid wear under the conditions of some years ago. Bituminous-bound crusts continue to be employed for residential streets, and for roads with moderate or "limited" traffic, but such crusts are not in the running as regards main thoroughfares or streets with heavy and concentrated traffic. There is abundant evidence that the cost of maintenance of many streets in the London area has, as far as annual charges are concerned, been reduced by wise expenditure on reconstruction; and no doubt it will be possible, in the course of the next few years, to ascertain to what extent such reconstruction has proved a direct economy over and above the indirect economy due to the improvement of the surface. Really satisfactory foundations, and the use of the best methods of putting down the carpet layer of wood, asphalt, or other material, seem in some cases to have reduced the wear and tear, in proportion to the traffic carried, to what it was some years ago; and further developments may possibly result in actual reductions in the cost of maintenance, or at least in checking to an important extent the tendency to an increase in the total annual cost per square yard.

* * *

Scientific Research in Sewage Purification. The Institute of Sanitary Engineers is to be congratulated upon the excellent paper by Mr. A. J. Martin read at last Monday's meeting of that body. Not only was the paper one of great merit, but in the discussion which followed it every speaker is to be numbered among the greatest experts of the day. Some extracts from the paper itself, together with an account of the discussion, are given elsewhere in these pages. The author first pointed out the need for scientific investigation, and next raised the question as to who should carry out this work, giving consideration to the possibility of the officers of the Royal Commission taking up the task. In

considering the work of the Royal Commission one is apt to lose sight of the fact that their work has hitherto been limited to what could be satisfactorily accomplished as a means to a particular end. While it has been the duty of the officers of the Commission to carry out very thorough investigations in some directions, their work appears to have fallen short of much that might have been desired both by themselves and by all those interested in the subject in other directions. The reason for this is quite clear when it is remembered that the object of the Royal Commission was to obtain and present sufficient evidence to enable them to come to conclusions which would form a proper basis for future legislation. As soon as this object has been attained the research work has stopped short, for it was not the duty of the commissioners to go further. The need for further scientific research is apparent to all, and it is to be noted that every speaker was in absolute agreement with the arguments brought forward by Mr. Martin. It is, however, open to question as to how the work may best be done, and the subject is one upon which there is apt to be considerable difference of opinion. Laboratory work is, of course, essential, but it cannot be fruitful unless it is supplemented by a considerable, and probably by a greater, amount of work carried out at sewage disposal installations of all kinds. Apart from the chemical and bacteriological facts of the case, we shall have to consider the equally important and probably more important matters of construction and management. The workers who will carry on future researches must, if they hope to produce useful results, include engineers of several kinds and sewage works managers as well as chemists and bacteriologists. The results of such a combination would undoubtedly be of enormous advantage, not only to science, but to humanity in general.

* * *

The Metropolitan Water Board and the Borough Councils.

A good deal may be said in favour of the view taken by the Bermondsey Borough Council with respect to the claims of the Metropolitan Water Board set forth in clause 61 of the board's Various Powers Bill, and the council, to its credit, has not missed the opportunity of saying what it thinks in plain and concise terms. The particular claim set up by the Water Board is that it shall be compulsory upon local authorities to give the board not less than three days' notice (unless otherwise agreed or in case of sudden emergency) whenever they require to dig or sink any trench, or drive any tunnel or heading for laying down, altering, or constructing any sewer to which any main pipe, syphon, or other work of the Water Board has been placed. There is an additional demand thrown in, as if to emphasise the board's authority and position, that the Water Board shall be entitled to superintend the work, and that the borough councils must conform with such reasonable requirements as may be made for protecting the board's authority. This sounds like a claim to special consideration by the water authority which the Bermondsey Borough Council resents with some spirit. The demand, it is pointed out, is unprecedented, it would create inconvenience, delay, and friction, and it is regarded as "intolerable" that work executed by the borough councils should be done under the superintendence of and to the satisfaction of another municipal authority. Very effectively, as we think, it is also argued that if such powers are granted to the Water Board there could be no justification for refusing them to gas, electricity, hydraulic, and other companies. The result of such an inconceivable state of things would, of course, be the creation of a series of intermediate despotisms and the practical ousting of the borough councils from the control of the streets which has been vested in them by the Legislature. The grievance of the councils at the frequent action of companies in causing streets to be broken open inconsiderately is by no means a fanciful one, and any such legislation as that proposed by the Metropolitan Water Board would tend to aggravate it considerably by introducing a new element which strikes at the dignity of the metropolitan authorities. The local government of London needs not the questionable aid of such a factor in order to introduce yet another incentive to division or strife, and we imagine that the question at issue may be settled much more satisfactorily by methods other than those suggested in the Water Board's Various Powers Bill.

* * *

Sanitation in East Stow.

In consequence of some doubt existing as to the sufficiency of the arrangements made for the discharge of the duties of inspector of nuisances, and on account of the receipt of a petition signed by a number of ratepayers who alleged that the recently appointed officer would not have time to perform all his duties, the Local Government Board have caused an inspection to be made of the rural district of East Stow, Suffolk. This duty has been carried out by Dr. Fletcher, one of the board's medical inspectors, whose report on the sanitary circumstances and administration of the district is before us. The general result of the inspection may be said to be satisfactory, inasmuch as a long period of inactivity on the part of the council appears to have been succeeded by a real effort to secure improvements in the sanitary circumstances of the district. The new policy, however, finds itself hampered in the natural course of events with the results of the old, so that, although something has already been achieved in the way of improvement, much still remains to be done. The chief criticism of the report is as to the water supplies of the district, which are unsatisfactory as regards sufficiency as well as quality, and Dr. Fletcher recommends that expert advice should be obtained as to the best method of securing an adequate and wholesome supply. Other matters which are said to require attention are the housing of the labouring classes—a difficult matter in a district where the ruling agricultural wage is only 12s. per week—the abatement of nuisances due to faulty middens, and so forth, and the provision of isolation hospital accommodation. The East Stow report is by no means so bad as many we have read, and the district council should feel encouraged to undertake the reforms suggested at the earliest possible moment, in the knowledge that any financial sacrifice involved will be amply repaid in an improved condition of the public health.

* * *

The "Local Candidate" Again.

In response to an advertisement issued some time ago by the Dartmouth Town Council inviting applications for the appointments of surveyor and inspector of nuisances, 108 candidates presented themselves. Three of these were in due course selected for final consideration, among them being a certain Mr. F. J. Voisey, of Dartmouth, an ex-councillor. It is hardly necessary to add that this gentleman obtained the appointment. We do not wish to repeat here what we have so often said before as to the hardship which such an appointment involves upon other applicants. Mr. Voisey undertook, if the council wished it, to obtain the certificate of the Royal Sanitary Institute. The enthusiasm of the council for the sanitary administration of the district was shown by their anxiety lest the appointment as inspector of nuisances should not meet with the approval of the Local Government Board. In that case it might have been expected that the council would stipulate for a determination of the appointment. Not so, however; but the salary is to be halved! The duties of surveyor are, of course, so simple that anyone can perform them, no sanction of the Local Government Board being required to such an appointment. Some explanation should be required in every case where ex-councillors are appointed to posts of this kind, and too great publicity cannot be given to them.

D

A Plea for Scientific Research in the Field of Sewage Purification.

MR. A. J. MARTIN AT THE INSTITUTE OF SANITARY ENGINEERS.

On Monday evening last, at a meeting of the Institute of Sanitary Engineers, held under the chairmanship of Sir William Ramsay, K.C.B., F.R.S., a paper on the above subject was read by Mr. A. J. Martin, M.INST.C.E., F.G.S., F.R.SAN.I.

Mr. MARTIN commenced by pointing out that in the course of the past ten years loans to the amount of £18,000,000 had been sanctioned for works of sewerage and sewage disposal in this country. He ventured to say that rarely of late years had so much public money been spent with so little definite scientific guidance. They had been groping in the dark. Engineers had gone on designing purification works on certain lines, not because those lines were necessarily the best, but because they had designed works in the same way before, and found them to answer, and they did not care to run the risk of trying other methods of which they had had no experience. That attitude might be an unheroic one, but it was at least a safe one; and in the present state of our knowledge an engineer was hardly justified in going very far beyond the limits of his own experience. In the absence of definite scientific data, they had had to fall back upon empiricism. There was no blinking the fact that rule of thumb had played a very large part in the field of sewage disposal. Purification works which had given good results in one place had been slavishly duplicated elsewhere to deal under different conditions with a totally different sewage. Rules for tank and filter capacity had been applied indiscriminately. Controversies had raged even with regard to questions of fact; and appeals to prejudice had been freely resorted to.

Mr. Martin proceeded: In speaking of the lack of scientific data I have not lost sight of the valuable experimental work which has been carried on by Leeds, Manchester, Leicester, Birmingham and other towns, or of the generous way in which they have contributed their results to the common stock. But all this work has been done for the purpose of testing the efficiency of a particular process in dealing with a particular sewage. The object in view has been to arrive at the best way to purify that sewage, and it has been pathetic to hear how the results of these purely local experiments have been quoted as statements of universal fact. What I am now pleading for is definite scientific research work carried out with the sole object of obtaining data of general applicability. . . .

It is safe to say that there is no other branch of engineering which involves so many different sciences as the purification of sewage. In addition to those structural considerations which arise in connection with every other engineering work, the sewage works engineer has to do with chemistry, botany, biology, hydraulics, the physical properties of liquids and solids, and the durability of materials under somewhat peculiar conditions. And notwithstanding this, it is quite common to hear questions of sewage disposal argued as if there were only a single consideration involved and sewage were a liquid of definite chemical composition. What we want is a set of data—not, be it noted, in the form of hard-and-fast rules for tank capacity or volume of filtering medium per unit of flow, but definite information as to the results obtained under strictly defined conditions. This information obviously cannot be obtained amid the welter of disturbing influences which beset the everyday work of purifying sewage. The necessary experiments must, in the first instance at least, be carried on in the laboratory. There is a tendency to look askance on laboratory work in this connection, but questions are constantly arising in the purification of sewage which can only be answered satisfactorily by means of laboratory experiments. . . .

We want to know the nature of the changes which take place in liquids of different composition under different conditions; how these changes can be controlled; the action of the various micro-organisms and ferments present in sewage; the influences which stimulate or retard their activity; the amount of ammonia which can be oxidized in unit time per unit of surface of materials of varying textures and different chemical compositions; the effect of temperature, aëration, dilution, and the presence of different chemical substances, on the purification processes in their various stages; the relation of the keeping properties of an effluent under different conditions to its chemical composition and biological contents; the effect of various sterilising agents on the after-history of an effluent. And at every step of the way new lines of research will be opened up. In addition to these strictly scientific investigations there is a great deal of testing work which badly needs doing—to determine, for instance, the efficiency of precipitants, the value and durability of different filtering materials, and the uniformity of the distribution effected by various methods—all such tests, in short, as would be of general utility as opposed to those which relate to a particular sewage.

There will, I think, be little difficulty in convincing the most sceptical that there is a vast amount of work to be done, but the urgency of the need may not be quite so apparent. The question of cost may be raised, and a doubt expressed as to the propriety of carrying on scientific investigations at the country's expense. To those who take this attitude the best answer perhaps will be to remind them that we are spending every year from £1,500,000 to £2,000,000 on works of sewerage and sewage disposal, that breakdowns and consequent lawsuits not infrequently occur, and to ask them whether it is not reasonable to expend a few thousands of pounds as an insurance against such risks. . . . But who is to undertake the work? I have already pointed out that it will rarely be possible to carry on the necessary investigations in conjunction with the everyday treatment of sewage. The volume and composition of ordinary sewage are so variable, and the work of purification is beset by so many disturbing influences, as often to render it exceedingly difficult to interpret the results obtained. And, apart from this, few local authorities would feel justified in employing the necessary staff of observers. It would obviously be unfair to expect the sewage works manager to undertake the work. His responsibilities are already so great, and his vigilance is already so severely taxed, that he could not in justice to his ordinary duties undertake the additional work involved by a delicate scientific investigation. Accurate scientific observation, moreover, is a skilled occupation demanding special training, and can no more be carried on by an untrained man than the duties of the sewage works manager himself. . . . Many of our great universities and technical colleges are well equipped for carrying on experimental work of the kind proposed, and some of them have already made a start with it. But the funds available in this country for scientific research are severely limited, and it is doubtful whether any university would undertake so large and many-sided an investigation. The matter is, after all, a national one, vitally affecting works upon which a very large amount of public money is being spent every year, and of grave moment to the health of the country. A Government which has assumed the control of the work in question to the minutest detail cannot reasonably refuse to provide the scientific data which are absolutely necessary if this control is to be intelligently exercised. . . .

When we remember the valuable scientific work which for the past twenty-five years has been done by the State Board of Health of Massachusetts, the population of which hardly exceeds that of the West Riding of Yorkshire, it is not very creditable that this great and wealthy country, with its teeming population and its tiny rivers, should grudge either time or money to ensure the success of the work which is being carried on for the protection of both. It is difficult to appreciate too highly the thorough and systematic way in which the experimental work at Lawrence has been carried on, or the generous manner in which the State Board of Health have placed their results at the disposal of the civilised world. The Royal Commission on Sewage Disposal

may or may not be a permanent body, but I for one sincerely trust that before they bring their labours to a close, some definite steps will have been taken to ensure the carrying on of their work, and the systematic development of its scientific side.

The Chairman, in opening the discussion, said he had to confess that both the present holder of the office of President of the Local Government Board, Mr. John Burns, and his predecessor, Mr. Walter Long, had been quite sympathetic with regard to the work of the Royal Commission on Sewage Disposal, but the methods of the Government were such as to make it impossible for any definite action to be taken. A Bill had been drafted, but no opportunity had been afforded for introducing it into Parliament. What he wanted to know was why should the attention of legislators be taken up by the consideration of abstruse political problems rather than by an important sanitary problem which affected everyone in the country?

Dr. Rideal said the difficulty with which they were confronted was that of continuing the work of the Royal Commission. If they were successful in getting a President of the Local Government Board who would promote a Bill to carry out the recommendations of the commission, they might see in course of time a central authority who would have control of the rivers boards, and it was that central authority that would carry out the scientific work required. But how could that central authority be financed? His own view was that it would be a good scheme if the rivers boards, when appointed, were financed by the ratepayers. The different boards would have varying problems to consider; therefore, instead of the central authority having an elaborate laboratory in London, it would be much better for each of the rivers boards to have their own scientific staff engaged on work directed to the aims and objects of a particular watershed.

Dr. Kenwood thought it would be agreed that a continuance of the scientific work of the Royal Commission was generally desired. The establishment of central laboratories had been suggested, but his own view was that laboratories would be required on some of the works themselves if they were to obtain proper results. An enormous number of analyses would be required, and it seemed to him that these could best be carried out by those conversant with the conditions obtaining.

Mr. W. D. Scott-Moncrieff observed that Mr. Martin had given a very excellent sketch of what they wanted to know, and a very fair *résumé* of the practical work which a body of investigators ought to be engaged in.

Mr. J. D. Watson, chief engineer to the Birmingham, Tame and Rea District Drainage Board, in proposing a vote of thanks to Mr. Martin for his paper, said that what the latter had impressed on them was a duty which they ought to perform. They were behind other countries in having failed to attend to the matter before. Both the Germans and Americans were ahead of them in making investigations into problems which they intended to deal practically with in the future. He had been amazed at the amount of scientific work done by the Metropolitan Commission of New York in order to place the facts before the experts they called in to advise them with regard to the disposal of the sewage of New York; and he thought something ought to be done in this country if they were to keep their place in the first rank in such matters. If there were so much difficulty in getting passed into law Bills relating to public health work, he thought the Local Government Board might set apart a considerable sum of money to allow of such questions being dealt with in a scientific manner.

Mr. A. P. I. Cotterell (Westminster and Bristol), seconding the vote of thanks, said the paper was a very timely one, and added that he was bound to agree as to the need for greater scientific accuracy in the field of sewage disposal. At the same time, one could not but admire our British way of muddling along on a system of trial and error, for, on the whole, they had learnt a great deal—more, perhaps, than if their work had been carried out in the laboratory. He thought, however, all felt they must have the proposed central authority.

Mr. H. Percy Boulnois (Westminster) said that while all appeared to be agreed as to the desirability of the central authority, his view was that they did not want to have too many authorities. They had already a great number. His suggestion was that the Local Government Board should obtain the necessary powers. They had a great deal of the machinery ready to hand, and they could start a proper scientific department such as they sadly needed. He agreed that they could overdo things in the matter of scientific investigation; they must not overlook the practical side. There had, for instance, been much scientific research in both France and America with regard to the question of roads, but in both those countries the roads were in a terrible condition. There had not been that same research into road here, and yet our highways were, he thought, the finest in the world. He agreed, however, that there must be further scientific investigation, but he hoped, as he had said, there would be no increase in the number of authorities.

Dr. McGowan said he did not think they need ever be afraid of scientific investigation being overdone in this country. (Laughter.) He thought that what was needed was an effort to persuade the Man in the Street that the points Mr. Martin had raised were really of the first importance to the well-being of the country.

The vote of thanks was carried.

Mr. Martin, in reply, said it would be futile to enter into a discussion as to the relative places of science and practice; one could not do without either if satisfactory progress was to be made. Both Dr. Rideal and Dr. Kenwood rather shied at the idea of a central investigating department, and seemed to incline to having departments in the various districts. He thought, however, they were going a little too fast: his own view was that before they got down to dealing with particular sewages, there was an enormous amount of fundamental work to be done. As to the difficulty of getting Parliament, in the congested state of public business, to do anything in the matter so far as the formation of a central authority was concerned, that was only possible with the assistance of Parliament; but it ought not, in his view, to be difficult for a responsible Minister to provide the necessary facilities by means of a Government grant.

On the proposition of Mr. Boulnois, a vote of thanks was accorded to the chairman, and the meeting terminated.

Amman Valley Sewerage.—At a special meeting of the Cwmamman Urban District Council recently the report of the committee appointed by the different councils interested to formulate a joint sewerage scheme for Pontardawe, Cwmamman and Ammanford was adopted subject to the deletion of the clause including Brynamman.

The Tavistock Arbitration Award.—Mr. A. J. Ram, the arbitrator in the proceedings between the Tavistock Urban District Council and the Duke of Bedford for the purchase of certain of the latter's large public properties, has fixed the purchase price at £30,726. The value put on the properties by the agent of the Duke of Bedford was £52,344, while the council offered £16,500. The properties concerned include the waterworks, the markets, and the town hall.

Railways and Road Vehicles.—General opposition by the districts concerned will be offered to the clauses of the London and South-Western Railway Bill, 1913, by which the company seek power to own, work, and use road vehicles, moved by animal or mechanical power, for the conveyance of persons, luggage, and goods to or from their stations or otherwise. Apparently there is no limit to the weight of goods that may be carried or to the number of trailers that may be used. The Surrey County Council are recommended by their Parliamentary Committee to petition against the clauses on the main ground that this unprecedented addition to the statutory powers of a railway company, involving a serious increase of heavy motor traffic on the roads, should not be authorised by Parliament until the suggested amendment of the highway law, to meet modern conditions and requirements of road traffic, have been considered and settled by Parliament. In the alternative, protective clauses should be inserted giving the highway authorities power to register and license road vehicles, to regulate the routes and conditions of traffic, and to obtain some contribution towards the increased cost of road maintenance resulting therefrom.

London Street Pavings.

METROPOLITAN COMMITTEE'S TENTH ANNUAL REPORT.

The Metropolitan Paving Committee have issued their tenth annual report relative to the paving works carried out in the County of London by various road authorities, compiled from information furnished by the engineers to the various authorities concerned. It may be recalled that the committee was formed as the result of a conference of representatives of the metropolitan borough councils held at the Westminster City Hall on January 8, 1903, for the purpose of considering the general question of materials and means of paving the streets of London. The information furnished in the returns on which this report is based relates to practically all the best-known descriptions of paving, the method of laying, the period the paving has lasted, cost of laying, effect of motor-omnibus traffic on the roadway, saving on tar-sprayed roads, and other details.

The chief features of this year's return may be very briefly summarised as follows:—

Principal Kind of Paving Laid.—The bulk of the paving laid down in the districts mentioned in the returns during the year appears to have been creosoted soft wood, although in some instances other kinds of paving predominated. Large areas of tar-macadam were laid in some districts, principally in limited traffic residential and business streets, while a large amount of tar-spraying has also been undertaken.

Foundation.—In some boroughs a foundation of Portland cement concrete 9 in. thick (in one case 12 in.) has been adopted, while in others a 6-in. foundation has been deemed sufficient. There is a decided tendency to increase the thickness of concrete foundation, owing to the detrimental effect of heavy motor traffic.

Effect of Motor Traffic.—Motor traffic is considered to be detrimental to macadam-paved roads, and the majority of the borough surveyors are of opinion that motor traffic has increased the cost of the upkeep of the roads. A digest of the replies received from the surveyors of various metropolitan boroughs to the committee's inquiry as to whether the increase of motor traffic has had the effect of increasing the cost of paving and maintaining the roads in their borough is appended to this report.

Saving on Tar-sprayed Roads.—Considerable saving continues to take place in those boroughs where the tar-spraying of macadam roads is largely undertaken. From the appended information it will be seen that a very considerable saving has been effected in the boroughs of Fulham, Greenwich, Hammersmith and Wandsworth in the cost of scavenging, watering and maintenance of highways since the adoption of the system of tar-spraying macadamised roads. It is, moreover, generally agreed that a great improvement in the road results from tar-spraying.

The returns sent in during the past year have been put in tabulated form, and may be briefly summarised as follows:—

GREENWICH.

Some 3,600 super. yds. of tarred macadam, 4 in. deep, were laid in this borough. The macadam was consolidated with the steam roller and laid on an old foundation, the subsoil being gravel. The cost of laying per yard super. was 3s. 3d. without foundation, the work being carried out by the local authority. The surveyor mentions that 47,227 super. yds. have been tar-sprayed in the borough at a total cost of £463 19s. 9d.

HAMMERSMITH.

In Stamford Brook-road tar-macadam, composed of Trinidad Lake bitumen and granite mixed, 3 in. thick, with a sealing coat of refined Trinidad Lake bitumen, was laid on a foundation of old macadam at a cost of 3s. 9d. per yard super. In another thoroughfare, with limited traffic, tarred-slag macadam, 3 in. thick, was laid on an old foundation at a cost of 2s. 9d. per yard super. In this borough 275,164 super. yds. have been tar-sprayed at a cost of £602 5s. 8d.

HAMPSTEAD.

Hard and soft wood, lithofalt block paving, lithomac paving and tar-macadam were laid in this borough during the past year. The 8-in. by 3-in. by 4-in. creosoted deal blocks were laid with close joints run in with a mixture of boiling pitch and creosote oil, grouted with Portland cement and top dressed with fine shingle on an old 6-in. foundation broken up and a new Portland cement foundation 9 in. thick, including 1 in. floating formed. The foundation was laid by the local authority, the paving by a contractor at a cost of from 5s. 7½d. to 5s. 8d. per yard super. without foundation. The 4-in. Jarrah blocks which this paving replaced had been down for eleven years in these heavy traffic roads. In Heath-street, where the traffic is limited, these blocks were laid in the same manner on an existing foundation made good and refloated with Portland cement and sand, at a cost of 7s. per yard super., including the work of remaking the foundation. The 5-in. deal blocks which this paving replaced had been down nineteen years.

In Finchley-road, a heavy traffic thoroughfare, 8-in. by 3-in. by 3¼-in. sectional Jarrah blocks were laid, the courses divided by fillets of ⅜ in. in depth and $\frac{1}{17}$ in. in thickness, the joints being filled in with a mixture of boiling bitumen. They were laid on an existing foundation made up to the proper level with Portland cement concrete, and refloated with Portland cement and sand at a cost of 13s. 6d., including the cost of the work of remaking the foundation. The Jarrah blocks which this paving replaced had been down eleven and twelve years. The surveyor states that this sectional block paving has proved very satisfactory after an experience of seven years; the wear is smooth and even, and there is no corrugation of the paving as in ordinary hardwood paving.

Lithofalt blocks, 9 in. by 4½ in. by 1¾ in., were laid in Belsize-road, where the traffic is considerable. They were laid on wet floating, on an existing foundation, made up to suit the new paving. The blocks were supplied by a contractor, and the work was executed by the local authority, the cost per yard super. being 7s. 1d. with foundation.

Lithomac paving, 2 in. in thickness, was laid in College-crescent, where the traffic is considerable, at a cost of 5s. 1d. per yard super. with foundation.

HOLBORN.

Most of the paving laid in this borough consisted of compressed rock asphalt 2 in. thick, the Portland cement concrete foundation being, in nearly every case, 9 in. thick. The rock asphalt was compressed with heated pelons, the cost per yard super. varying from 10s. 2d. to 13s. 9d. with foundation, and 9s. to 9s. 3d. without foundation. This paving has worn well. Some Trinidad Lake asphalt macadam, 3 in. thick, was laid at a cost of 4s. 9d. per yard super. without foundation.

In Chancery-lane, where the traffic is, of course, considerable, creosoted Swedish deal blocks, 3 in. by 9 in. by 5 in. have been laid in pitch grout finished in cement, joints $\frac{1}{10}$ in. in thickness, on a Portland cement concrete foundation, 9 in. to 11 in. in thickness, at a cost of 13s. 3d. per yard super. with foundation, and 7s. 7d. without foundation, the annual cost of maintenance per yard super. being 1s.

KENSINGTON.

The return from this borough contains particulars of a new description of paving—namely, camphor wood blocks, 9 in. by 3 in. by 4 in., grouted tar pitch and cement, and laid on a 6-in. Portland cement concrete foundation at a cost of 11s. 3d. without foundation.

Creosoted deal blocks, 8 in. by 3 in. by 4 in. or 4½ in. or 5 in., were laid, grouted tar pitch and cement on a 6-in. Portland cement concrete foundation, at a cost of from 9s. 2d. to 10s. 3d. with foundation, and 6s. 8½d. to 7s. 4½d. without foundation. In Notting Hill Gate the wood paving which this paving replaced had been down twelve years, and in residential thoroughfares the paving replaced wood paving which had been laid from sixteen to twenty years previously.

Kensington asphalt clinker blocks were laid in residential thoroughfares by the local authority.

LONDON COUNTY COUNCIL.

In Bridge-street and Church-street, Greenwich—very heavy trafficked thoroughfares—the county council have laid 3-in. by 9-in. by 5-in. Jarrah wood blocks in pitch on a 9-in. concrete foundation, at a cost of 15s. 6d. with foundation and 12s. 9d. without founda-

tion. It would appear from the return that even in the case of a new side street, between Tufton-street and Smith-square, Westminster, the council have considered it desirable to place a 9-in. concrete foundation under the 2 in. of asphalt.

CITY OF LONDON.

In the City of London rather more asphalt than wood was laid during the period under review. The 2½-in. natural rock asphalt was compressed *in situ*, and laid on a 9-in. Portland cement concrete foundation at a cost of from 13s. 6d. to 15s. 6d. per yard super. with foundation, and 10s. to 10s. 9d. without foundation, the annual cost of maintenance varying from 6d. to 1s. 9d. per yard super.

Creosoted deal blocks, 3 in. by 5 in. by 8 in., the joints being filled in with a boiling mixture of pitch and oil, were laid, in the case of Bishopsgate-street, on a 9-in. Portland cement concrete foundation with 3 in. of broken brick rubbish under. In Creechurch-lane and Northumberland-alley, Fenchurch-street, a Portland cement concrete foundation of 8 in. and 6 in. respectively was considered sufficient. The engineer states that the repaving in Bishopsgate is consequent upon a widening of the street, and that the paving was originally laid in 1874, and repaired from time to time. The cost of this soft wood is from 10s. to 11s. 7d. per yard super. with foundation, and from 7s. 6d. to 8s. without foundation. The annual cost of maintenance is 1s. per yard super. in Bishopsgate and 6½d. per yard super. in the two other streets.

ST. MARYLEBONE.

In Wimpole-street and neighbourhood a large area of new wood pavement was laid by this council in the year 1911, the material employed being creosoted yellow deal blocks, 5 in. by 3 in. by 9 in., laid close jointed, and grouted with pitch and creosote oil on a 6-in. cement concrete foundation. The work was carried out by the council with direct labour, at a cost per yard super. of from 13s. 11½d. to 14s. 6d. with foundation. The same material laid in the same way was used for considerable areas of pavement renewals, the work being done by the local authority at a cost per yard super. of from 7s. 11½d. to 10s. 6¾d. without foundation; 56 000 super. yds. were tar-sprayed at a cost of 1¾d. per super. yard.

Large areas of tar-macadam were laid in limited traffic residential streets. This was laid to a depth of 4½ in. when finished, bedded on the old macadam foundation. The work was done by contract at a cost of from 4s. to 4s. 7d. per super. yard without foundation.

ST. PANCRAS.

The 2-in. asphalt laid in this borough, at a cost of 11s. 4d. per yard super. with foundation, and 8s. 3d. without foundation, replaced 5-in. Jarrah blocks which had been down twelve years in Upper Woburn-place, a thoroughfare carrying considerable traffic.

In Seymour-street, where there is also considerable traffic, 5-in. by 3-in. by 9-in. creosoted deal blocks were laid, and half pitch-grouted with lath joints on a 12-in. Portland cement concrete foundation, at a cost of 15s. 6d. with foundation, and 8s. 4d. without foundation. This paving replaced 4-in. Jarrah blocks which had been down sixteen years.

In Gordon-square, where the traffic is limited in extent, 5-in. by 3-in. by 8-in. creosoted deal blocks were laid, dipped in pitch and oil, on an old concrete foundation, at a cost of 8s. 10½d. with foundation, and 6s. 11d. without foundation, replacing 5-in. Jarrah blocks which had been down nineteen years.

WANDSWORTH.

In this borough large areas of creosoted soft wood blocks 8 in. by 3 in. by 5 in., were laid, dipped in a mixture of tar and pitch, and grouted with Portland cement mortar on a 6-in. Portland cement concrete foundation. The cost is not given in the return, as the contract included other works in a lump sum, but the price in the schedule attached to the contract was 11s. 6d. per square yard for extra work.

CITY OF WESTMINSTER.

The return from the City of Westminster deals with creosoted pine blocks and combined strip paving. The blocks were laid close jointed, grouted with a mixture of boiling pitch and creosote oil, and after with cement grout, top-dressed with ⅜-in. ballast on a 6-in. Portland cement concrete foundation, and filling in places floated with 1-in. floating. The cost of the pine blocks varied from 10s. 5d. to 12s. 7½d. per super. yard with foundation, and from 7s. 9d. to 8s. 9d. without foundation, while the cost of the combined strip paving is given at from 8s. 5d. to 12s. 9d. with foundation.

EFFECT OF MOTOR TRAFFIC ON COST OF PAVING AND MAINTAINING ROADS.

The committee, having been informed that in order to withstand the greater weight and strain which is now imposed on road foundations due to the increase of motor omnibuses and other heavy mechanically propelled vehicles, it had been found necessary in many cases to increase the thickness of the concrete foundation, invited an expression of opinion from the surveyors of the various metropolitan boroughs on the subject of whether the increase of motor traffic has had the effect of increasing the cost of paving and maintaining the roads in their respective boroughs.

The following is a digest of the replies received:—

Battersea.—Have the subject under consideration, and will be shortly issuing a report on the subject.

Bermondsey.—In consequence of the motor omnibuses and other heavy mechanically propelled vehicles it has been found necessary to increase the thickness of concrete of the carriageway from 6 in. up to 9 in., or even 12 in. in some cases, thus considerably increasing the cost of construction.

Fulham.—Motor traffic has had the effect of, if anything, decreasing the cost of maintenance of wood-paved roads. A record of the wear is as follows:—

Fulham Road (near Stamford Bridge):—

Date.	No. of years laid.	Rate of wear per annum.
September, 1902 ...	10	0·209 in., relaid 1904.
July, 1907	3	0·17 in.
June, 1912	8	0·136 in.
Dawes Road (part):—		
(*a*) September, 1902 ...	7	0·12 in.
(*b*) September, 1902 ...	11½	0·14 in., relaid 1905.
(*a*) July, 1907 ...	11	0·12 in.
(*a*) June, 1912 ...	16	0·103 in.
Lillie Road (a section):—		
September, 1902 ...	7½	0·192 in.
July, 1907	11½	0·186 in., relaid Aug., 1907.
June, 1912	5	0·126 in.

On water-bound macadam roads motor traffic has effected considerable damage and disintegrated the surface, but the roads that have been so effected have been re-made with bituminous macadam, and the result is that the cost of maintenance of such treated roads now submitted to motor traffic is not more, if as much, as the water-bound surface previous to the motor traffic coming upon it. The scavenging has been considerably reduced. A record of the manure and refuse taken in one week on the whole of the wood-paved roads in Fulham in 1909 was 85 tons 2 cwts. 3 qrs. According to the meteorological report rain fell on two days to the extent of 0·11 in. and 0·16 in. respectively. In the same month, two years later, the record was 64 tons—that is a reduction of 20 tons, or equal to 1,000 tons per annum. The motor traffic soon finds out any weak spots in the wood paving, and these are repaired immediately. This appears to increase the number of repairs, but, as will be seen from the actual wear in the depth of the material, the life of the wood paving is considerably increased, and more than compensates for the increased cost of repair. The concrete foundations have withstood the motor traffic very satisfactorily, and where there have been any weaknesses the motor traffic very soon discovers it. Except for the making good of these weak places there does not appear to be any cause for complaint.

Finsbury.—The surveyor cannot say that the motor traffic has increased the cost of road maintenance in this borough. Practically the whole of the roads used by motor traction are roads paved with granite, wood or asphalt on from 9 in. and upwards of Portland cement concrete.

Greenwich.—There is an increasing charge for maintenance of all roads, perhaps not so much on granite-sett and wood-paved as macadamised roads. There is no doubt that the greater weight is causing great damage to the old concrete foundations, which were never put in to carry such traffic, and the increased load and speed is causing greater vibration.

Hackney.—Great increase of motor traffic has necessitated constant attention to the roads over which such traffic passes, and the expenditure of considerable sums of money on their maintenance, renewal and repair. Roads which, until the advent of motor traffic, were in good condition are now having their

surfaces destroyed and their foundations disintegrated, while others have had to be entirely re-made with more lasting materials. Where this has not been necessary up to the present time it has been found that the usual life of the road has been considerably curtailed—even to the extent of 25 per cent. Foundations of Portland cement concrete, which were sufficient a few years ago, are now quite inadequate; and in all renewals where defects have been found, and in new work undertaken, the foundations are now increased in depth by 50 per cent.

Hammersmith.—Since the more general use of motor omnibuses and other heavy mechanically propelled vehicles the Hammersmith Borough Council has increased the thickness of concrete foundation in wood-paved roadways from 6 in. to 8 in. The increase of motor traffic has undoubtedly added to the cost of construction of all classes of roads. As regards maintenance, on wood-paved roads the surveyor thinks that time will prove decreased cost, inasmuch as the life of the wood will be slightly lengthened; but on all other roads he considers the expense is largely increased.

Hampstead.—Motor-omnibus traffic has considerably increased the charges for maintenance of all classes of roads. With regard to wood-paved roads, the life of the paving has undoubtedly been reduced one or two years in consequence of this traffic, and the depth of the concrete foundation has had to be increased from 6 in. to 9 in. Two new 'bus routes have recently been opened over macadam roads which are quite unsuited to this traffic, and it will be necessary to at once spend a little over £6,000 in wood and other paving to meet the requirements of this traffic. The additional cost of the road maintenance in this borough for the past two years, caused by motor-'bus traffic, has been about £5,000 per annum.

Holborn.—There is no doubt that motor traffic has increased the cost of the upkeep of roads. Apart from motor omnibuses and motor vehicles used for commercial purposes the main roads have to carry very heavy burdens in the shape of traction engines and lorries, and the foundations of many roads are not strong enough to bear such enormous weights. In place of a concrete foundation 6 in. thick, which was sufficient ten years ago, the Holborn Borough Council are now putting in Portland cement foundations 12in. in thickness.

Lewisham.—There is no doubt whatever that the heavy motor traffic of the present day is very materially increasing the cost of maintenance of roads. The twin-tyred vehicles, such as motor omnibuses, create a partial vacuum between tyres, and suck the surface of the roads upwards. This, of course, has a bad effect on wood paving, but an infinitely worse effect on water-bound macadam roads, where the surveyor has seen stones pulled out by this influence. The heavier motor traffic, such as steam lorries, is undoubtedly damaging the foundations of many roads, and it has become necessary to increase the thickness of the concrete. Of course, this is impossible in roads which are already paved without breaking up the entire job, but in laying new paved roads the surveyor is providing an additional depth of concrete.

City of London.—Due to the increase of motor vehicles, the existing foundations of many of the main thoroughfares are not of sufficient strength to withstand the weight and strain now imposed upon them; and the city engineer considers that the minimum thickness of the concrete foundation should be 9 in.

St. Marylebone.—It does not appear that the cost of maintaining wood-paved roads in this borough has been increased in consequence of their being traversed by motor vehicles, although recently this council have increased the depth of concrete foundations for wood paving in the more important thoroughfares from 6 in. to 8 in. and 10 in. The effect of motor traffic on macadam roads, in the more frequented thoroughfares, has been that the roads have had to be re-coated annually, and in order to counteract this the council have been extensively substituting tar-macadam for macadam. Quite recently the London General Omnibus Company inaugurated a new service of motor vehicles traversing an important water-bound macadam road in the borough, with the effect that it will have to be repaired within a very short period; and another road, under similar conditions, has had to be dealt with by the council as a matter of urgency.

St. Pancras.—Many wood-paved streets in this borough have either already been injured or shortly will be, by this traffic breaking up the concrete foundation insufficiently strong to carry the traffic. The St. Pancras Borough Council have recently had to re-form the concrete foundation of Seymour-street when repaving it. The original concrete foundation was about 6 in. thick, and for many years it proved sufficient to carry the very heavy ordinary traffic of the street, but as soon as two services of motor 'buses began running, the surface in many places showed indication of subsidence, and on examination the concrete was found to be completely broken up, and it was found necessary at the time of repaving the street to form a new concrete foundation which has been put down 12 in. thick. The additional cost in this street alone of removing the old foundation, carting rubbish to shoot, and providing a new foundation, amounted to about £2 600, being about 40 per cent of the total cost of the job. In Great College-street they have a daily and very frequent traffic of a motor steam wagon, and the condition of the granite paving in this case indicates the destruction of the foundation. A short section of this was opened up last summer, and a new foundation formed, and the road repaved, but a considerably longer length of this and adjoining streets will require the same treatment at an estimated cost of £1,200, necessitated entirely by this motor traffic. On macadam roads the motor-'bus traffic is terribly destructive; the increased cost of maintenance will be an item of very considerable amount, and brings one to the conclusion that a water-bound macadam road is entirely unsuitable for motor-omnibus traffic, and yet such traffic cannot be forbidden the use of macadam roads. The convenience of motor omnibuses as a means of public traffic is such as to render it improbable that even if the power existed they would be debarred from using such roads. It therefore follows that such roads should be paved with other material than water-bound macadam, so as to carry without destruction this traffic. The cost of repaving these roads is formidable, and hence the claim of the local authorities that grants should be made by the Road Board from the fund provided by the petrol tax towards the necessary expenditure in London as well as on provincial county roads.

Paddington.—In recent years, when renewing wood-paved carriageways, and where the existing concrete foundation, &c., originally about 7 in. deep, has been found to be defective, they have been replaced with concrete, &c., of a thickness of from 10 in. to 13 in. There can be no doubt the increased amount, the greater weight and the greater speed of vehicular traffic have caused an increase in recent years in the cost of maintaining carriageways.

Poplar.—The increase of motor traffic has certainly had the effect of increasing the cost of road maintenance.

Southwark.—The increase of motor traffic has had the effect of increasing the cost of paving and maintaining the roads in this borough, but it is not possible at present to give actual details as to the cost.

City of Westminster.—The city council last year approved an alteration in their specification for paving work to provide for the laying of 8 in. of concrete foundation and 1 in. of floating instead of 6 in. of concrete and 1 in. of floating formerly specified—this, of course, only to apply in cases where new concrete foundation is laid. In the opinion of the city engineer the increase of motor traffic prejudicially affects macadam roads, and, perhaps to some slight extent, asphalt roads also; but he does not think that as a result of motor traffic in Westminster there has been any increase in cost of maintaining wood-paved roads originally laid on present-approved methods.

Woolwich.—On the motor-'bus route from Lee Green to Sidcup through Eltham, which is still an ordinary water-bound macadam and tar-sprayed road, the extra wear has been very considerable, and the Woolwich Borough Council is now considering the advisability of adopting a more durable paving to withstand the modern traffic.

"The Surveyor" in the Colonies.—We acknowledge with pleasure the receipt of the following letter from Mr. F. McArthur, the city engineer of Regina, Sask., Canada. Incidentally, it throws light on the enterprising methods of Canadian local authorities, and is an example we commend to the notice of our home local government bodies: "Enclosed please find official order for twelve months' subscription for THE SURVEYOR (commencing January 1, 1913). I shall be obliged if you will forward this publication and send account to this [city engineer's] department, when same will be passed for payment."

The Management of Roads in Germany.

ADMINISTRATIVE ARRANGEMENTS IN CERTAIN PROVINCES: DEVELOPMENTS DURING THE PERIOD 1905-1910.

Official reports relating to the management of highways in Germany show that while in some cases no changes of importance have taken place during the period from April, 1905, to April, 1910, there have, in other states, been considerable developments under powers conferred by the Statutes enacted in 1875 and 1902. In Germany the Imperial Government does not control the roads; the administration is in the hands of the State authorities, or those of provinces into which the State is divided, and local bodies corresponding to our county and district councils. Such control is, of course, on a scale very different from that of State control over areas approaching or exceeding the whole German Empire in area. On the other hand it involves some general control, and in some cases direct administration, over areas considerably exceeding those of English counties. For instance, among the German provinces to be mentioned below, East Prussia, Hanover and Brandenburg occupy each more than 14,000 square miles, West Prussia more than 8,000, Wurtemburg more than 7,000, and Saxony more than 6,000. These areas may be compared with the West Riding of Yorkshire 2,736 square miles, Devonshire 2,586, the North Riding of Yorkshire 1,995, Northumberland 2,018, Lancashire 1,905, Somerset 1,640, and Shropshire 1,319 square miles. It is clear that the State control in Germany differs less from the county control of England than it does from State control in America. The small State of Maryland, however, with an area of 12,210 square miles, and Massachusetts with 8,040 square miles, resemble both in area and in the density of population some of the German provinces which form areas of highway administration, and some four or five other American states fall into the same category. Most of the States of the American Union, however, are very much larger, and a number of those in the middle and western portions compare with European countries in area, though with much smaller populations, while State control in France or Italy is exercised over similar areas with large populations. In so far as it affords material of value as regards the areas to be considered in the question of highway administration in the United Kingdom, the example of Germany is rather *germane* to a discussion of groupings of counties with areas such as those of the Saxon Heptarchy than with respect to a general State control or even separate State control in the three kingdoms and the Principality.

ADMINISTRATION IN CERTAIN PROVINCES IN GERMANY.

The following particulars relate to a number of provinces, sufficient to convey an idea as to the position of affairs generally, and as to the extent to which it has been found desirable to make changes in administrative arrangements. The material is that furnished by an article in *Der Strassenbau*, specially translated for THE SURVEYOR, the matter being rearranged under different heads for the convenience of the reader. References to "changes" relate to the period from April, 1905, to April, 1910.

East Prussia.—No changes have been made in the administration of provincial highways which are managed by the provincial authorities in the districts of Koenigsburg (rural), Tilsit (rural) and Niederung. In the remaining thirty-one districts in which there are provincial highways their maintenance is in the hands of the district authorities by agreement, the sums paid by the province ranging from 345 marks to 682 marks per kilometre (£28 to £55 per mile) per annum. During the five years under review about 7 miles of provincial highways have been transferred to urban authorities. The province continues to supervise, through its technical officers, the maintenance of the provincial highways, and there has been no change in the management of district and parish roads.

West Prussia.—No very important changes have been made in the organisation, provincial management of highways being exercised as before, except as regards a short stretch of road in the Loebau district which has been transferred to the local authority. For the most part the district roads are maintained under the supervision of the district surveyors, and road inspectors acting under their instructions. In some districts special inspection circuits have been constituted, which are placed under the direction of district council committees. The parishes maintain certain lengths of road with the help of the districts, and subject to inspection by the district surveyor.

Brandenburg.—Out of the 885 miles of provincial roads in this province, some 9 miles have been handed over to the smaller authorities, bringing the total so handed over to nearly 73 miles. Of this total 15 miles have been taken over on payment of lump sums, and about 58 miles with perpetual annual payments. The rural road inspectorships terminated with the year 1909, and the maintenance of rural roads is now carried out under four chief road surveyors, whose headquarters are in Berlin. The employment of technically trained road surveyors in place of highway inspectors has been continued, and there are now nine such officers and thirty-seven highway inspectors. The district surveyors are assisted by technical staffs, while the less important local roads are managed by road inspectors who directly control the roadmen. The smaller parishes and owners of private estates often apply to the district road officials for assistance in laying out and improving their roads, and the districts exercise control over the construction of parish roads.

Posen.—The roads formerly maintained by the province have been handed over in all but seven districts to the district councils. The mileage so transferred is 2,180, and the annual allowance made for their maintenance is £72,417, or an average of about £33 a mile. As a result of the transference, 117 out of 153 road inspectors, including twelve chief inspectors, have passed into the service of the districts concerned. In most of the districts departments for the management of roads have been constituted, but in some districts the work is carried out by the rural road inspectors without such an organisation. The organisation of the district road departments is usually placed at the disposal of the parishes and landed estates free of charge.

Schleswig.—Up to the close of the period covered by the report—to March, 1910—the maintenance of provincial roads was in the hands of the province itself in nine districts, and in forty-eight urban and rural districts the roads were maintained by the local authorities by agreement with the province for annual allowances. A similar arrangement was in force with fourteen town corporations, while in the case of one district the arrangement was that the sums actually expended should be reimbursed. The agreements with the urban authorities were made for ninety-nine years, but those made with the rural districts expired in March, 1910. These have not been renewed, but the management and ownership of the provincial roads have since been transferred to the districts in consideration of annual allowances. In some districts the councils have not accepted the terms offered, or do not wish to take up the responsibility for road maintenance, and here the provincial roads are maintained by the province. The changes involve an addition of 776 miles to the district roads, and new parish and estate roads have been made. On the other hand, the mileage of roads in the hands of private persons or of companies has been further reduced, and a number of "road unions" have dissolved and have handed over to the districts the roads which they had made.

Saxony.—In the governmental circuit of Magdeburg—except in two districts—the roads are managed and maintained by the districts. Roads converted into highways by parishes and landowners with the assistance of the province and of the district likewise pass over to the district after completion. In one rural district the roads are provincial, parish and estate roads, none being maintained by the district, which, however, contributes one-quarter of the cost of construction of parish and estate roads and one-tenth of the cost of improvements, and retains the duties of inspection. In the Marseburg circuit the distinction between provincial and district roads is maintained. In the circuit of Erfurt the provincial roads are under the supervision of the rural road inspectors, and the

district roads are inspected partly by the district officers and partly by provincial officials.

Hanover.—No changes have taken place in the organisation, but the transfer of about 6 miles of roads to urban authorities may be noted, the lump sum payments made amounting to £974, or £157 a mile, and the annual payments to £765, or £123 a mile.

Westphalia.—Three more towns have taken over the maintenance of provincial roads, bringing the total of such towns to eighteen, and the mileage so transferred to 65. Further agreements have been made with the districts as regards the co-operation of the provincial and district authorities in the maintenance of district roads.

Hesse-Nassau.—(*a*) The Governmental Circuit of Cassel. Some 13 miles of roads have been transferred to three towns, with lump sums in consideration thereof. A change has been made in the management of rural highways, the cost of construction and maintenance of which legally devolved upon the parishes though contributions were made out of the governmental circuit and the district funds, the work being carried out by the former authority. Recently, however, most of the districts have taken over the management of the highways, while new construction work has been left to the parishes. Under a new law the entire burden of road construction falls upon the districts. (*b*) Governmental Union of Wiesbaden. This authority carries out, as heretofore, the technical supervision of all roads in the neighbourhood. The responsibility for the construction and maintenance of local roads devolves on the parishes. The provincial authority (Governmental Union) grants subsidies for the construction or completion of roads and carries out such work on account of the parishes, and undertakes by agreement, on account of the parishes, the maintenance of existing roads. In addition, this authority provides the technical staff necessary for construction and maintenance. In many cases the districts have also assisted in the making of local roads by the granting of subsidies, and by providing district road keepers.

Rhine Province.—No material changes have taken place in the management of provincial roads, but the province has continued the transfer of roads to the smaller authorities.

While in some parts of the province district roads can hardly be said to exist there has been considerable activity in other portions, and a number of districts have created road systems by taking over parish roads, the management of which is in the hands of suitable officials and their staffs. Road management in the parishes is not uniform. Usually it is in the hands of the burgomasters, while in some cases officials with some technical qualifications have been appointed.

In Hohenzollern no changes have taken place, and no material alterations have been made in Schleswig-Holstein. In the latter province the whole of the provincial roads are directly maintained and managed by the provincial authority. In Pomerania the management and maintenance of the provincial roads is in the hands of the districts, under agreements with the provincial authority.

SOME ADMINISTRATIVE DETAILS.

In Brandenburg the average length of a highway inspector's circuit is about 13½ miles, a very slight increase since the year 1905. In a West Prussian district mentioned in the report the length in charge of each road keeper is from 5 to 6 kilometres—say 3 to 3¾ miles—this man being charged with the duty of carrying out the smaller repair and maintenance work. In Posen the salaries of the rural road inspectors have been fixed at 4,100 marks (£205), with triennial increments up to £300. The salaries of district road surveyors vary between £120 rising to £225, and £150, rising to £230 with certain allowances, including £60 to £75 for expenses. The road overseers receive in most districts commencing salaries between £60 and £75, and a maximum salary of £125.

In Westphalia salaries have been fixed as follows: Rural road inspectors, £210 to £350; technical secretaries, £165 to £200; first-class road overseers, £82 to £140; second-class road overseers, £110. In addition a house or rooms is made or free quarters are provided. In this province there is a school of road construction attached to the Agricultural College at Soest, and a number of road surveyors and road keepers have taken the autumn course instituted by the State. An idea of the relative numbers of the two classes of officers is conveyed by the figures for the Governmental Circuit of Wiesbaden, where eight inspectors have under them fifty-one road surveyors. There are 229 road keepers for the government and local roads. The employment of experienced and reliable road keepers is giving good results in the Rhine Province.

In two districts of Brandenburg the district committee is assisted by a number of honorary road overseers, each of whom exercises supervision over the roads near his house.

ELECTRICITY WORKS EXTENSIONS AT KINGSTON-ON-THAMES.

DIESEL HORIZONTAL ENGINES.

In order to deal more economically with their day load and their small load during the night, the electricity department of Kingston-on-Thames Corporation are installing two Diesel oil engines of the horizontal type.

Although there are, of course, a large number of vertical Diesel engines running in England, Mr. J. E. Edgcome, M.I.MECH.E., M.I.E.E., the borough electrical engineer, believes that these are the first horizontal Diesel engines installed in this country for central station work.

The engines have been manufactured by the Maschinenabrik Augsburg-Nürnberg A.G. at their Nürnberg works. One set comprises a four-cycle, four-cylinder, horizontal Diesel engine of 400 b.h.p., with fly-wheel type alternator, giving an output of 270 kilowatts. The second set is a two-cycle, two-cylinder, horizontal Diesel engine of 500-b.h.p., with fly-wheel type alternator, giving an output of 335 kilowatts. Messrs. Siemens Bros. Dynamo Works, Limited, of Stafford, are the makers of the alternators.

In connection with these Diesel sets there are also being installed, in duplicate, cooling water pumps for supplying water to the water jackets of the cylinders and cylinder heads, as well as separate pumps for supplying cooling water to the pistons of the two-cycle engine.

Two oil storage tanks are being installed, each capable of storing 60 tons of fuel oil, which will be pumped by means of an electric pump direct from a tank barge at the riverside into these storage tanks, a distance of 150 yds. From the main storage tanks the oil will be pumped electrically into a small storage tank fixed near the roof above the engines, whence it will feed by gravitation through the filters to the engines, so that all handling of the fuel oil is avoided.

This particular type of engine is designed to run at all loads on gas-tar oil as well as on ordinary fuel oil.

A new high-tension alternating current main switchboard is being installed, consisting of twenty-four generator and feeder panels, with provision for six further panels. The board will be fitted with duplicate high-tension bus-bars, remote control operating board, automatic overload oil switches on the feeders and reverse current switches on the generators, and indicating and signalling lamps on each panel in connection with the bus-bars and oil switches. The whole of the high-tension gear will be enclosed in separate moulded stone cubicles with a complete system of interlock, which will absolutely prevent the handling of any live high-tension gear.

The total cost of the work will amount to approximately £13,500, but Mr. Edgcome estimates that the annual saving in fuel costs will be considerably more than the extra charges for interest and repayment of capital.

"The Surveyor's" Coming-of-Age. Mr. F. W. Hodson, M.INST.C.E., F.G.S., consulting engineer, Loughborough, Leicestershire, writes: "Let me congratulate you on the 'Majority' and, again, on the 'Annual' issue. The contrast between the latter and the first issue is remarkable, and typical of the growth of the profession and of the growth of the influence of THE SURVEYOR on the profession. At first a weak and puny baby, it was unwanted—no one rushed to advertise or to contribute. The profession has grown. THE SURVEYOR has grown faster; it leads, rather than follows, the trend of improvement, many are eager to contribute to it, and many to advertise. It is a great success, and a tribute worthy of your untiring efforts."

Standards and Tests for Sewage and Sewage Effluents Discharging into Rivers and Streams.

ROYAL SANITARY INSTITUTE DISCUSSION.

The Eighth Report of the Royal Commission was considered in a paper submitted by Dr. Samuel Rideal, F.I.C., F.C.S., at a meeting of the Royal Sanitary Institute in London, on the 11th inst., an interesting discussion—to which reference was made in our issue of last week—following. Colonel T. Walter Harding presided over the gathering.

The CHAIRMAN remarked that the recommendations of the Eighth Report of the commission, like those of the previous reports, could have no legal force until they were embodied in an Act of Parliament. Whether Parliament would have time to deal with such commonplace matters that did not appeal to the votes of the electors he could not say, but there was more probability of a Bill being brought in by the Government to deal with the suggestions in these reports if it were found that there was substantial agreement upon them. The Eighth Report had been spoken of in somewhat strong terms, having been described as revolutionary and reactionary, but such terms did not necessarily condemn it. He saw in the New York *Engineering News* that the proposals of the report were spoken of as being as revolutionary for England as they were rational, scientific and practicable for that or any other country.* There was no doubt the recommendations in the report were disturbing, because it was proposed that there should be a statutory standard and a new form of test which was to be the basis of this, while certain relaxations would be permitted according to local circumstances. Hitherto there had been no statutory standard by compliance with which a local authority could avoid prosecution. Many witnesses, especially those representing supervising bodies, gave evidence that it would be impracticable to have a statutory standard. He agreed with that if it were proposed to have a rigid one to which all had to conform. But if it were not rigid in character, if the permissible deviations were few and on common-sense lines, and if the standard itself were within the limits of what had been shown to be practicable, he thought a standard would be useful. On one hand local authorities very naturally asked this sort of question: "Tell us what you expect of us, and if it is reasonable and practicable, and we can afford it, we will try to carry it out, and all the more readily if you can assure us that you will ask nothing more for, say, another ten years." On the other hand, the rivers boards and active county councils had found themselves compelled to adopt some standard; but the standards differed as also did the tests on which they were based and it was not surprising to find that they had little weight in courts of law. It seemed desirable, therefore, that all these varying standards should be brought into line. It was interesting to find that judges had required to be satisfied, not as to the figure of impurity in a given discharge, but as to the effect of the discharge on the stream, whether or not it brought about any nuisance. That was a common-sense view, and one which had influenced the commission in their recommendations in the Eighth Report. If a statutory standard were fixed it must be based on this: that the governing condition of a discharge was its capacity to bring about nuisance in any form in the stream. He thought that discussion might show less objection to the fixing of a standard than to the form of test upon which it was proposed to base it. Changes in routine work were no doubt disturbing, and tended, to some extent, to make useless records on old lines; but such difficulties were very often exaggerated, and they would be found to melt away in practice. The objection to the proposed five days' oxygen absorption test recommended in the report had been mainly because it had been found to give a great deal more trouble than the four-hour permanganate test. That might be; but if the permanganate test required to be supplemented by other tests, and in addition to that they had to estimate the amount of albuminoid and the quantity of nitrate, the question was whether it did not involve more trouble than the single test they proposed which approached more nearly to natural conditions, and gave a better idea of the way in which oxidation was likely to proceed in the stream than was possible by the use of a vigorous oxidising agent like permanganate. Objections had, of course been made that the report did not state what were the relative volumes of effluent and diluting tap water, and it had been suggested that if that were not fixed the results would not be comparable, and that they would vary very much. He regretted that it had not been possible to publish appendices dealing with all these matters. The main feature of the Eighth Report was that they did not propose that an effluent should be considered only *per se*, but judged by its effect on the stream; that was to say the real object to be aimed at was the prevention of nuisance in any of the forms associated with polluted river water. During the time he was chairman of the West Riding Rivers Board he was long attracted, he confessed, by the simplicity of the method of dealing with the effluent by itself in a channel, but his views had been considerably changed as a result of the observations made by the officers of the Royal Commission, some interesting particulars of which they would find in the appendices about to be published. They found, of course that there was no such thing as a perfectly pure river water; their observations showed that clean water might take about ·2 of oxygen, and the important point was brought out that if a river water did not take up more than ·4 of oxygen under the conditions of that test there was no likelihood of any nuisance arising. But that was the border line—the limiting figure; the moment any water exceeded that limit of ·4 there was a probability of nuisance, and if it exceeded it considerably they would find evidence of nuisance. If an effluent was to be considered by itself, and to be so conditioned that, flowing by itself without any dilution, it was not liable to develop nuisance, the standard would have to be that on the five days' oxygen test it should not take up more than ·4 of oxygen. That standard would be, in most cases, impossible of attainment within reasonable limits of expenditure. It would be too drastic, and unnecessarily so, for it was rarely the case that an effluent was not diluted by from at least 8 to 10 volumes of river water. The statutory normal standard proposed by the Eighth Report was based on a dilution of the effluent with 8 volumes of clean river water taking up ·2 of oxygen in the five days' test; that was to say, an effluent conforming to the normal standard if mixed with 8 volumes of clean water would give a mixture which would not take up more oxygen than the limiting figure of ·4. He granted that a literal and logical application of this dilution principle would result in a special standard for each discharge, and even a varying standard for each, but the Royal Commission did not propose anything of the kind; it would be impossible of administration. What they did propose was that there should be a normal standard generally applicable to most places with provision for fixing one or two lower or possibly higher standards where local circumstances appeared to justify it. The normal standard would be the only statutory standard. There would be no statutory right to relaxation because of dilution, but certain conditions of dilution would warrant a *primâ facie* case for consideration by the Rivers Board or central authority, as, for example, if admixture did not bring the water to such a condition as to take up more than ·4, and if the river were able to return to the normal ·2 before the next pollution. But the central authority, in considering such cases, would have to take into account other conditions than those of dilution, and would specially consider neighbouring sources of pollution, and such matters as the presence of weirs, the velocity of the stream, and so forth. His own belief was that cases like those of certain Yorkshire rivers, where pollutions succeeded each other rapidly, and where, besides sewage effluents, they had many trade effluents of large volume that discharged within a certain reach of river, would have to be dealt with *en bloc*, and it seemed unlikely, in such cases, that any relaxation would be permitted to any individual discharge. He must remind them that they

* See THE SURVEYOR, January 3rd last p. 20.

must look at the matter from a broader point of view than that of the special stream with which they might happen to be concerned.

Dr. Rideal said it would seem that the commissioners considered that their main objective was primarily the improvement of rivers, and only secondarily the improvement of effluents, although everyone had looked for their prescribed decision as to the best means of purifying sewage, and also how far it was possible to recover some of the constituents for agricultural purposes. Previously used tests for albuminoid ammonia, oxygen absorbed from permanganate, and others, were abandoned, and main, if not sole, reliance was to be placed on the estimation of dissolved oxygen. The Eighth Report recommended that the dissolved oxygen absorption test should be applied to the effluent not filtered but with its suspended solids, and that absorption of dissolved oxygen should be fixed at 2·0 parts per 100 000 in five days at 65 deg. Fahr. This, coupled with the proviso that the effluent did not contain more than 3 parts of suspended solids, was the general standard which it was now recommended should be prescribed by statute or by order of the new authority for ten years. They must strongly object to the duration of five days as compared with the twenty-four and forty-eight hours alternative times laid down in the Fifth Report, which were long enough in practice and were generally adopted when the Fifth Report was welcomed. A protraction to five days was inadvisable for a control test: in that time the water of most English rivers would be down to the sea, and the absorption in twenty-four hours was quite sufficient to show the pollution. The Royal Commissioners applied the same delay of five days to the test of a recipient water, as judged by their own standard that if 100,000 c.c. of river water did not take up more than 0·4 gramme of dissolved oxygen in five days, the river would ordinarily be free from signs of pollution, but that above that figure it would almost certainly show them. That figure (0·4) they termed the "limiting figure," and in their opinion it should be the foundation upon which any scheme of standards should be constructed in order to ascertain the minimum degree of purification which would be sufficient to obviate risk of nuisance. The same formula was also available to calculate dilution. Unfortunately, the commissioners had discounted their own formula, on the chief ground that it would be difficult to administer. Therefore the proposal that the general standard for an effluent should be capable of being relaxed, so long as the river did not reach this limiting figure, gave a possibility to many authorities of being released from their obligations of purifying their sewage up to such a high standard. What was wanted was an immediate test of the present state, such as the one laid down by the New York Commission, that the water should not fall below a content of 3 c.c. of dissolved oxygen per litre (0·43 parts per 100,000 by weight), which was equivalent in the case of their mixture of fresh and salt water at summer temperature to 58 per cent of saturation. The Eighth Report states that when the oxygen of a river was reduced to about 4 c.c. per litre (0·57 parts per 100 000 by weight) the water was usually in a doubtful condition, and was on the verge of producing nuisance; and when the oxygen was reduced still lower, nuisance might be expected. But it was significantly said that under no circumstances must compliance with the standard be held to justify the use for drinking purposes of streams receiving these effluents without subsequent treatment by the waterworks authority. In future a river must have an oxygen absorption ranging between 0·4 below and 0·2 above the next outfall. It seemed to him that a dual standard of that character for the rivers would not be an improvement, and while it was obvious that below outfalls the quality of a river must necessarily fall, to fix only this variable standard for the quality of the rivers ignored some of the other more important factors. The commission having fixed in their own minds this dual standard for the quality of the rivers in future, it followed that variable effluents could be discharged into rivers without infringing these conditions in certain places. On the other hand, it would be exceedingly difficult in many places to discharge into a river an effluent, however much purified, which would not temporarily reduce the river to a lower figure than 4 c.c. per litre. No town in future could exist on a river whose volume was not at least four times that of the effluent unless its quality were much above the general standard. Similarly no town in future could discharge into the same river as a town higher up unless it were sufficiently distant away for the river water to have ceased absorbing oxygen at the 0·4 rate and become "clean." Nitrates in effluents had no future value, and storm water would still give rise to difficulties.

Dr. Wilson said the discussion seemed to come under two heads—namely, whether a statutory standard was desirable, and whether the test suggested was a suitable and reliable one. With regard to the second of those questions, he thought the commission had made a great mistake in trying to get a single test by which they would be able to say whether a sewage effluent was good or bad. It was impossible in the present state of their knowledge to express an opinion of that kind on a single test. As to the definite statutory standard, long before the commission considered it he had gone into the matter very carefully, and had been considering it ever since, and he was of opinion that it was neither desirable nor practical. If they had a fixed statutory standard, everyone, he thought, would admit that it would be quite unfair to apply it to all kinds of places. His own impression was that it was quite right that the same standard should not be asked of every authority, and that some machinery should be devised for allowing varying standards. He did not think the commission had been very fortunate in their suggestions. He regretted that they had arrived at the decision that in certain instances there was no need to treat sewage at all beyond rough screening, and in other cases settlement, and he regarded the step as reactionary. One important point had not been dealt with in the report. The commissioners did not say whether they intended that the provisions of sec. 17 of the Public Health Act should be repealed or not—that was to say, that no authority should be allowed to discharge effluent into a stream and deteriorate it. He thought that was a very serious matter from the point of view of public policy, because it put the settlement of very grave and important rights in the hands of a Government bureau. He did not believe that Parliament would view that with any great approval, and he did not think they should. His view was that the aims of the commission should be obtained without fixing any statutory standards which would hamper the proposed central authority.

Mr. J. D. Watson, chief engineer to the Birmingham, Tame and Rea District Drainage Board, remarked that engineers had had a great deal of responsibility thrown upon them in the designing of works in times past. Much public money had been wasted through the necessity for designing works considerably in excess of the needs of the situation, and he was glad to see that the Fifth Report of the Commission, in the first instance, seemed to indicate that there was a dawn of some kind of hope for an end of this struggle in the dark. The Eighth Report had gone further. It had given them some idea of what they should do in certain cases—not, say, in all cases, he was glad to say, as otherwise he could not give his support to the suggestion for the establishment of a fixed standard. He was glad there was a prospect under the proposals of the commission to get to an end of the present waste of public funds. Of course, the cast-iron standard would be extremely objectionable and if the proposal was a rigid one, to which every authority in the country were called upon to conform, he would condemn it. But as he understood it, it was simply put forward as something for them to aim at, and the rivers boards and central authority were going to retain the power to vary the standard here and there as cases might occur, and he felt sure that if they had a Government staff in which they had confidence the proposals would work excellently. There were one or two points upon which he was not quite clear. The average summer temperature in England was 65 deg. Fahr., and the test had to be applied at that temperature; but sometimes they got down to an arctic temperature, and bacteria beds gave very poor results. Were the results obtained from the beds to be judged on the 65 deg. temperature? Temperature had a great deal to do with the working of bacteria beds. He had very great pleasure in saying that he thought they were indebted to the Royal Commission for the work which they had done, and he considered that the report which they now had in their hands took them a great stride forward.

Dr. Adeney agreed with what had fallen from Mr. Watson. All interested in the protection of our rivers and of our authorities from unnecessary expense would

agree as to the real value of the commission's reports. As regarded the test which the commission had proposed, he took it that what was primarily wanted was to prevent nuisance in streams, and investigations generally had shown that the dissolved oxygen test was the only one capable of being applied to that end. It very properly took no notice of the harmless constituents in sewage effluents, whereas the albuminoid ammonia and permanganate tests emphasised these. It was, moreover, easy to apply and capable of development.

Mr. G. A. HART (Leeds) said the principal trouble, to his mind, in connection with the report had been the lack of appreciation of the difficulties of the situation. If they were to have a statutory standard, and it was not to be used in a legal sense why have it? If they were to have an authority to whom they were to appeal—a central authority—without resorting to the courts at all, and that authority were armed with the powers given by sec. 17 of the Rivers Pollution Act, it appeared to him that they could not be in a better position.

Dr. GILBERT FOWLER (Manchester) said he was personally of opinion that the two tests chosen by the Royal Commission really gave the best idea of an effluent one could get. If it came to making a rigid standard, he agreed with Mr. Watson that it was impracticable and highly dangerous, because, he ventured to say, if they wanted to "catch" any works, it could be done in a single day by watching the outfall. But river authorities were, as a rule, reasonable people, and looked at the condition of the river. The condition of the river was the main thing, and it was a step in the right direction that the Royal Commission had aimed at—getting a good river. It seemed to him that the real difficulty was that of administration, and he had looked for guidance in that connection over as wide an area as possible. America and Germany seemed to furnish a way out of these troubles, and he ventured to suggest that it might be found best for a watershed to be considered as a whole by some central authority, and the condition of the river or rivers in it determined to begin with, by the general sense of the community which would be represented on such a central board. It seemed to him quite right to say what should be a standard for any given watershed. All the authorities in the area would contribute to a general sewerage and sewage disposal rate and works constructed as required by the circumstances. The cost would then be borne equitably by all.

Mr. BALDWIN LATHAM put a question as to what the Royal Commission meant by "nuisance." His own experience had shown him that a river might be so denuded of oxygen that it would not support fish life, and still there would be no smell or any nuisance.

Mr. W. KAYE PARRY (Dublin) pointed out that from the first Dr. Adeney had advocated the adoption of the oxygen absorption test, and he thought one result of this Eighth Report was to show that Dr. Adeney had all along been working on right lines. The report would be extremely satisfactory to engineers in Ireland.

Dr. MCGOWAN, discussing the question of the period over which tests should extend, said it had to be borne in mind that the longer the time taken the less risk there was of any slight difficulties affecting the tests. With a twenty-four hours' test one would require to be very exact, and the five days' test appeared to be the safest, having regard to everything. As regarded the question of temperature their figure had been arrived at on the basis of records of river temperatures which had been taken, the reading being in almost every instance 65 deg. It had been objected that this standard test did not indicate the nature of an effluent, and how far an effluent had been purified, but the object of the standard was not to do that, but to show the effect an effluent could reasonably be expected to have on a river.

Mr. A. P. I. COTTERELL (Westminster and Bristol) said the recommendations of the commission required a great deal of thought, and after what he had heard that evening he thought they would be very far reaching. They might go rather further than many anticipated, and instead of levelling down, as they were expected to do by the commissioners, the general tendency would be to level up. He was strongly in favour of the idea that the river and not the sewage effluent was the thing which had to be purified. They would learn more about the proposed administration when they saw the appendices which had been spoken of, but there would be few who would be opposed to the formation of a central authority and rivers boards. These were needed for other purposes quite apart from sewage disposal.

Mr. W. H. MAKEPEACE (Stoke-on-Trent) suggested that the recommendations involved a considerable expense in the measurement of streams.

Dr. CALVERT said he thought the test proposed by the commission was likely to give different results in the hands of different chemists.

The CHAIRMAN, in closing the discussion, said he was glad to find that although there had been brought forward a number of minor objections to the proposed test, the fundamental features of the Eighth Report had not been seriously attacked by any except, perhaps, Dr. Wilson. Dr. Rideal had regretted the absence of any bacterial test, but he (the chairman) was afraid it was impracticable to have a bacterial test of sewage. The only alternative was absolute sterilisation, and he thought they would agree, if only from the financial point of view, that that was impossible. Water authorities must be responsible for any further purification.

IRISH ROAD BOARD GRANTS.

ADVISORY COMMITTEE APPOINTED.

In the House of Commons last week, Mr. Hayden asked the Secretary to the Treasury whether the Road Board would favourably consider a proposal that grants should usually be made on the scale of 75 per cent of the total improvement in road-crust work; and, in view of the fact that the board are prepared to allocate further grants up to £100 000 for the period ending March 31, 1913, and that most of the local authorities are unaware of this sum, would the board indicate to each county the approximate sum for which schemes might be considered; and, inasmuch as the actual execution of the works under the above £100,000 would not probably be completed before March, 1914, would the board consider the advisability of indicating now a further allocation to each county to cover the period to March, 1914?

Mr. Masterman: The Road Board are usually prepared, within the limits of the funds available, to make a grant of either 50 per cent of the total cost of resurfacing or 75 per cent of the cost of improvement in road-crust work on roads which they consider suitable for grants. Before allocating further grants, the board desire to have certain technical advice as to the roads on which monies can most advantageously be spent, and in order to obtain such advice they have appointed an Advisory Committee of Irish road engineers, who will shortly commence an inspection of a considerable mileage of Irish roads. The board are not prepared to indicate a further allocation to each county at the present time.

Structural Economy.*—We have received an admirable little book by Mr. E. A Slater, which every borough engineer should make a point of possessing. It represents the "bovril" of engineering practice from foundations to bridges and cuttings, dealing on the way with walls, ground floor construction, roofing materials, upper floor, girders, roofs, ventilation and heating, drainage and sanitary fittings, corrugated iron buildings, fencing, planning, paving, roads, tramways, quays, and service and storage reservoirs. There is a chapter on the law relating to structures, and a number of calculations of real practical value. Mr. Slater's main object is to emphasise the importance of contemplating ultimate economy in carrying out works of the kind enumerated. Original cost is not everything; subsequent maintenance has also to be added. Particular attention is given to the laying out of industrial suburbs, and this feature of the book should appeal to officials who have to give practical effect to the provisions of Mr. Burns's Act of 1909. The methods described in the book are explained in such a way as to induce builders, and those who employ them, to think twice before the old text-book rules, or rule-of-thumb traditions, are continued. The building trade is too much confined to a theoretical rut, and Mr. Slater shows by one practical illustration after another how and why the formulæ of the past should give way to the theorems of the present.—*Municipal Journal.*

* By E. A SLATER, ASSOC.M.INST.C.E., F.S.I., M.INST.M.E.&E., Lecturer on Structural Engineering. 6s. nett. St. Bride's Press, Limited, 24 Bride-lane, E.C.

Comparative Reports of General Practice.—LXXX.

DUST COLLECTION IN AND AROUND THE METROPOLIS.

The present comparative report of general practice, which deals with dust collection in and around the Metropolis, is reproduced by the courtesy of Mr. Reginald Brown, M.INST.C.E., F.S.I., engineer and surveyor to the Southall-Norwood Urban District Council. Mr. Brown has collected information on the subject from no fewer than sixty-one districts, and is to be congratulated on the successful manner in which he has accomplished the difficult task of compilation.

District	Population	Area in acres.	Storage		Collection.						Disposal. How is your Refuse disposed of (in cubic yards) per annum						Remarks
			Do you insist upon the provision of galvanised iron sanitary dustbins?	Do the owners or council provide same?	(a) How often is the refuse collected?	(b) Do you collect by contract or by your own staff?	(c) Is there a "house-to-house" collection, or is the "Kerb" system adopted?	(d) What is the average number of men and carts employed daily?	(e) No. of cubic yards collected daily.	(f) Have you made any regulations as to assistance to be given by occupier. If so, what?	Tip.	Brickfields	Barging	Destructor	Other means.	Cost.	
Acton	60,000	2,305	Yes	Owners	Weekly	See remarks	House-to-house	1 foreman, 24 men, 10 vans	35 to 50 tons	Yes (see remarks)	3,615 laundry clinker	--	—	36,000 house refuse	—	Tip—nil. 5·2 pence (excluding capital charges)	(b) The whole of the house refuse and trade refuse (up to half a load per shop and factory) is collected once each week by the council's own staff. Cost, £3,000 per annum. (f) The occupier of any building in or in connection with which an ashpit consisting of one or more movable receptacles is provided for the reception of house refuse, shall place such ashpit at or about the level of the ground floor of such building, but not within any dwelling house, and in such a position that the refuse may be readily removed therefrom, and as far as practicable so that access to such ashpit may be obtained from the adjoining street without passing through any dwelling-house or through any gateway, doorway, or opening having a less clear width than twenty-three inches.
Barking ..	31,000	3,813	Yes	Owners	Weekly	Own staff	House-to-house	7 men and 4 carts	39	No	13,338 (1911)	—	—	—	—	2-	
Bermondsey	125,960	1,506	No	Council provide pails	Bi-weekly generally. Daily exceptional.	Own staff	House-to-house Bell on van	15 carmen, 10 carriers, 4 pail cleaners (extra men as required for trade refuse).	11,500 van loads per annum.	No	—	—	1,886 loads (practically all unburnable trade refuse)	11381½ van loads	—	-	
Brentford	16,496	1,090	Yes	Owners	Weekly	Own staff	House-to-house	3 carts, 6 men	9½ to 10 tons	No	—	—	—	3,020 tons	—	Cartage & collection 2/3·512 per ton. Burning 2 7·316 per ton	

Camberwell	261,357	4,393	Metal dustbins compulsory.	Owners	Weekly (except very exceptional cases)	Own staff	House-to house	60 carts and vans, 60 carmen, 33 collectors	47,565¾ loads (see remarks)	No	—	—	—	—	By rail and other shoots 47,565¾	3/0½ per load.	(*e*) Average cart per load of collection and disposal 8/3½. Contractors find own shoots.
Carshalton	12,000	2,926	Yes	Owners	Weekly	Contract £385 per annum	House-to house	2 men, 2 carts	3 yards each cart daily	No	1,768	—	—	—		4·36 shillings per cubic yard	
Chiswick	40,000	1,337	Yes	Owners	Weekly and bi-weekly in summer from large flats	Own staff (see remarks)	House-to house	12 men (including 6 carmen) and 6 vans	29 tons (approx.)	No	—	—	491 tons	8,550 tons	—	Barging 3/- per ton. Destructor 3/2½ per ton	(*d*) Paid by piece work at the rate of 2/2 per ton in summer, and 2/- per ton in winter, council providing horses and vans.
Croydon	170,451	9,012	As far as possible	Owners	Certain business premises daily and twice weekly. General collection weekly	Collection by direct labour	House-to house	80 men, 30 horses	38,550 tons per annum	See remarks	6,550 tons	—	—	32,000 tons	—	Nett cost of disposal at destructor, including loan charges but deducting receipts for sale of clinker, is 1 4½ per ton average	(*f*) No regulation, but occupiers in many cases voluntarily place their bins outside their premises.
Deptford...	109,498	1,563	Insist on provision of dustbins in accordance with provisions of Public Health (Lon.) Act, 1891	Owners	Weekly	Own staff	House-to house	See remarks	64½ loads	No	2 loads	—	16,553 loads	—	3,153 loads by rail. 124½ loads free shoots	2 9½ load by rail. To tip 6d. per load. Barging 2 3 per load	(*d*) 22 horses, vehicles, and carmen, 17 dust carriers, Monday to Friday. 14 horses, &c., and 14 carriers Saturday.
Edmonton ...	63,146	3,854	Yes	Owners	Weekly, oftener if necessary	Contract	House-to house collection	6 vans regularly, sometimes 7. Two men to each van	50 cubic yards per day	No	16,000 cubic yards per annum	—	—	—	–	See remarks*	(*b*) Contractor provides horses, men, vans and implements, for £1,188 per annum. * During six months summer deposited on council's sewage farm. During six winter months deposited on brickfields
Ealing	65,000	2,947	Yes	Owners	Weekly	Own men occasionally hired horses	House-to house	15 trouncers, 15 horses, carts and drivers	13,791 tons for the year ending March, 1912	No	—	–		—			All to destructors. Cannot give cost per ton, as the burning of nearly 100 tons of sewage sludge is burnt with the house refuse, and the destructor works are all kept in conjunction with the sewage works.

(To be continued.)

Office Conversations.

MORE OR LESS IMAGINARY.

[*Contributed.*]

VI.—*In re* a Roadman.

I really fail to see how it shows hardness on my part, Mr. Climson. I'm here to do my best by the ratepayers, and to put old chaps of seventy years of age upon the roads isn't, in my opinion, the way to do it. Oh, yes, it's all very well to say that it keeps them out of "the house"—prevents them coming upon the rates—and all that. If it's sentiment you're on, I'll give you best. Not sentiment? You put it forward as a serious financial proposition? As chairman of the Highways Committee you advocate the employment of these poor old wrecks? Right! Now we can go ahead, and if I can't convince you before you're five minutes older, I'll eat the broom of the patriarch among my roadmen, and if he ever sees his hundredth birthday again I'll—— Talking nonsense, am I? Come to the point?

* * * *

We pay our old men an average wage of 16s. a week, and for this they potter around in general, sweeping a bit here and a bit there, yarning awhile at intervals with passers-by, and occasionally getting mixed up with a motor car. Yes, you're quite right—I had it on the tip of my tongue to say it. They are of some little use when the rollers at work, and the care with which they lay a patch is most commendable. Mosaic isn't in the same street with it. And then they'll tend the patch and shape it round and sweep mud over it for weeks after, and it's a remarkable thing—I daresay you've noticed it, Mr. Climson—that the nearer a patch may be to the "Lion" or the "Boar's Head" the greater is their assiduity. Working with the water van is another of their favourite occupations, and they cheerfully share the beer that the driver gets for paying special attention to the draw-ups of the various pubs. Blame them? Not in the least. Do the same myself? Well, perhaps I should, and—you've raised the point you know—I'm sure you would. Rainy days afford another opportunity for them to exhibit their usefulness. It's a case of one man one gulley, and I've often admired the patience with which they sweep a small heap of paper and oddments off the grating so as to allow a free run from the channels. It wouldn't do to sweep the obstruction right away—that 'd mean an effective clearing of the grate, and their job 'd be gone.

* * * *

Sixteen shillings a week—that's what we pay for the service, and I call it jolly dear at the price. A younger man wouldn't do much better? You'll excuse me, Mr. Climson, but if I had a younger man who wouldn't do better he'd very quickly get the sack. I flatter myself that there's not much slacking among the men that I employ. Their average pay is 24s. a week, and if the worst of them doesn't do four times the work of the best of the old men it's about time I woke up. And now to my point—eh? I want what? To drive 'em into the workhouse? Nothing of the kind. Let me finish before you say anything like that. Eight shillings a week 'd be affluence to any of the old chaps, and, too, they could always pick up an odd shilling here and there. We couldn't regularly "pension them off"? The Act wouldn't allow it? Of course not: but we could pay 'em 8s. a week as roadmen and refuse 'em a broom! The saving? Oh, that's easily proved. Four old men cost 64s. a week—16s. each—and their work equals that of one young fellow at 24s. Now then. Pension off—I use the term for convenience—pension off the four old uns at 8s. a head. Cost equals 32s.: employ one young man at 24s.—total 56s.—and there's a clear saving of 10s. a week, with more efficient labour, and four decent old chaps rendered happy for life with a small "holding" outside the "Lion" or whatever particular house they fancy.

* * * *

The scheme doesn't appeal to you? I'm sorry, but I never thought it would, and, of course, if you won't be convinced there's an end of the matter. I suppose you heard that poor old Brown was killed by a car this morning? Yes, he was sweeping the High-street, and the car caught him up and carried him a score of yards and left him a mangled heap just outside Bagnell's. Had to take a wheel off to get the remains away! Horrible? I should think so. That's the third killed during the last eighteen months. Ought to be prosecuted? Well, so they are in a way; but it's always the same verdict: "Accidental death—driver exonerated from all blame." It 'll be the same in Brown's case, you see if it isn't. How old? Well, he couldn't have been a day under seventy-five, and that brings another argument up. How about the old age pension? Every man over seventy years of age that we employ is dropping his pension and we are paying it. Why, there 'd be no need for the 8s. a week in such cases. No keeping off the rates, eh? No keeping out of the house! You're convinced, are you? Well, I'm glad of it, and I take it that I can have a free hand now? Sack the present men? Oh, no, I shouldn't do that exactly; but I certainly shan't put any more centenarians on. Good-bye.

* * * *

Want a job? On the roads? Colonel Jubber sent you? Well, that's like his cheek, too. Just you go back, my man, and tell Colonel Jubber, with my compliments, to go—— Didn't mean no harm? Perhaps he didn't, but it's like his cheek all the same. Thinks because he—— Oh, you heard of poor old Brown's death and thought you could take his place. Well, you're much of an age, that's pretty evident, and I'm afraid that's up against your chance. You see, I've been thinking the matter over, and I've decided that we must have younger labour. You can still do a good day's work? Very likely; but you see—er—— No, I don't mind having a look at them. Hum—excellent—couldn't be better—sober, steady, industrious—yes, yes, that's all right; but age is against you. Only just seventy? Comparatively young? Well, yes, that may be as regards my present staff; but we're adopting a new policy, and—really, I'm very busy, and I can't stop talking here. You're over seventy, and with your old age pension and——

* * * *

Heavens, don't fire up like that! Why not? It's made to go round. I'll take it myself if I'm out of collar at seventy and the locker's empty. Five shillings a week is not to be sneezed at. Eh? Oh, of course, if you put it that way, it's different. You've plenty of work in you, and it 'll be time enough to think about the pension when it's the only thing between you and the house? I admire your pluck; but—— Give you a trial? Oh, there 'd be no trial needed in your case. Here, hang it all—go down to the yard and tell Mr. Gunn that I sent you. Ask him to give you a broom. That's all right—that's all right. Run along sharp, or you may find he's put someone else on. Oh, lor, what a consummate ass I am! After all my talk, the very first old chap that pitches a good yarn—— How Climson 'll laugh when he hears of it! Come in, Mr. Smith; just the man I wanted to see. Shan't keep you a minute.

* * * *

It's about our men on the roads. I want you to weed out the old uns as speedily as possible. Sack 'em? Good heavens, no. But as they drop out replace them by younger ones. We're not running an infirmary, remember, or a home for the aged poor. I've had Mr. Climson up talking about it, and he's given me a free hand in the matter. Want a man to take Brown's place? Yes, but—er—you see, I've just filled that. A man named Stevens came round just now, and — Old Rooty Stevens? How on earth should I know what they call him? I can't be expected to call every man in the town by his nickname. About seventy? Tall, white whiskers, bell-bottomed trousers, fur cap—yes, that about fits. You understood me to say that we'd have no more old men? And so I did. Really, you're very dense this morning, Mr. Smith. When I say no more I mean no more, and Stevens is to be the last of 'em. You're the deputy here, and—— I fail to see what there is to grin at. Only smiling? Well, if I smiled

like that I'd take something for it. It 'll grow on you, if you aren't careful. No wonder you didn't get Walson-on-Stoke!

* * * * *

No, I've nothing else for the moment. Brown's funeral? Yes. I think I ought to attend—some of the council are sure to be there, too—although I'd far rather follow the gentleman that killed him. Put me down for 5s. I'm glad you thought of it. Poor old chap, he wasn't of much use on the roads—I suppose there isn't one that knew the whole art of "miking" as he did. He was a past-master at it. Made a book? What, old Brown? No wonder he was always engaged in mysterious conversations, and pleaded so hard when I wanted to shift him out to Landon End. Been a gentleman's servant, had he? What a fall! But there, we mustn't stop here yarning. Let me know how Stevens goes on. I think you 'll find him as good as the best. Gunn might send me in a special report at the end of the week. Stevens 'll be the last of the old brigade, remember, Mr. Smith. Forty-five 'll be the age limit now, unless there's something very exceptional about a case, and then we might strain a year or so. And, oh, if Colonel Jubber sends any men along—never mind their age, or their colour, or their creed, or anything else—just return 'em with my respectful compliments.

INSTITUTION OF MUNICIPAL AND COUNTY ENGINEERS.

EAST MIDLAND DISTRICT MEETING AT NEWARK.

A general meeting of the members of the East Midland District of the Institution of Municipal and County Engineers was held in the Town Hall, Newark, on Saturday last, those present including Messrs. R. J. Thomas (Buckinghamshire), president, Thomas Palmer (Lincoln), E. H. Crump (Hinckley), Thomas Lake (Bourne), S. Haseldine (Carlton), A. Barlow (Ripon), E. Purnell Hooley (Nottingham), J. T. Collinge (Mansfield), E. J. Silcock (Westminster and Leeds), J. D. Kennedy (Retford), R. Oakden (Newark), J. Cracroft Hallet (Carlton), H. Gilbert Whyatt (Grimsby), T. P. Frank (Newark), W. B. Purser (Kesteven County Council), C. A. Clews (Derby), F. W. Wright (Ilkeston), A. G. Wheeler (Eastwood), S. Maylan (Basford), W. Harold A. Court (Leicester), R. A. MacBrair (Lincoln), hon. district secretary, and Thomas Cole (Westminster), secretary. Among the visitors were Messrs. A. W. Shelton (Nottingham), A. R. Agnew (Bourne), Jno. Bailey (Spalding), A. Lamb (Nottingham), J. W. Pell (Nottingham), F. Turnell (Nottingham), and P. A. Watford (Newark). The members were received by his Worship the Mayor of Newark (Mr. H. Stallard, M.R.C.S.), the president, Mr. R. J. Thomas, thanking his Worship for his hearty welcome.

A letter was read from Mr. E. G. Mawbey, borough engineer of Leicester, the chairman of the East Midland District, expressing his great regret at being unable to be present. In his absence Mr. R. J. Thomas, the president, was elected chairman of the meeting.

A paper on "Rural Housing" was read by Mr. T. Lake, surveyor to the Rural District Council of Bourne. The discussion on the contribution was opened by Mr. A. W. Shelton, of Nottingham, member of the Royal Commission of Irish Rural Housing, and the following members spoke—viz.: Messrs. E. P. Hooley, R. Oakden, H. G. Whyatt, W. B. Purser, S. Maylan, E. H. Crump, E. J. Silcock, T. P. Frank, and R. J. Thomas. Messrs. Lake and Shelton replied.

The Mayor and Mayoress afterwards entertained the company to tea. Music had very kindly been arranged, and a very pleasant time was spent. The president suitably expressed the thanks of those present for the hospitality shown to the members.

COUNCIL MEETING.

At the recent meeting of the council—partly reported in last week's issue—there were present Messrs. R. J. Thomas (president, in the chair), T. W. A. Hayward, W. N. Blair, W. T. Lancashire, G. F. Carter, W. H. Prescott, O. E. Winter, J. W. Cockrill, E. P. Hooley, J. J. Barber, N. Scorgie, E. B. Martin, H. E. Stilgoe, W. Harpur, A. D. Greatorex, A. H. Campbell, W. Stubbs, J. L. Redfern, C. F. Wike, J. S. Pickering, A. E. Collins, G. A. Phillips, Thos. Cole (secretary), and H. A. Giles (assistant secretary).

ELECTED AS MEMBERS.

Messrs. W. H. Budgett, assistant engineer to the Wood Green Urban District Council; H. L. Harrison, district surveyor to the Bedfordshire County Council (West District); J. R. Treadwell, highway surveyor to the Easthampstead Rural District Council; R. J. Taylor, district main road surveyor to the Bedfordshire County Council; W. A. Macartney, burgh surveyor, Johnstone; G. H. Dallow, surveyor to the Halesowen Rural District Council; Geo. Smith, surveyor to the Eton Urban District Council; N. F. Spence, surveyor to the Hartshorne and Seals Rural District Council; W. Eyre, surveyor to the Yeadsley-cum-Whaley Urban District Council; H. Spreadborough, town surveyor, Youghall; J. H. Leverton, surveyor to the Harpenden Urban District Council; R. W. Burton, highway surveyor to the Dunmow Rural District Council; W. Wright, municipal engineer, Lagos; A. J. Lyddon, deputy county surveyor, Essex; C. A. Lake, highway surveyor to the Thirsk Rural District Council; D. C. Thwaites, assistant borough engineer and surveyor, Ossett; B. Haylor, deputy engineer to the Willesden Urban District Council; and G. W. Humphreys, chief engineer, London County Council.

ELECTED AS ASSOCIATE MEMBERS.

Messrs. J. A. Booth, assistant engineer and resident engineer, Glasgow Corporation Waterworks; G. E. Fryer, chief assistant surveyor to the Ripley Urban District Council; W. Walsh, engineering assistant, Blackburn Corporation; P. Morris, town planning assistant to the Doncaster Rural District Council; R. A. Campbell, resident engineer, Glasgow Corporation Waterworks; F. Pritty, assistant engineer to city engineer, Glasgow; E. Pritchard, engineering assistant, London County Council; F. W. Dean, assistant engineer, Withington, Manchester; J. H. Smyth, chief engineering assistant to the Willesden Urban District Council; W. J. Smith, assistant to engineer and surveyor, Willesden Urban District Council; R. J. Hake, assistant to surveyor to the Williton Urban District Council; J. T. James, main road inspector to Herefordshire County Council; R. O. Jones, assistant surveyor to the Glamorganshire County Council; P. A. Reece, engineering assistant, Manchester Corporation; and E. F. Scholfield, chief engineering assistant to the Burnley Rural District Council.

ELECTED AS STUDENTS.

Messrs. A. O. Jenkins, burgh surveyor's office, Dumfries; P. Harrison, assistant to Ruislip-Northwood Urban District Council; E. J. Mulliss, county surveyor's office, Hereford; G. V. Roberts, county surveyor's office, Hereford; and R. R. Hogsden, council offices, Midhurst.

TRANSFER FROM AFFILIATED MEMBER TO MEMBER.

Mr. A. H. Clayton, county road surveyor, Aboyne, Aberdeenshire.

The council learnt, with regret, of the death of Mr. J. Robb.

NEW AFRICAN DISTRICT.

A suggestion for the formation of a new African district was referred to the Constitution Committee.

RELATIONSHIP BETWEEN SUB AND MAIN CONTRACTORS.

The council received a report from the Arbitration Clause Sub-Committee on the reception of a deputation from the Confederated National Association of Master Plasterers, Plumbers and Slaters. Certain difficulties arising from the present system of letting main and sub-contracts were laid before the committee, and the matter was referred to them by the council for further consideration and report.

TOWN PLANNING CONFERENCE.

The Town Planning Committee reported list of papers recommended for acceptance for reading at the forthcoming conference. It was agreed that an exhibition of plans, drawings and models should be arranged for.

"The Builder."—Mr. Herbert W. Wills has been appointed editor of the *Builder*. Mr. Wills is a Fellow of the Royal Institute of British Architects, having served for four years on the council of that body; and he has carried out, in conjunction with his partner, many important public buildings.

Assistants' and Students' Section.

CONDUCTED BY SYDNEY G. TURNER, ASSOC.M.INST.C.E.

All communications in regard to this page must be addressed to The Editor, St. Bride's House, 21 Bride-lane, Fleet-street, E.C. *Envelopes must be marked "Assistants' Section" in the top left-hand corner. Correspondents are invited to submit questions for consideration and answers to the questions which appear. For the contributions considered to be the most meritorious, one or more premiums in books will be awarded monthly. Diagrams must be drawn to scale on separate sheets, ready for reproduction.*

THE MONTHLY PREMIUM.

Mr. H. M. WEBB, of Worcester, to whom the premium for January was awarded, has selected the following books:—

"Public Health Law," by Sydney G. Turner (St. Bride's Press).

"Practical Road Engineering," by H. P. Boulnois (St. Bride's Press).

"Reinforced Concrete Construction," by Cantell (Spon).

These have been duly forwarded to him.

QUESTIONS.

This week answers are invited to the following questions:—

300. Retaining Wall.—A retaining wall is required to support a roadway having no footpath, and consequently heavy vehicles such as steam rollers, &c., will seriously surcharge the wall. The height of the roadway above the adjoining ground is 8 ft., and the filling will be good clay. Design a suitable wall in mass concrete, and show calculations. (D. G. B., *Darlington.*)

307. Hydraulics.—A stream is gauged over a rectangular weir or notch. The width of the notch is 3 ft. 6 in., and the height of the still water over the edge of the notch is found to be 14½ in. Find how many gallons pass over the weir per twenty-four hours, neglecting the velocity of approach. (D.)

308. Moment of Inertia.—Show how to find the moment of inertia of a tee section. What use is made of the moment of inertia in finding the strength?

309. Water Supply.—In laying a large water main carrying water from a gathering ground several miles from an urban district, and also distributing mains in the district, where and at what point- would it be necessary to place air and other valves? Give reasons. (W. L., *Ripley.*)

310. Decay of Timber.—What are the causes of decay in timber placed under water? How can it be prevented?

[The Editor is at all times glad to hear from readers who desire to submit questions regarding matters of general interest, points of daily practice, &c., for insertion in the "Assistants' and Students' Section." Questions which are published are taken into consideration, as well as other matter, in awarding the Monthly Premium.]

REPLIES TO QUESTIONS.

304. Geodesy.—What is meant by reducing a horizontal measurement to mean sea level? (Perplexed.)

In surveying operations it is usual to reduce all distances, not only to a horizontal surface, but to

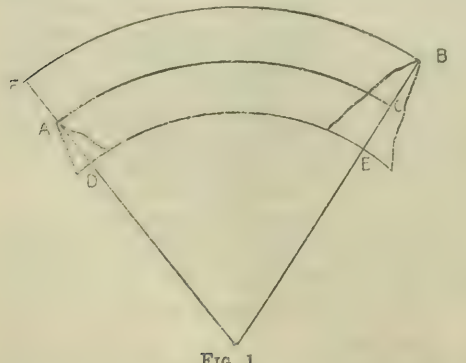

FIG. 1.

a standard horizontal surface, that of "mean sea level."

This surface is spherical, and is that which would be taken up by the surface of the sea if the land were removed.

Let figure (1) represent part of a section taken through the centre of the earth.

A and B are two high mountains, and D E is the surface of "mean sea level."

Draw arcs A C and B F parallel to D E.

Then A C and B F are the horizontal distances between A and B, taken at different levels.

It is evident that they are both greater than D E, and it is the reduction of them to D E which is known as the reduction to mean sea level.

This reduction is applied as follows:—

Let r = radius of the earth.

h_1 = height of A above mean sea level.

h_2 = height of B above mean sea level.

$$\text{Then } \frac{AC}{DE} = \frac{r + h_1}{r} \text{ and } \frac{BF}{DE} = \frac{r + h_2}{r}$$

so that all measurements taken at a height h_1 above mean sea level are reduced by multiplying them by $\frac{r}{r + h_1}$ and those taken at a height h_2 by multiplying by $\frac{r}{r + h_2}$

As r = 20,900,000 ft. approx., it is evident that the correction is very slight, and in most cases is less than the probable error of measurement.

In triangulation work, where the lengths are all calculated from one base line, the trouble of reducing each length separately is avoided by first reducing the base line, and then calculating the other lengths, which are thus reduced automatically. (H. M. W., *Worcester.*)

305. Mechanics.—A machine is driven from a pulley 4 ft. in diameter by means of a belt. If the difference of pull in the two sides of the belt be 20 lb., and the pulley makes 150 revolutions per minute, what is the horse power transmitted by the belt? (T. R.)

Speed of pulley = 150 revs. per min. = $\frac{150}{60}$ revs. per sec.

Radius of pulley = 2 feet.

$\therefore$ *linear* speed at rim = $(2\pi \times \frac{150}{60} \times 2)$ feet per sec., and all the time this is experiencing a "counter-motion" force of 20 lb. weight nett.

Now, force overcome = work done.

$\therefore$ work done = $(2\pi \times \frac{150}{60} \times 2 \times 20)$ ft.-lb. per sec.

But 1 horse-power = 33,000 ft.-lb. per min.
= 550 ft.-lb. per sec.

$$\therefore \text{H.P. transmitted by belt} = \frac{2\pi \times 150 \times 2 \times 20}{60 \times 550}$$

Taking the value of π as $\frac{22}{7}$, we get

$$\text{H.P. transmitted by belt} = \frac{2 \times 22 \times 150 \times 2 \times 20}{7 \times 60 \times 550}$$

$$= \frac{8}{7}$$

$$= \underline{1{\cdot}143} \text{ (approximately).}$$

(W. W., *Strathaven.*)

306. Building Materials.—What are "encaustic" tiles, and how are they made? (Pup.)

Encaustic tiles are those in which the colours are produced by substances mixed in with the clay, and not by printing on after the tile is made.

Such tiles may be made from ordinary clays and marls carefully prepared and mixed with various colouring substances, such as manganese for black or cobalt for blue.

They may be divided into two classes: Those which are ornamented by inlaid patterns of different colours and those which are of the same colour throughout.

We will now consider the first class.

The clay is very carefully prepared, mixed with the colouring matter, and "slipped"—that is, passed through fine muslin or silk sieves.

Then it is boiled in the "slip kiln" until it

The Surveyor
And Municipal and County Engineer.

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becomes plastic, and "wedged," or cut up into pieces, which are dashed together to drive out the air in them and to consolidate them. After this stage it is "aged," or kept for several months, during which fermentation goes on and organic matters disappear, the "wedging" being repeated at intervals. Then it is "slapped," or cut by a wire into long pieces, which are kept always in the same direction to consolidate the mass and to preserve the grain.

Each tile consists, as a rule, of three layers: The face, which is composed of very pure clay of the colour required for the ground of the pattern; the body, which is of coarser clay; and the back, which is formed of a thin layer of clay different from the body, to prevent warping.

The clay for the face is cut into a slab about a quarter of an inch thick, and large enough to allow for contraction in burning.

This slab is placed on a mould of plaster of Paris, in which the form of the inlaid pattern is left in relief.

The facing clay is pressed on this, and receives an indentation corresponding to the pattern required.

It is then backed up with the body of coarser clay and with the third layer just mentioned.

When this has been done the maker's name is stamped on the back, and a few holes are cut to give a key for the plaster.

Slip clay of the required colours is then poured into the various parts of the pattern indented on the face.

When this has become hard, all superfluous clay is scraped off, the tiles are trimmed and dried, and then carefully baked in ovens, being arranged in large fireclay jars to prevent harm from smoke.

After this the tiles may be glazed by dipping into a mixture of powdered glass and water, and reheating.

The second class of tiles, those of the same colour throughout, are made by the dry process.

The clay is carefully prepared, mixed with the colouring matter, "slipped," dried, and then reduced to fine powder.

After this it is placed in a press and subjected to enormous pressure from a steel die.

This die consolidates the powder, and at the same time impresses any pattern required on it.

The tiles are then carefully dried in a hot room, glazed and fired. (H. M. W., *Worcester.*)

THE CROSTON APPOINTMENT.

Among the applications received by the Croston, Lancashire, Urban District Council in response to their recent advertisement in this journal for a surveyor, inspector of nuisances, collector and gas manager, at a salary of £90 per annum, with an allowance of £5 a year for acting as secretary to the Higher Education Committee, is the following:

Gentlemen,—I hereby beg to make application for the positions of surveyor, inspector of nuisances, collector and gas manager to your council, advertised in The Surveyor dated February 14, 1913.

In support of my application I beg to submit the following facts of my experience and qualifications for your kind consideration.

I am forty years of age, married, and have a family of ten children.

I am at present in the service of a large urban district council on the outskirts of London as a deputy engineer at a salary of £300 per annum; but seeing the various and multitudinous duties to be performed in your district, and the very munificent salary offered, I am tempted to make application for the appointment.

I am a member of the Institution of Civil Engineers, a member of the Institution of Mechanical Engineers, a member of the Institution of Gas Engineers, a chartered accountant, M.A., B.Sc., and also pay subscriptions to other smaller societies engaged in advancing the various professions mentioned in your advertisement.

I have a very extensive knowledge of all kinds of road and sewer repairs, the construction of sewage disposal works and their upkeep, electrical tramway traction, refuse collection and disposal, public baths, the manufacture and distribution of gas, collection of rates, inspection of food, sewers, overcrowded houses, common lodging houses, knackers' yards, and, in the evening, rearing and washing of babies and the education of older children. I may say that I have from time to time written theses on the above subjects, among which I would mention "The Civilisation of the Sewer Rat," a treatise on "Gas as Applied to Public Speakers," "Sausages and their Origin," "The Practice and Theory of Chastising Children," "Motor Buses *v.* Bassinettes," and others.

I should be quite prepared to carry out the whole of the duties enumerated in your advertisement for the salary mentioned, and would, if the council so desired, keep up a large establishment, a town house, electric launch, and provide one or two high-power motor cars to travel round the district.

I have a perfect mania for work, and, in addition to the duties specified, would gladly undertake to manage the local workhouse, pumping station and library, clean down the town hall, read the lessons on Sundays, control the fire brigade, cleanse verminous persons, and act as commanding officer of the Boy Scouts in my spare time. My wife would also be glad to mind the babies of ratepayers while they attend the theatre or picture palace, assist at the mothers' meetings, act as lady sanitary inspector, cater for the mayoral banquets, teach the school girls and preside at all tea fights, bun scrambles and Dorcas conversaziones.

The advertisement does not state whether the successful candidate is required to pay the whole 7d. for the insurance stamp, or whether a portion of his salary is stopped for superannuation and fidelity bond security, but I would be happy to pay all if appointed.

Herewith I enclose copies of testimonials from Mr. Lloyd G——, Sir Alexander B——, and Lord Rob——s, and could let you have further testimony as to my moral character from the Rev. A. S. S. Stiggins, pastor of the Land of Hope Mission, Mile End.

I have the honour to be, Gentlemen,

Your obedient Servant,

I. Dontfink, P.I.C.E., M.I.M.E., M.I.G.E., R.A.O.B., P.S.A., L.C.T.U., N.S.P.C.C., K.C.B.

London N.

February 12, 1913.

Another candidate—"Anxious" (not to get it)—generously offers to carry out the duties of the position at a salary 50 per cent lower than that mentioned in the council's advertisement, in addition to which he is prepared to pay his travelling expenses to Croston in the event of further particulars of his qualifications—which compare very favourably with those of the gentleman whose application appears above—being required. He, too, is a family man and a teetotaller.

DARTMOUTH BOROUGH SURVEYORSHIP.

APPOINTMENT OF AN EX-COUNCILLOR.

At a recent special meeting of the Dartmouth Town Council it was reported that 108 applications had been received for the vacant surveyorship, and that three applicants had been selected for final consideration—viz., Mr. A. E. Abbot, of Wolverton, Bucks; Mr. F. J. Worden, of Okehampton; and Mr. F. J. Voisey, of Dartmouth, an ex-councillor.

Mr. Voisey was called in, and Mr. Palfery told him that it had been publicly stated that councillors had been canvassed by him for the appointment.

Mr. Voisey replied that he had not asked any single member of the council for support since the advertisement of the vacancy was issued.

Alderman Row said the rumour was that he had seen some members of the council before the advertisement appeared.

Mr. C. N. Fishott said that as a bosom friend he could say that Mr. Voisey had never asked him for his support for the appointment.

Mr. Nance, addressing Mr. Voisey, said that he had on other occasions criticised the council with great vigour. He wondered whether he would be capable of doing his best, for instance, with regard to that article of traction he had so consistently attacked—the "Dreadnought" (steam refuse lorry)—and keep it in good, lasting order.

Mr. Voisey replied that if elected he would not forget the difference between the position of councillor and surveyor. With regard to the steam lorry, he would do his best concerning that.

Mr. Voisey also said that if the council wished it he would be prepared to obtain the certificate of the Royal Sanitary Institute.

After further discussion, a ballot was taken. Mr. Voisey received seven votes and Mr. Worden four. Mr. Voisey was then elected, but on the condition that his salary as surveyor be £100 per annum and as sanitary inspector £50 per annum, the latter to be reduced to £25 if the sanction of the Local Government Board to his appointment were not obtained within a reasonable time.—*Western Daily Mercury.*

MARRIAGE OF MR. R. J. THOMAS.

The marriage of Mr. Robert J. Thomas, M.INST.C.E., of The Chantry, Aylesbury, president of the Institution of Municipal and County Engineers, and Miss Enid Adlie Rees Parry, elder daughter of Dr. Parry, J.P., and Mrs. Parry, Tynewydd, Carnarvon, was solemnised on Wednesday at Moriah Chapel, Carnarvon. The building was decorated beautifully with palms, smilax, and arum lilies, and the ceremony was witnessed by a large congregation. Mr. Sidney Stallard, county surveyor of Oxfordshire, acted as best man.

After the ceremony a largely attended reception was held at the Royal Sportsman Hotel, and later the newly wedded pair left for London en route for Paris and the Riviera.

Opposition to Railless Traction.—Many petitions have been lodged in Parliament against the various Bills for the promotion of railless traction, largely on the question of compensation for wear and tear of roads belonging to outside authorities.

Road Accident: A Question of Indemnity.—Mr. Justice Darling heard arguments in the King's Bench Division on Saturday last on the verdict of the jury in an action brought by Mrs. Ellen Newcombe, a widow, living at Purley, against Mr. Edward Yewen, a contractor, and the Croydon Rural District Council. Mrs. Newcombe was, as reported in our issue of the 31st ult., awarded £1,000 and her daughter £200 damages in respect of the death of Mr. Newcombe, the husband and father. The deceased man, who was a commercial traveller, was going to post a letter when he fell down a trench in the road, and died from his injuries. At the time of the trial his lordship entered judgment for Mrs. Newcombe and her daughter, and he now heard arguments as to whether the rural district council were indemnified by the contractor. His lordship held that the council were entitled to the indemnity claimed, and he made a declaration in their favour accordingly.

THE COST OF MAIN ROADS.

Replying to a question as to how many miles of main roads were managed by county and urban councils respectively in 1890 and in 1912, what these bodies paid for maintenance, and what portion of the cost was contributed from the Imperial Exchequer and from the local rates, Mr. John Burns states that there is no record of the total mileage of main roads in the year 1890, and there has not been any specific contribution from the Imperial Exchequer towards the cost of main roads since the year ended March, 1889. He gives the following statement of the cost in the years 1890-91 and 1910-11 respectively, these being the earliest and latest years for which the figures are available:—

	1890-91.	1910-11.
County councils	£1,070,000	£2,224,000
Councils of boroughs other than county boroughs ..	128,000	297,000
Authorities for urban districts other than boroughs	335,000	528,000

Payments by county councils to councils of boroughs and other urban authorities are not included in this statement.

WOOD PAVING IN PARIS.

Suggestions having been made that wood pavement is being abandoned by the city of Paris in favour of asphalt, the Improved Wood Pavement Company, Limited, recently communicated with the authorities of the French capital and obtained the following statement on the subject from the Director of Public Works:—

"... The city of Paris has no intention of abandoning wood in favour of asphalt. It is true that we intend to proceed to a fairly large extension of the asphalt paving, but this will be to replace macadam and stone paving. It is only in very exceptional cases, and in places where experience has proved that wood does not appear to be in place, that asphalt will be substituted. Doing away with wood paving is not intended by the engineers of the city of Paris, all the less so as it is hoped that by the application of new processes of impregnation with creosote under pressure, which they have experimented with and which are about to be employed on a large scale, they hope to increase considerably the length of life of the wood pavement, and thus to be in a position to retain for this kind of road surface a prominent place in the Paris road system."

Talbot Car Record.—Driving a 25-horse power Talbot car, belonging to Lord Shrewsbury, Mr. Percy Talbot, on Saturday last at Brooklands, covered 103¾ miles within the hour—a world's record. Considerable interest has been shown in the quartette of Talbot cars exhibited at Manchester by the Bolton Motor Company on Stand No. 31. There are four models for the present season, and all of them follow the same general line of construction, differing only in the sizes and number of cylinders and the various chassis measurements. The 12, 15 and 25 horse power cars are four-cylinder models, the 20-horse power model having six cylinders of the same dimensions (80mm. × 120mm.) as the four-cylinder "12."

Institution of Mechanical Engineers.—The report of the council, presented at the sixty-sixth annual general meeting of this body last Friday, stated that there was a nett addition to the membership during the year of 332, raising the total to 6,160. The proposals of the council in regard to establishing examinations for graduates and associate members of the institution were adopted. Sir H. F. Donaldson was elected president in succession to Mr. E. B. Ellington. Sir John Wolfe Barry and Mr. Henry Davey were elected vice-presidents. The ballot for members of the council resulted in the election of the following: Dr. H. S. Hele-Shaw, F.R.S., Mr. Alfred Herbert, Mr. J. Rossiter Hoyle, Mr. Robert Matthews, Mr. Donald B. Morison, and Sir Gerard A. Muntz.

CORRESPONDENCE.

For every ill beneath the sun
There is some remedy or none;
If there be one, resolve to find it;
If not, submit, and never mind it.
—Anon., *circa* 1845.

FERRO-CONCRETE BOW GIRDERS.

To the Editor of The Surveyor.

Sir,—In your "Bridges" article, p. 161 of the issue of January 31st, there is a reference to the bow type of girder in ferro-concrete. Girders of this kind were used for a bridge of 60 ft. span which formed a part of the wharf and pier works briefly described by Mr. C. S. Meik, M.Inst.C.E., in a paper read at the Engineering Conference, 1907, of the Institution of Civil Engineers, p. 33 of the report. In the discussion, p. 57, Mr. R. J. G. Read said that the girder was remarkably stiff under test. Possibly Mr. Meik will be able to furnish a reference to some publication in which details of this girder are given. Yours, &c.,

Reginald Ryves

QUERIES AND REPLIES.

We cannot undertake to reply to any queries which are not accompanied by the writer's name and address. These are required as a guarantee of good faith, and not for publication. Sketches accompanying queries should be made separate, on white paper, in plain black ink lines. Lettering or figures should be bold and plain.

895. Surveyors' Charges.—"Querist" writes: I shall be much obliged if you can inform me what is the usual surveyor's scale of charges for an inspection and detailed report on the condition of drainage in connection with a country mansion, including plan and specification of work to be done and supervision.

It will perhaps be best in replying to the above to give the charges made by an ordinary London engineer, who is a sanitary expert. The fee for inspecting and testing the drains at a country mansion would be based upon a charge of 5 guineas a day for personal work and 1 guinea a day for assistant's work. It is impossible to be more definite, seeing that the inspection of the drains at a country mansion may be a simple matter to be done easily in one day, or it may be necessary to spend several days on the work. Supposing that the work occupied a principal and an assistant for one day, the fee charged for the report would be about 10 guineas, plus travelling and out-of-pocket expenses. This would allow for the time spent in writing the report at the office. Such a report might include a sketch plan and estimate. For preparing a complete plan and specification of work, the fees generally charged are 5 per cent commission on the cost of the work done if the job is over £500, and 10 per cent if the job is under £500. Also the cost of clerk of works' salary and expenses must be added to the above, plus out-of-pocket and travelling expenses. These are the ordinary fees charged by men who make a speciality of doing work of this kind, and they should be applicable to the case mentioned. The lowest fee for which a qualified engineer or surveyor should work as a consultant is 3 guineas a day, and to this extent the fee of 5 guineas a day mentioned above might be reduced; but, on the other hand, if the surveyor were a man of great experience, holding a high position in the profession, he would probably charge, say, 10 guineas a day or more for his work.

The British Fire Prevention Committee's Reports.—The British Fire Prevention Committee announce that they have accepted the offer of a leading firm of publishers in Hanover to issue regularly a German edition of their Red Books and Journals simultaneously with the English edition, for the benefit of the Continental public authorities concerned. This is, the committee believe, the only instance where any English technical publication of official character is to be regularly reprinted in the German language, and the fact of this arrangement being possible is not only a compliment to the British Fire Prevention Committee's work generally, but to its Testing Station, which is the only one of its kind in Europe. The first four publications to appear in this Anglo-German edition will deal respectively with celluloid film substitutes, asbestos cement roofing, petrol extinguishers, and reinforced-concrete doors.

LOCAL GOVERNMENT BOARD INQUIRIES.

The Editor invites the co-operation of Surveyor *readers with a view to making the information given under this head as complete and accurate as possible.*

INQUIRIES HELD.

Exmouth U.D.C. (February 12th. Mr. W. O. E. Meade-King).—£1,200 for the purpose of the water undertaking.—The surveyor, Mr. S. Hutton, stated that the proposed work—laying a 9-in. main from Capel-lane to Redgate—was part of the original high-level filter scheme carried out in 1907 to 1908 from his designs. He was then of opinion that this pipe line could be postponed for several years, and one of the existing 7-in. mains used; and he contemplated that when the consumption from these works reached over 150,000 per diem, the laying of the 9-in. main would have to be considered. The figure named had been regularly exceeded during the past summer, and had, on certain days, reached a little over 200,000 gallons. With regard to the second section of the work, the 6-in. main in the Exeter-road district, the need of it had occupied his attention for several years past. Nothing less than a 6-in. main would provide sufficient margin for future extension of the district, and the council adopted the principle of a 6-in. main when, in 1909, they laid about 130 yds. in Albion-street, and which would form part of the new leading main.

Fareham R.D.C. (February 5th. Mr. P. M. Crosthwaite).—£12,831 for works of sewage disposal.—It was explained that the sewage would be kept in a tank at Elmore until a favourable time to discharge it into the sea. The place of discharge would be about 500 yds. from Elmore Point. The council's consulting engineer, Mr. Wilberforce Cobbett, of Fareham, who had prepared the scheme, said the total capacity of the tank would be 47,065 gallons, and he considered it impossible that there could be injury to shellfish. Mr. Mitchell Geo. Weekes, of Westminster, who had inspected the site of the proposed work, plans, &c., said the scheme would properly drain Lee as at present populated, and with a large increase in future.

Hove T.C. (February 11th. Mr. R. H. Bicknell).—£2480 for constructing underground lavatories in Norton-road and on the Western Esplanade.—It was explained that the site in Norton-road was chosen after certain negotiations with owners of surrounding property. The proposed structure on the Western Esplanade, it was added, would be underneath the footpath.

Mexborough U.D.C. (February 12th. Mr. A. G. Drury).—£7,370 for the purposes of sewerage and sewage disposal.—It was stated by the clerk, Mr. J. W. Hattersley, that the application was rendered necessary by the large increase of the population of the district. Since the original sewage loans were obtained it had been found necessary to obtain additional ground for treating the sewage, and the main part of the required loan referred to that. The surveyor, Mr. G. F. Carter, in reply to the inspector said that the necessity for the relief sewer had become more accentuated owing to the increase of building on the high levels of Mexborough. Mr. Carter explained the possible future extensions of the present scheme. The inspector: It seems to me that you are looking a long way ahead. The surveyor: Town-planning, sir.

Rathdown No. 1 R.D.C. (February 10th. Mr. A. D. Price).—£3,000 for the purpose of providing a water supply for the districts of Goldenball, Balally, and Sandyford.—Mr. P. H. M'Carthy, engineer, gave evidence in support of the scheme. The system of working by pumps, he said, which had been in existence in the Sandyford and Balally districts was both troublesome and dangerous. With reference to the Dublin Corporation supply, he was instructed by the council to see the borough surveyor, the late Mr. O'Sullivan, who told him there was no possibility of giving these districts a supply owing to the high levels.

Scarborough T.C. (February 13th. Mr. A. G. Drury).—£3,639 for the construction of lavatories, bathing shelter, and pavilions in connection with the South Cliff-gardens, and £400 for the purchase of pleasure boats for the Mere.—The town clerk, Mr. S. Jones, stated that the £3,639 which was the subject of the application was for further work in connection with the land south of the spa. The lavatory to be erected in place of the one withdrawn amounted to £890 instead of £800 originally. It was to be placed in the north-east corner of the land, and the drainage, instead of falling on the foreshore,

as was originally proposed, would now be taken through a drain, which would pass over the spa promenade, and eventually find its way to the corporation outfall sewer. The sum of £220 was for the work of drainage. A further sum of £1,079 was for the erection of six bungalows or shelters at the south-east corner of the land, and this sum included the filling up of a small creek and the drainage of the surrounding land. The inspector: The bulk of the amount is for earthwork? The town clerk: That is so; we are using this earth for filling up somewhere else. The last amount was the sum of £1,450 for the bathing shelter. That work was dependent on the corporation coming to an agreement with the adjoining landowner, the Scarborough Cliff Bridge Company. The borough engineer, Mr. H. W. Smith, said the lavatory would be brick built, with tiled roof and lined inside with glazed bricks. The shelter was an extension of a shelter erected last spring. The existing shelter served two purposes. In the early morning it was used for lady bathers, and during the day time it served as a shelter for the general public. With regard to the additional bungalows, he had sufficient applicants to let these bungalows twice over. If they doubled the number they would not have the slightest difficulty in finding tenants for them. This was one of the most popular improvements the corporation had made during recent years. The inspector: Are they self-supporting? The engineer: Oh, yes; we charge £8 a year for the small ones, £10 for the end ones, and £12 for the largest.

Southport T.C. (February 11th. Mr. A. G. Drury).—£60,000 for sewerage and sewage disposal work for the district of Birkdale and Ainsdale, including the erection of a destructor near the depot in Shaftesbury-road, and the erection of certain works in the township of Halsall.—The town clerk, Mr. J. E. Jarratt, stated that the township of Ainsdale had been without any system of sewerage. It was a residential district, an old village with a large amount of undeveloped land which the landowner, in conjunction with the Southport Corporation, was anxious to develop on town-planning lines. Mr. Midgley Taylor, consulting engineer for the scheme, gave the necessary details.

Stafford T.C. (February 11th. Mr. A. G. Malet).—£10,000 for the purchase of land and for the construction of a new road between Lichfield-road and the Lammascotes.—It was claimed that the construction of the new road would open out a large area of building land, and that it would provide a nearer approach from the south to the east of the town. The scheme was opposed by several members of the town council, who objected to the cost.

Worthing T.C. (February 7th. Mr. P. M. Crosthwaite).—£3,430 for an extension of the surface-water drainage, and £7,389 for sewage outfall works.—The town clerk, Mr. W. Verrall, explained the schemes, which, he said were urgently needed to remedy flooding, which had caused serious inconvenience in some parts of the town. The proposed extension of the sewage outfall would meet the needs of the borough for some time to come. The surveyor, Mr. F. Roberts, gave details of the proposals, and said the additional cost of extending the existing outfall pipe further seaward to correspond with the proposed new one would be £400. The council were willing to carry out this suggestion if pressed to do so.

APPLICATIONS FOR LOANS.

Dewsbury T.C.—£550 for works of street improvement.

Dunmow R.D.C.—£4,183 for sewerage purposes.

Friern Barnet U.D.C.—£2,583 for widening Colney Hatch-lane, and £850 for paving footpaths.

Grimsby T.C.—£7,948 for works of sewerage.

Harrogate T.C.—£5,485 for street works.

Leicestershire C.C.—£1,850 for extensions to the Barrow-on-Soar grammar school.

Swansea T.C.—£20,000 for a housing scheme.

Tiverton T.C. £2,900 for extensions of the gasworks.

Yarmouth T.C.—£5,965 for granite-sett and concrete paving works, and £2,000 for wood paving.

LOANS SANCTIONED.

Aylsham R.D.C.—£226 for works of road improvement.

Buxton U.D.C.—£1,000 for gas mains, services and meters.

Crompton U.D.C.—£3,525 for the reconstruction of a portion of Rochdale-road.

Doncaster T.C.—£12,285 for a technical school.

Flint C.C.—£5,909 for a new school at Sealand.

Coole T.C.—£1,660 for laying out a public park.

Larne R.D.C.—£750 for water supply extensions.

Lurgan R.D.C.—£10,200 for the provision of labourers' cottages.

Maldens and Coombe U.D.C.—£3,180 for making up parts of Duke's-avenue, Park-view, George-road, and Queen's-road.

North Riding C.C.—£5,900 for a new school at Yarm.

Poole T.C.—£185 for alterations to lodges in Poole Park.

Prestwich U.D.C.—£14,049 for improvements in Bury Old-road.

Rathdown (No. 2) R.D.C.—£250 (repayable in twenty years) for improving the water supply of Greystones.

Royston U.D.C.—£2,800 for extension of sewers.

Scarborough T.C.—£1,500 for the erection of seventeen bungalows on the North Side.

Southall U.D.C.—£770 for laying out Southall Park.

Sutton-in-Ashfield U.D.C.—£1,424 for works of sewerage.

FORTHCOMING INQUIRIES.

FEBRUARY.

		£
22.—	**Guildford.** For the reconstruction of a bridge (Major J. Stewart)	2,000
24.—	**Northampton.** For a housing scheme (Mr. Courtenay Clifton)	10,246
25.—	**Boston.** For the provision of dwellings (Mr. C. H. Eyles)	690
25.—	**Denbigh.** For the provision of municipal offices (Mr. P. M. Crosthwaite)	10,000
25.—	**Fleetwood.** For electricity and street purposes (Mr. T. C. Ekin)	9,946
25.—	**Hexham.** For sewage disposal purposes (Mr. A. G. Drury)	3,500
25.—	**Paignton.** For foreshore and sewerage purposes (Mr. A. A. G. Malet)	4,793
26.—	**Abergele.** For surface water drainage (Mr. P. M. Crosthwaite)	2,000
26.—	**Benfieldside.** For sewage disposal works (Mr. A. G. Drury)	11,000
26.—	**Bispham.** For electric lighting purposes (Mr. T. C. Ekin)	8,178
26.—	**Falmouth.** For sea wall, footpath, and sewerage purposes (Mr. R. G. Hetherington)	1,015
27.—	**Bedlingtonshire.** For works of sewerage (Mr. A. G. Drury)	2,467
27.—	**Hastings.** For electricity purposes (Mr. H. R. Hooper)	8,134
27.—	**St. Austell.** For water supply purposes (Mr. R. G. Hetherington)	7,000
27.—	**Southgate.** For laying out a park (Mr. M. K. North)	2,400
28.—	**Bromsgrove.** For the provision of a depot and mortuary (Mr. W. O. E. Meade-King)	1,730
28.—	**Wellington.** For road and bridge building purposes (Mr. A. A. G. Malet) ...	500

MARCH.

4.—	**Saxmundham.** For sewage disposal works (Mr. A. A. G. Malet)	10,500

Arterial Roads.—This subject is touched upon in the fifth annual report of the traffic branch of the Board of Trade, issued last Friday as a Blue-Book [Cd. 6608]. The report says: "The adoption of a general road scheme would be of great benefit to town planning schemes, in that direct road communication with Central London, with the prospect of cheap travelling facilities, would be assured to centres of development. Moreover, it must not be overlooked that while adequate provision for the traffic of London is of paramount importance, there would be no difficulty at this stage in preparing the plans of each town planning scheme so as to conform to a general road scheme without interfering with the proper consideration of the various other points which such schemes necessarily embrace. On the other hand, it is clear that independent town planning schemes would be fatal to the construction of any important new main road in the future.

Municipal Work in Progress and Projected.

The Editor invites the co-operation of SURVEYOR *readers with a view to making information given under this head as complete and accurate as possible.*

The following are among the more important projected works of which particulars appear below: Buildings—Arbroath £7,000 Deptford £7,500, Newport, Penistone; housing and town planning—Bradford, Ealing, Swansea; roads and materials—Cardiff, Cheshire, Cornwall, Hove, Margate £10,000, Southend £30,000, West Sussex £56,000; sewerage and sewage disposal—Belfast £63,697, Loughborough £5,000, Ossett £8,142; water, gas and electricity—Sheffield £121,600. Particulars of other works projected will be found on our "Local Government Board Inquiries" pages.

BUILDINGS.

Arbroath T.C.—A site in Market Gate is to be purchased for £400 for the erection of public baths, towards which a gift of £7,000 has been offered by Mr. Andrew Carnegie on condition that a rate of 1d. per £ is imposed for maintenance.

Atherton U.D.C.—A new school is to be built at a cost of £2,500.

Bermondsey B.C.—The question is under consideration of extending the accommodation of the Rotherhithe public baths, and rebuilding the Spa-road baths, which are beyond repair and obsolete.

Bourne R.D.C.—Plans have been considered for the erection of bridges in the parishes of Castle Bytham and Swayfield, and alternative schemes are to be prepared.

Carmarthenshire C.C.—A new bridge over the Sawdde was formally opened last week. The contractors were Messrs. Morgan, Morgan & Sons, Gwynfi.

Coventry T.C.—The General Purposes Committee have submitted a proposal for a depot at an estimated cost of £3,500. The suggestion is to adapt existing buildings and build new premises.

Dartford U.D.C.—Plans have been approved for a public library at an estimated cost of £7,500.

Dodworth (Yorks) U.D.C.—A proposal for the provision of new municipal offices is being considered.

Howden R.D.C.—The council have agreed to the provisional purchase of an additional acre of land for the extension of the site of the proposed hospital, and also for the addition of two private wards. This will render necessary a further loan of £250, in addition to the £3,200 applied for.

Leigh-on-Sea U.D.C.—The tender of Mr. Thomas F. Tracey, at £110, has been accepted for the construction and completion of the timber piling on the cliffs opposite Avenue-road.

Liverpool T.C.—The Baths Committee are conferring with the Finance Committee with respect to a scheme for baths at the pierhead, to consist of a plunge pond 120 ft. by 40 ft., together with a suite of slipper baths, and blocks of public offices.

Lurgan R.D.C.—The surveyor's recommendation has been provisionally adopted to expend £450 in rebuilding Knock Bridge.

Lynn T.C.—The borough surveyor, Mr. A. J. Smith, has submitted alternative schemes for a new public baths, one to cost £1,487 and the other £1,451.

Maldens and Coombe U.D.C.—Extensions to the highways depot are to be carried out at an estimated cost of £454.

Newport (Mon.) T.C.—The Parliamentary and Works Committee recommend the corporation to rescind their former resolution to erect a 60-ft. wide ferro-concrete bridge, and that the sub-committee be empowered to confer with an expert with a view to adopting plans for constructing a stone bridge. It was pointed out that if the bridge were constructed of ferro-concrete the cost, including a temporary bridge, laying pipes and cables, and tram track was estimated at £65,000, but that a similar bridge of stone would probably cost £100,000.

Penistone U.D.C.—A new town hall and council offices are to be built from the designs of Mr. H. R. Collins, of Barnsley.

Southport T.C.—A new bandstand is to be built in the Municipal Gardens at an estimated cost of £850

Winchester T.C.—The General Purposes Committee has been instructed to bring up a scheme for slipper baths upon a site at North Walls.

Ystradgynlais R.D.C.—The tenders of Messrs. Holbrough & Co., Gloucester, at £2,398, for the building of two ferro-concrete bridges at Brynmorgan, Upper Cwmtwrch, have been accepted, subject to the approval of the Local Government Board.

HOUSING AND TOWN PLANNING.

Boston R.D.C.—Land has been purchased at Wrangle and Wigtoft for the erection of cottages, and it is proposed to expend £630 upon dwellings at Bennington.

Bradford T.C.—Two hundred workmen's dwellings are to be built and let at a rent of 4s. 6d. per week, inclusive of rates.

Ealing T.C.—The borough surveyor, Mr. C. Jones, has been authorised to prepare a scheme for workmen's dwellings at a cost not exceeding £5,000.

Erpingham R.D.C.—It has been decided to purchase cottages and land at Beaconsthorpe and West Beckham for housing schemes.

Featherstone U.D.C.—Negotiations are in progress for the purchase of land for a housing scheme.

Godstone R.D.C.—The council have decided to adopt Part III. of the Housing of the Working Classes Act in the parish of Limpsfield, and have instructed their surveyor, Mr. T. C. Barraclet, to prepare plans for five cottages. It is proposed ultimately to erect about twenty.

Ripley U.D.C.—A scheme for the erection of twenty-five houses on Heage-road has been adopted.

Selby R.D.C.—During a discussion on the housing question, Mr. W. Armstrong (Brayton) said there were plenty of people who would build if there were not so many restrictions in force, and Dr. Stedman (medical officer) said that the council's building by-laws would not allow of the putting up of a bungalow. He had several times advocated the alteration of the by-laws. The urban council had found it advisable to get their by-laws altered. The Finance Committee were asked to consider the by-laws.

Swansea T.C.—Mr. Henry C. Portsmouth, architect, has submitted sketch plans with respect to the housing scheme on Town Hill. The borough surveyor, Mr. G. Bell, explained that an area of 50 acres would be dealt with, and that for excavating the roads drainage, sewerage and lighting, the cost would be £20,000; but if the pathways were paved the figure would be £23,657. Mr. Portsmouth has been requested to supply twenty-five designs of the smaller and twenty-five of the larger type of houses.

Swaffham R.D.C.—The council have selected plans for workmen's cottages in the following order: Mr. Arthur Pells, architect, Beccles, first; Mr. P. E. Culling, Norwich, second; the surveyor (Mr. W. R. Kipling), third. Schemes are to be prepared for the erection of cottages in Holme Hale, North Pickenham, and Great Cressingham.

Tendring R.D.C.—Workmen's cottages are to be built at an estimated cost of £2,000.

Tiverton T.C.—The council have agreed upon the terms and conditions of the proposed competition for the best scheme of laying out the Elmore site for working-class dwellings. Designs are to be invited from architects and surveyors in Devon and Somerset. It is proposed to carry out the scheme in three stages, the plan to be drawn so that the north-west section of about 1¾ acres be dealt with first; the houses to be generally in accordance with the Local Government Board memorandum, from eighteen to twenty houses to the acre, and to have the following accommodation: Type A—Parlour, living room, scullery (with bath), coal store, larder and water-closet, three bedrooms above. Type B—Without parlour. Type C—No parlour, no bath, two bedrooms. The houses were to be let, including rates, at from 3s. 6d. to 5s 6d. per week. A premium of £25 is offered for the design most approved by the council.

PARKS AND OPEN SPACES.

Bacup T.C.—The council have accepted the gift of the Stubbylee and Moorland estate from the trustees of Miles Ashworth and Edward Hoyle, comprising 24 acres, for conversion into a public park. This gift includes several thousand pounds from the Ashworth Bequest for the laying out and maintenance of the public park, and also Stubbylee Hall, the residence of the late Maden Holt, many years member of Parliament for North-East Lancashire.

Bristol T.C.—Part of Easton Colliery is to be purchased for £636 and laid out as a recreation ground at a cost of £611.

Margate T.C.—It has been agreed to provide a bowling green pavilion at the further end of Cliftonville.

REFUSE COLLECTION AND DISPOSAL.

Hove T.C.—It has been resolved to try an experiment in disposing of the house refuse by means of the "crusher" system, at a cost of £1,200 a year. It was explained by Councillor Cushman, chairman of the Sanitary Committee, that the crusher was a machine which was composed of a series of steel hammers, and the house refuse was so treated by this means that it came out of the machine resembling brown mould which possessed manurial qualities. In Southwark, where the crusher was used, it was found that the farmers would purchase the residue as manure, and his analysis of the two towns' refuse showed that in Hove there was reason to believe that the residue would contain the same valuable qualities and could be sold and the profit devoted to relieving, if not wholly covering, the repayments on the capital outlay that would be required to introduce the system.

Teddington U.D.C.—Messrs. G. Rowe & Sons' tender of £48, one of five received, has been accepted for a new dust van.

ROADS AND MATERIALS.

Bognor U.D.C.—It has been agreed to carry out the scheme of the surveyor, Mr. O. A. Bridges, for the widening of the promenade between the pier and the east end lavatories by raising the existing apron in front of the sea wall to the level of the present parade, and facing the front thereof with concrete, with bull-nosing at the top, and fixing galvanised iron fencing and standards thereon, at an estimated cost of £1,283.—The surveyor has been instructed to prepare plan, specification, and estimate for the widening and improvement of the parade and highway between Lansdowne-mansions and the Cosy Corner tea-rooms, by extending the parade southward to the sea, and increasing the width of the highway by throwing therein a portion of the north side of the parade.

Brighton T.C.—The tramway rails and paving in Richmond-place are to be relaid at an estimated cost of £1,900.

Bristol T.C.—It is proposed to carry out road improvements in Bedminster at an estimated cost of £1,100.

Cardiff T.C.—The city engineer, Mr. W. Harpur, has presented to the Public Works Committee a report advising that a patent cutting machine be purchased to cut down the wood blocks when they become worn for use in secondary streets. It was stated that the application to the Local Government Board for sanction to borrow £35,000 for hardwood paving was in abeyance in view of the suggestion since made by the Government inspector that the committee should obtain the fullest information regarding the relative wearing qualities and suitability of Jarrah hard-wood blocks and creosoted soft wood. The committee decided unanimously to use Jarrah wood, and to repeat the application for sanction to borrow £35,000. The estimate for creosoted soft wood was £25,925, and for sectional hard wood £37,595. The streets included in the scheme are Queen-street, St. John-street, the Hayes, Working-street, Castle-street, Cowbridge-road, Custom House-street, Bute-street, Newport-road, St. Mary-street, and High-street. In his report the city engineer stated that the wearing quality, as well as the freedom from rot, of Jarrah blocks was remarkable. Blocks which had been down under the heaviest traffic for fourteen or fifteen years showed but little wear, which was quite negligible, the actual wear being not greater than that of granite setts.

Cheshire C.C.—It is estimated that the expenditure on the main roads will amount to £121,742 during the coming financial year. The council have accepted from the Road Board offers of grants of £15,500 for tarmacadam and tar-spraying. The board also offered £2,000 towards a suggested scheme for dealing with dangerous corners; but the council have replied that they are prepared to co-operate in the scheme conditional upon the whole cost being borne by the Road Board.

Coleraine U.D.C.—The surveyor, Mr. W. J. Given, has reported that during last year the amount of tarmacadam made was 645 tons, of which 212 tons were used on streets and footpaths. The cost of manufacture was £265 8s. 4d., which worked out at about 8s. 3d. per ton. After allowing for wear and tear of plant, this gave a reasonable margin of profit; in fact, the council were obtaining a considerable revenue from the scheme.

Cornwall C.C.—The county surveyor, Mr. E. A. Brookes, has prepared a scheme for the improvement of the Redruth-Penrhyn road, at an estimated cost of £10,700, and the council have appointed a deputation to confer with the Road Board on the subject, with a view to obtaining a grant of £5,000 and the balance on loan, and to ask that such grant might be in addition to the usual grant of £6,000 a year received from the Road Board.

East Preston R.D.C.—A letter has been received from the clerk to the county council intimating that the Provisional Order making the road from Brighton to Portsmouth a main road has been confirmed, and the road will be taken over when completed to the satisfaction of the county surveyor.

Epsom R.D.C.—A Local Government Board inquiry is to be held as to the application for powers under the Private Street Works Act, 1892, with regard to the making up of several roads in Cheam.

Esher and the Dittons U.D.C.—Raleigh-drive and Loseberry-road, Claygate, are to be made up under the Private Street Works Act.—The surveyor Mr. H. C. Fread, has reported his final apportionments for making up Imber Park-road at £975, or 11s. 4d. per foot frontage. This is a slight increase on the provisional apportionment, owing to the subsoil necessitating iron pipes for the branch drains to the gullies on the surface-water drain.

Halifax T.C.—Notice to treat has been served upon various owners of property in connection with the widening of Bull Green

Hove T.C.—It has been decided to widen Hove-street, from the Connaught Hotel on the north to Kingsway on the south, at a cost of £10,000.

Kiveton R.D.C.—Improvements are to be carried out at Dinnington-road at a cost of £3,000.

Maldens and Coombe U.D.C.—£454, the amount of the estimate of the surveyor, Mr. R. H. Jeffes, is to be spent on enclosing the council's land in King's-avenue by means of a brick wall, and in draining and providing an entrance.—The tenders of Messrs. Mowlem & Co. have been accepted for making up Duke's-avenue, £1,360; Park-view, £238; Queen's-road, £501; and George-road, £491.—Messrs. Wainwright's tender has been accepted for artificial stone at £645.

Margate T.C.—The Town Planning Committee are promoting a scheme for the construction of a road between Margate and Westgate along the cliffs, at an estimated cost of £12,000. Another feature of the scheme is the construction of a promenade at the foot of the cliffs.

Newquay (Cornwall) U.D.C.—It has been decided to carry out the widening of the main road at the entrance to the town adjacent to the Barrow Fields at a cost of £500, providing the sanction of the Local Government Board be obtained for £250 and a grant obtained from the Road Board or County Council for £250.

Richmond T.C.—Cumberland-road and Kew Gardens-road are to be repaired at a cost of £941 and £492 respectively.

Sevenoaks R.D.C.—Rye-lane, Otford, is to be widened at an estimated cost of £1,200.

Skegness U.D.C.—It has been decided to make up several private streets under the Private Street Works Act.

Southend T.C.—It has been decided to complete the Western Esplanade scheme at a cost of £30,000.

The promenade portion will be ready by the summer of 1914, but the 3 acres of gardens adjacent to the pier will take about three years to finish. The entire promenade will be 8 miles long, and it is claimed that it will be the finest and widest in England.

Todmorden R.D.C.—An estimate of £250 for road improvements has been approved.

Tynemouth T.C.—After considering the report of the borough surveyor, Mr. J. H. Smillie, on the subsidence of the sea promenade, the council decided to take expert opinion upon his scheme for the repairing of the road, and to apply to the Government for a grant in aid of the scheme from the fund dealing with coast erosion.

Wandsworth B.C.—The borough surveyor, Mr. P. Dodd has received instructions to carry out channelling and road repair works, at a cost of £3,000.

West Sussex C.C.—It is proposed to expend £56,000 upon road improvements, and a grant of £14,000 in aid of the scheme has been made by the Road Board.

Weymouth T.C.—The borough surveyor, Mr. K. J. S. Harris, is preparing plans for an improvement scheme from Gloucester-road to King-street.

SEWERAGE AND SEWAGE DISPOSAL.

Banbury T.C.—Messrs. Willcox & Raikes have been requested to include in their sewage disposal scheme the provision of a new cast-iron rising main, 15 ft. in diameter, from the pumping station to the farm.

Belfast T.C.—The council have accepted the tender of Messrs. J. & R. Thompson, of Belfast at £63,697, for the construction of a ferro-concrete outlet sewer at the sewage disposal works. The city surveyor, Mr. H. A. Cutler, in a report on the subject, stated that on revising his estimate of 1910, to harmonise with present prices, he found that the total amount had increased from £40 000 to £57,597.

Bristol T.C.—It has been decided to substitute a 24-in. pipe sewer for one of 12 in. in Bloomfield-road, Brislington, at a cost of £756.

Canterbury T.C.—The city surveyor, Mr. C. Turley, has received instructions to prepare a plan for a new lavatory in the recreation ground.

Darlington T.C.—The question of a proposed expenditure of £4 500 for a new sewer in Cocker Beck Valley, and £7,100 for a new sewer to join the existing sewer from Blackwell Mill and continue to the proposed new works at the sewage farm, has been referred to the General Purposes Committee for a detailed report.

Derby T.C.—The tender of Mr. G. F. Tomlinson, at £429, has been accepted for sewerage works.

Cillingham T.C.—The tender of Messrs. Goddard, Massey & Warner, of Nottingham, at £202, has been accepted for a sludge press for the outfall works.

Crimsby T.C.—The tender of Messrs. Swaby & Walsham has been accepted for the construction of the conveniences in Nelson-street.—The tender of Messrs. Wilkinson & Houghton, Cleethorpes, at £1,333, has been accepted for the construction of a new sewer.

Heavitree U.D.C.—The purchase has been effected of the Whipton sewage farm for a sum of £586.

Loughborough R.D.C.—The Hathern Parish Council have been invited by the council to give consideration to a proposed sewerage scheme for the district, estimated to cost £5,000, which has been prepared by Mr. F. W. Hodson.

Ossett T.C.—The council have passed the scheme of the borough engineer Mr. H. Holmes, for the extension of the sewage disposal works, at an estimated cost of £8 142.

Skegness U.D.C.—The surveyor, Mr. R. H. Jenkins, has estimated the necessary repairs at the sewage pumping works to cost £506, and he has received instructions to prepare a general scheme for the work.

WATER, GAS, AND ELECTRICITY.

Aberdeen T.C.—The Electricity Committee have agreed to accept the offers of the Oerlikon Engineering Company, London and Zurich, and Bruce Peebles & Co., Edinburgh for additional generating plant for the production of gas and new electricity generating plant. The cost of the new plant will be £11,000.

Aberdeen T.C.—The tender of the Woodall-Duckham Vertical Retort and Oven Construction Company, Limited, at £15,619, has been accepted for the installation of five beds of retorts at the gasworks.

Birmingham T.C.—The tender of Kopper's Coke Oven and By-Products Company, Limited, at £32,900, has been accepted for coke ovens at the gasworks.

Bridge of Allan T.C.—The council have agreed to acquire the local gas undertaking, and the matter will be put to the vote of the ratepayers.

Chesterfield T.C.—An expenditure of £3,040 is to be incurred for an installation of high-tension transforming machinery and transmission lines at the electricity works.

Fifeshire C.C.—It has been agreed to promote a Provisional Order for a new water supply for the Dunfermline district.

Greenock T.C.—The gas manager recommends that a gasholder, of 2,000,000 cub. ft. capacity, be put down in order to cope with the increased demand, and it is proposed to appoint a deputation to visit a number of gasworks in order to obtain information.

Hereford T.C.—Electricity pumping machinery is to be installed at the waterworks at a cost of £1,000.

Hull T.C.—The nett profit on the water undertaking last year amounted to £19,803.

Lampeter T.C.—Improvements in the water supply are to be carried out at an estimated cost of £2,500.

Lisburn U.D.C.—The gasworks are to be extended, at an estimated cost of £2,000.

Louth T.C.—The council are giving consideration to the purchase on behalf of the town of the Louth Waterworks Company's undertaking.

Northampton T.C.—The water undertaking last year made a profit of £2,480.

Rothesay T.C.—A scheme is under consideration for the erection fo a new gasometer and retorts, at an estimated cost of £18,000.

Sheffield T.C.—Extensions to the electricity buildings and machinery, involving an outlay of £121,600, are recommended by the Electric Light Committee.

Stirlingshire C.C.—It has been decided by the Eastern District Committee to continue the 6-in. water main from Rabbithill to Avonhedge, at an estimated cost of £1,080.

Stourport U.D.C.—The tender of Mr. G. Law, of Kidderminster, at £1,349, has been accepted for carrying out a water supply scheme.

Swansea T.C.—The final terms agreed upon by the corporation for the supply of water to the Oystermouth (Mumbles) Urban District Council are that the basis of payment is to be the assessable value of property in respect of which water rent is collected. The corporation are to be responsible for the laying of the pipe line up to the reservoir, but the corporation will hold the district council responsible for the maintenance of the pipe line inside their district.

Westbourne R.D.C.—The council have accepted the offer of the Chichester Corporation to lay a 4-in. water main to Bosham for £800, the council to have the option of purchasing by valuation at the expiration of ten years.

Workington T.C.—Extensions of the gas undertaking are to be carried out at an estimated cost of £7,000.

MISCELLANEOUS.

Bingley U.D.C.—It has been decided to buy a motor fire engine, and sell one of the steam fire engines.

Esher and the Dittons U.D.C.—Subject to the consent of the Local Government Board, the council will in future pay their workmen full sick allowance for ten days and half allowance for the next ten days, less the money received by the employees under the National Insurance Act. At present the council employ twenty-four men who are over fifty years of age, among them two veterans of eighty-three and eighty-four respectively.

Maldens and Coombe U.D.C.—It has been decided to acquire, in connection with fire prevention at Coombe, a first-aid motor appliance, estimated not to exceed £750 in cost.

Wimbledon T.C.—Extensions to the cemetery are to be carried out at a cost of £3,500.

Yarmouth T.C.—The whole of the tramway route to Wellington Pier is to be made a double line, at an estimated cost of £8,750.

PERSONAL.

Mr. L. D. Holgate, sewage works, Tiverton, has been elected a member of the Royal Sanitary Institute.

Mr. T. Orchard, surveyor to the Clutton Rural District Council, has, we regret to state, been laid up with an attack of bronchitis.

Mr. H. Holmes, M.INST.C.E.I., borough surveyor and waterworks engineer of Ossett, has been granted an increase of salary of £50 per annum.

Mr. W. Plant, borough surveyor of Stafford, has been granted an increase of his salary to the maximum (£400) from the beginning of the year.

Mr. J. Horan, who has been county surveyor of Limerick for a period of twenty-nine years, has tendered his resignation owing to ill-health.

Mr. G. R. Collinson, B.SC., chief engineering assistant at Rotherham, was on Wednesday appointed engineering assistant in the borough surveyor's office, Swansea.

Mr. H. D. Blake, the managing director of the Limmer Asphalte Paving Company, Limited, has been appointed the asphalt expert to the Engineering Standards Committee.

Mr. Henry William Apted, ASSOC.M.INST.C.E., assistant engineer to the Fylde Water Board, has been appointed assistant water engineer to the Richmond (Surrey) Corporation.

Mr. T. H. Harris, who has hitherto worked half the Tavistock rural district as surveyor and sanitary inspector, has been appointed for the whole district, in succession to Mr. W. J. Mason, deceased.

Mr. Richard F. Braithwaite, assistant surveyor, has been appointed surveyor and inspector of nuisances to the Selby Rural District Council, in succession to his late father, at a salary of £180 per annum.

Mr. F. E. Gay, assistant city surveyor of Bath, has been granted £30 in respect of work done in connection with the boundaries extension, and the salary of Mr. F. Hamblin, chief clerk in the city surveyor's department, has been increased by £10 per annum.

Mr. Charles William Stubbs, borough surveyor of Macclesfield, died, we regret to announce on Wednesday morning after an illness of several months. After being assistant surveyor for many years, Mr. Stubbs was appointed borough surveyor about eight years ago. He was fifty-six years of age.

Mr. Charles Cameron, the eldest son of Sir Charles Cameron, the Dublin city analyst, who was visiting at Walterston, Athlone, the residence of Mr. Harris Temple, Deputy-Lieutenant, was accidentally drowned last Sunday while fishing. A servant who was also involved in the accident was rescued.

Road Reconstruction in Wilts.—The Wiltshire County Council adopted on Wednesday a scheme for the reconstruction of the 35 miles of the London-Bath road which run through Wiltshire. The cost of reconstruction, and of maintenance for nine years afterwards, is estimated at nearly £75,000. The Road Board will make a grant of £34 700, and will lend £35,600 free of interest. The road will be constructed with a 3-in. coating of tar-macadam or Ferromac throughout, and its foundations will be strengthened. It will be widened to a minimum of 20 ft., and the camber reduced where excessive.

FOR OTHER ADVERTISEMENTS

See End of Paper.

WANTED, Assistant Road Foreman, age about 30 to 35 years, having a thorough knowledge of the Construction Repair and Scavenging of Public Highways. He must be accustomed to the various methods of modern Road Making, capable in organising and supervising workmen, and be able to set out and measure up work.

Applicants must be able to ride a cycle.

Salary, £2 per week.

Applications, accompanied by copies of not more than three recent testimonials, giving age past and present appointments and experience, to be sent to the Borough Engineer, Town Hall, Wolverhampton, by the 28th February, 1913.

COUNTY BOROUGH OF WIGAN.

APPOINTMENT OF BOROUGH ENGINEER AND SURVEYOR.

The Corporation of Wigan invite applications for the position of Borough Engineer and Surveyor at a salary of £350 per annum, rising by annual increments of £50 to £500 per annum.

Particulars of the duties and conditions of the position may be obtained on application to the undersigned.

Applications, endorsed "Borough Engineer," and stating age, qualifications and experience, and accompanied by copies of not more than three recent testimonials, must be delivered to me on or before Saturday, the 8th March next.

WILLIAM HENRY TYRER.
Town Clerk.

Town Clerk's Office,
Wigan.
February 20, 1913.

CITY OF COVENTRY.

CONTRACT FOR MATERIALS.

The General Works Committee of the Corporation of the City of Coventry invite Tenders for the supply and delivery of the following materials during the year ending 31st March, 1914:—

Broken Road Stone.
Granite Kerbs.
Granite Setts.
Stoneware Pipes.
Castings.
Workmen's Tools.

Form of Tender and full particulars may be obtained, and samples inspected, on application to the undersigned.

Tenders to be delivered to the City Engineer's Office on or before Monday, the 10th day of March, 1913, sealed and endorsed "Tender for Materials."

The lowest or any Tender will not necessarily be accepted, and no Tender will be considered that is not made out on the Form supplied.

J. E. SWINDLEHURST, M.INST.C.E.,
City Engineer and Surveyor.

Saint Mary's Hall,
Coventry.
February 19, 1913.

CITY OF COVENTRY.

WATERWORKS STORES (CAST-IRON PIPES, LEAD PIPES, SOLDER, &c.).

The Waterworks and Fire Brigade Committee of the Corporation of the City of Coventry invite Tenders for the supply and delivery of Cast-iron Pipes, Lead Pipes, Solder, Hydrant and Valve Boxes, &c., for the year ending 31st March, 1914.

Form of Tender and full particulars may be obtained, and samples inspected, on application to the undersigned.

Tenders are to be delivered at the Water Engineer's Office, St. Mary's Hall, Coventry, on or before Monday, the 3rd day of March, 1913, sealed and endorsed "Tender for Waterworks Stores."

The lowest or any Tender will not necessarily be accepted, and no Tender will be accepted which is not made out on the Form supplied.

J. E. SWINDLEHURST, M.INST.C.E.,
Water Engineer.

Saint Mary's Hall,
Coventry.
February 19, 1913.

WEST SUFFOLK COUNTY COUNCIL.

MAIN ROADS.

NEWMARKET-BURY-STOWMARKET ROAD.

RECONSTRUCTION.

STEAM ROLLING.

Tenders are invited for Steam Rolling in connection with the above works.

Conditions of Contract, with Specification and Form of Tender, may be obtained on application to the undersigned.

Tenders to be sent in on or before Monday, the 10th March, 1913.

W. LIONEL JENKINS, A.M.I.C.E., F.A.S.I.,
County Surveyor.

Shire Hall,
Bury St. Edmunds.
February 13, 1913.

Some Recent Publications.*

The Engineer's Year-Book of Formulæ, Rules, Tables, Data, &c. A Compendium of the Modern Practice of Civil, Mechanical, Electrical, Gas, Marine and Mine Engineering. By H. R. Kempe, M.Inst.C.E., with the collaboration of eminent specialists. Price 12s. 6d. With over 1,250 illustrations specially engraved for the work. London: Crosby Lockwood & Son.

The 1913 edition of this admirable and widely used compendium of information fully maintains the reputation which Mr. H. R. Kempe, M.Inst.C.E., has steadily built up for it during the past nineteen years, a reputation which has been made, not by suppressing difficulties, but by explaining facts and providing ample data. In the present edition advances in mechanical engineering have been recognised by the re-writing of the matter relating to "Steam Turbines," and the provision of a new section on "Marine Diesel Engines." The attention of municipal and county engineers may be drawn to the fact that the following sections are among those which have been revised and, in several cases, considerably extended: Reinforced Concrete, by Alex. Drew, M.I.Mech.E.; Waterworks, by R. F. Middleton, Assoc.M.Inst.C.E.; Electrical Engineering, by Prof. C. A. Carus Wilson, M.I.E.E.; Sewerage and Sewage Disposal, by E. J. Silcock, M.Inst.C.E.; Gas and Gasworks, by H. O'Connor, Assoc.M.Inst.C.E. There is also a new section on "Roads and Streets," by R. Ryves, M.Cons.E., Assoc.M.Inst.C.E., which includes useful data relating to recent practice and studies of important principles of road construction and maintenance. The volume contains abridgments of reports of the Engineering Standards Committee, and extracts from "Proceedings" of the leading professional institutions. The balance of the book is exceedingly good, a fair share of the space being devoted respectively to purely formal and mathematical data, the facts accumulated by experience, accepted theories and methods of design, and expositions of recent practice and developments. The mathematical information is very full and very clearly set forth, providing the engineer with innumerable short cuts in his calculations of areas, volumes, weights, ratios, and so on, and the tables are very clearly printed. Matters coming under the general head of Physics are adequately dealt with, neither the basic relations nor the application of principles to design being neglected; and the properties of the chief materials used in engineering work are set forth with due consideration of recent developments. Calculations for structural designs and for the design of machinery are well backed up by descriptions of details, large use being made of illustrations.

As regards the matter relating to the different highly developed branches of engineering work, it is surprising to find how much useful information on a single subject is included in the pages of a book which covers so large a field; and it is no exaggeration of the facts to say that the information is sufficiently advanced in character to be useful to the specialist in his own branch of work, and, at the same time so well chosen that it is also of great value to the engineer who needs to step outside his usual range of subjects. It would be impossible to find a volume better suited to the needs of the "up-country" engineer in the Colonies or India, or to the designing draughtsman in a consulting engineer's office in Westminster. The surveyor to a local authority who is called upon to combine as best he can the functions of half-a-dozen specialists will find this book invaluable.

Essentials of Electricity. By W. H. Timbie. Price 5s. 6d. nett. New York: John Wiley & Sons.

This book, which is one of the Wiley Technical Series, is intended primarily for the instruction of students who wish to enter or to advance themselves in one or another of the electrical trades. It is confined to direct currents, and treats only of the essential facts and laws which every efficient workman must understand. The intention of the author has been to make the work so simple and so plain that it may serve for self instruction as well as for use in class. In this he has been unusually successful, as the style and arrangement of the book are all that can be desired. The problems, which are exceedingly numerous throughout every chapter, are well chosen and of direct practical value. Many diagrams are scattered through the text. They are clearly drawn and will prove of material aid to the understanding of the principles set forth. Where photographs of electrical machines are given they are usually accompanied by simple diagrams showing the electrical connections.

The ground covered is shown by the following list of titles of the eleven chapters: I. Ohm's Law; II. Simple Electrical Circuits; III. Combinations of Series and Parallel Systems; IV. Electric Power; V. Wire and Wiring Systems; VI. Generators and Motors; VII. Locating and Correcting "Trouble"; VIII. Batteries; IX. Wiring Diagrams.

One of the most practical chapters in the book is that which describes the various troubles that arise in connection with the operation of electrical machines. A table is given showing the signs of troubles and their probable cause, the latter being listed in the most probable order in which they are likely to occur. For example, the sparking of brushes is to be sought in overload, brushes set wrong, poor brush contact, commutator rough or off centre, weak field or the armature winding broken or "short-circuited" by "ground" or "cross." The book is well indexed, and at the end of each chapter there is a short summary.

The author, who is at the head of the Department of Applied Science at Wentworth Institute, Boston, Mass., must be regarded as a text-book writer of unusual merit. The editor of the series states in his preface that Mr. Timbie was selected for this task not merely because of his intimate knowledge of industrial electricity, but also because of his well-known ability to present information in an unusually clean-cut and effective way. The present volume seems likely to prove even more popular than his previous work on the "Elements of Electricity."

Mention should be made also of the book's excellent form of publication, its pocket size, its semi-flexible cover, its thin paper, and its clear typographical arrangement.

The American Civil Engineers' Pocket-book. Second edition. Edited by Mansfield Merriman and others. Price 21s. nett. London: Chapman & Hall, Limited.

In estimating the value of a "pocket" book—the term being used rather to indicate the character of the contents than the shape and size of the work—two chief points arise for consideration—namely, the matters which are included, and their arrangement and the form in which they are presented. As regards the first point, the matters which are appropriate for inclusion will, of course, depend upon the scope of the work as indicated by its title, and the intentions of the compilers as expressed in the preface. The present work is published as a civil engineers' pocket-book, and the editors had in view the ambitious scheme of providing a reference book which would cover the whole wide field of civil engineering practice. It may be said at once that they have well succeeded in this difficult task, the main headings of the subjects dealt with comprising Mathematical Tables; Surveying, Geodesy and Railroad Location; Steam and Electric Railroads; Materials of Construction; Plain and Reinforced Concrete; Masonry, Foundations, and Earthwork; Masonry and Timber Structures; Steel Structures; Hydraulics, Pumping, and Water Power; Water Supply, Sewage, and Irrigation; Dams, Aqueducts, Shafts, and Tunnels; Mathematics and Mechanics; Physics, Meteorology, Weights and Measures; Steam and Electric Engineering; and Highways and Streets. As regards the arrangement of the work, it must be said that it is rather unusual for a book of this kind. A separate section is devoted to each of the above-mentioned headings, and there is a further subdivision of each section into a number of "articles." Thus we have within the compass of a single volume a series of condensed treatises upon the various branches of civil engineering practice. It must be pointed out, however, that a good knowledge of elementary mathematics on the part of the reader is assumed, and that the usual plan of a pocket-book is followed in so far as demonstrations

* Any of the publications reviewed, or referred to as received, will be forwarded by the St. Bride's Press, Ltd., on receipt of published price.

of the formulæ are not included. It might perhaps be thought that the novel arrangement of the work would render it less easy of reference, but this possibility is thoroughly overcome by the provision of a really excellent index. The typography is exceedingly good, illustrations are provided wherever required, and the general get-up of the volume, which contains 1,473 pages, printed on thin paper, is all that could be desired. Each section has been edited by an expert in the particular subject, the whole work having been produced under the personal supervision of the editor-in-chief. We can heartily recommend the book to our readers as a unique work of reference for all civil engineers.

Structural Engineering. By A. W. Brightmore, D.Sc., M.Inst.C.E. Price 15s. 6d. nett. London: Cassell & Co., Limited.

The success which this work has already achieved is such that a second edition has been called for. The aim of the author has been to place before the student, in a consecutive and intelligent manner, the principal ideas and methods which underlie the investigations necessary in the design of structures. That a knowledge of these principles is an essential part of the mental equipment of the civil engineer of to-day will be readily conceded, and Mr. Brightmore is specially qualified to write on this subject both by reason of his academic and engineering distinction, and his experience as a professor at the R.I.E.C. The ground covered comprises a consideration of girder and other members, arches, bridges, retaining walls, foundations, dams and reinforced-concrete design. The chapter on the last-named subject is new to the second edition, for which it has been specially written. The mathematical treatment of the problems involved is clear and intelligible, but it should be mentioned that the author indulges in the use of the calculus. We mention this, not by way of criticism, but in order to emphasise the fact that students cannot follow the scientific investigation of engineering problems satisfactorily unless they attain a certain proficiency in what are known as "higher" mathematics. Mr. Brightmore's book is rather more advanced than the ordinary work on strength of materials, but it covers a wider field than the larger works on particular branches of civil engineering practice. It will thus be seen that it has a definite place in technical literature, and the new edition will no doubt meet with a reception as cordial as that which greeted its predecessor.

Building Stones and Clay Products. By Heinrich Ries, Ph.D. Price 12s. 6d. nett. London: Chapman & Hall, Limited.

The author of this work, which is intended particularly as a handbook for architects, is Professor of Economic Geology in Cornell University, and is able to speak with authority upon the subject with which he deals. A knowledge of the properties and uses of the various building stones and clay products is essential to the architect, inasmuch as these materials are among those which are most ordinarily used in modern building construction, and when used they play a most important part in the composition of the structure. This book, therefore, should be welcomed by architects as a well-written and authoritative work. It should be pointed out, however, that the book is published in America by Messrs. John Wiley & Sons, and considerable space is devoted to the distribution of the different stones in the United States. Dr. Ries has divided his work into two parts corresponding to the two parts of the title. The first two chapters dealing respectively with rock minerals and the properties of building stone) are specially valuable. Subsequent chapters, each dealing with one of the main classifications of building stones, are sufficiently exhaustive. The subject of clay products (including bricks, terra-cotta, tiles, sanitary ware, &c.) is very well treated in the second part of the work. The whole is written in a style which is well up to the high standard expected of American technical books; it is copiously illustrated and well indexed. To those seeking full and accurate information on the subject of building stones or clay ware the book may be cordially recommended.

Foundations and Machinery Fixing. By F. H. Davies, A.M.I.E.E. Price 2s. nett. London: Constable & Co., Limited.

We quite agree with the opinion expressed by the author in his preface to this little book that the subject of engine and machine foundations has hitherto received rather scanty attention from technical writers. There can be no doubt as to its importance, for on the one hand inadequate foundations may lead to injury to the machinery or to nuisance from excessive vibration, while, on the other hand, it is easy to fall into the error of making foundations of unnecessarily extravagant design. Mr. Davies has covered the whole of his subject in ten well-written and practical chapters, of which we may, perhaps, specially mention the one on design, two on construction, and two on vibration. Many useful tables are scattered throughout the work, which is also well illustrated and sufficiently indexed. The author has well fulfilled the aim of his publishers in producing the series of books of which this is one—namely, to provide a practical handbook for practical men.

Spon's Practical Builders' Pocket-book. Edited by C. Young, F.R.I.B.A., and S. M. Brooks, L.R.I.B.A. Price 5s. nett. London: E. & F. N. Spon, Limited.

In this "pocket-book" the practical builder will find a mass of information in regard to the hundred and one knotty points which arise for solution in the course of a week's work. The book is not a price book, but rather an encyclopædia of useful knowledge for the builder. The scope of the work may, perhaps, best be indicated by mentioning at random a few of the headings, some 400 in number, which are shown in the table of contents. Thus we find information as to Asphalt, Concrete Building, Form of Contract, District Surveyors, Gas Lighting, Model By-laws, Quantities, Timber, and a host of other things which the practical builder wants to know. The new edition is a thorough revision of former issues, and has been enlarged by about seventy pages. It should find a place on the bookshelf of every builder's office.

Spon's Architects' and Builders' Pocket Price Book and Diary. Edited by C. Young, F.R.I.B.A., and S. M. Brooks, L.R.I.B.A. Price 2s. 6d. nett. London: E. & F. N. Spon, Limited.

This is the fortieth edition of this well-known pocket price book and diary, and it would be difficult to imagine a price book containing more information in so little space. The price book contains some 390 pages printed on thin paper, the prices being arranged according to trades. A diary is appended showing a week at an opening. An excellent index renders reference to any desired material a very easy matter. We have no hesitation in strongly recommending this book to all who are practically engaged in building work. It will easily go into the breast pocket, and is a valuable remembrancer and diary in one.

The publication of a memoir of the Geological Survey, entitled "Records of London Wells," is announced by the Board of Agriculture and Fisheries. This memoir gives a complete record of all wells known to exist in London. Part I. contains a table of strata penetrated by the wells, together with an account of the various types of wells, a discussion of the quantity and quality of water yielded, with special reference to the diminishing supply, and an account of some bournes. Part II. consists of a catalogue of those wells of which accounts have already been published, with references to the place of publication and a summarised description. Part III. is a descriptive list of wells, of which no account has been previously published, and gives sections of the strata passed through, the yield, with other details. The memoir is accompanied by four text illustrations, two coloured plates showing contours of the underground water surface and contours of the pre-tertiary chalk surface, and one plate illustrating the relation of rainfall to water level and to the flow of the bournes. Copies may be obtained, at the price of 4s. 6d., from any agents for the sale of ordnance survey maps, or through any bookseller, from Mr. T. Fisher Unwin, 1 Adelphi-terrace, London, W.C., who is the wholesale agent for the sale of geological survey memoirs in the United Kingdom (except in the County of London).

The Versatile Sanitary Inspector.—The Towcester Rural District Council determined recently to advertise for an inspector of nuisances, and the terms of the draft advertisement, as read by the clerk, proved somewhat elaborate. Councillor Grant-Ives thereupon intervened with the inquiry if they could not be shortened. He thought the advertisement might as well read: "Applicants must have the eye of a hawk, the nose of a vulture, the agility of an aeroplane, and the wisdom of Solomon."

INSTITUTION OF MUNICIPAL AND COUNTY ENGINEERS.

President—Mr. R. J. THOMAS, M.INST.C.E., County Surveyor, Buckinghamshire.

SOUTHERN DISTRICT MEETING.

District Chairman—Mr. R. READ, ASSOC.M.INST.C.E., Gloucester.

A Southern District meeting is to be held at the Town Hall, Southampton, to-morrow (Saturday).

PROGRAMME.

11.30 a.m.—The members will assemble at the town hall, where they will be received by his Worship the Mayor, Councillor H. Bowyer, M.N.R.

11.45 a.m. Drive to and inspect the Trinidad Lake Asphaltic Paving Company's works, road constructed and in course of construction by them, and ferro-concrete swimming bath. (Drive tickets, 1s. each.)

1.30 p.m.—Lunch at Ward's Restaurant. (Tickets, 2s. 6d. each.)

2.45 p.m.—Return to town hall. Formation of District Executive Committee. Discussion on paper entitled "Ferro-concrete Bath and Trinidad Lake Asphalte Road Construction," by Mr. J. A. Crowther, ASSOC.M.INST.C.E., borough surveyor, Southampton.

F. R. Phipps, A.M.I.C.E., Borough Surveyor, Town Hall, Basingstoke.

R. Read, A.M.I.C.E., City Surveyor, Gloucester.

NORTH-EASTERN DISTRICT.

A meeting of the members of the North-Eastern District will be held in Leeds on Saturday, March 8th.

A meeting of the institution will be held in the North-Eastern District at Newcastle-on-Tyne on May 2nd and 3rd next.

ANNUAL MEETING AND TOWN-PLANNING CONFERENCE.

The Fortieth Annual General Meeting and Conference with delegates from local authorities on Housing and Town Planning will be held at Great Yarmouth on July 23rd, 24th, 25th and 26th next. Those desirous of reading papers at either of these meetings are requested at once to communicate with me.

By order of the Council,

THOMAS COLE, *Secretary.*

11 Victoria-street, S.W.

INSTITUTION OF MUNICIPAL ENGINEERS.

President—Mr. FRANK LATHAM, M.INST.C.E.I., F.S.E., Borough Engineer and Surveyor, Penzance.

NORTHERN DISTRICT.

At the last meeting, held in Newcastle-on-Tyne on the 11th ult., on the motion of Mr. Turnbull (Shildon), seconded by Mr. Mole (Chester-le-Street), it was unanimously resolved—

"That the questions of superannuation and security of tenure of office are of such importance to surveyors that they should form part of the agenda for the meeting of the Executive Council, to be held on February 22nd, and should be kept to the front at all meetings until they become law."

A meeting to discuss the above questions and to frame a resolution to be submitted to the meeting of the council will be held in the Town Hall, Newcastle-on-Tyne, at 3 o'clock on the 22nd instant.

JOHN ROBINSON, *Hon. District Secretary.*

Union Offices, Darlington. February 18, 1913.

COUNCIL MEETINGS.

The following council meetings have been arranged: February 22nd, Newcastle-on-Tyne; March 26th, London; April 30th, London; May 31st, Manchester; June 28th, London; July 30th, London.

GENERAL MEETING.

A visit will be paid to the Building Exhibition at Olympia on April 12th, by kind permission of the promoters. Full particulars will be issued later.

EXAMINATIONS.

The next examination will be held in London and other centres during the week ending May 17th next. Copies of syllabus and forms of application to sit may be obtained from the secretary. Intending entrants are requested to make early application.

B. WYAND, *Secretary.*

39 Victoria street, S.W.

SOCIETY OF ENGINEERS.

At an ordinary meeting to be held on Monday, March 3rd, 1913, at the Institution of Electrical Engineers, Victoria Embankment, W.C. (south end of Savoy-street, near Waterloo Bridge), Mr. John Kennedy (president, 1912) will present the premiums awarded for papers published in the "Journal" during 1912. Mr. Arthur Valon, the president for 1913, will then deliver his presidential address.

The chair will be taken at 7.30 p.m.

A. S. E. ACKERMANN, *Secretary.*

17 Victoria-street, S.W.

APPOINTMENTS VACANT.

Official and similar advertisements received up to 4.30 p.m. on Thursdays will be inserted in the following day's issue, *but those responsible for their despatch are recommended to arrange that they shall reach* THE SURVEYOR *office by noon on* **Wednesdays** *to ensure their inclusion in the weekly list of summaries. Such advertisements may, in cases of emergency, also be telephoned (No. 1350 Holborn), subject to later confirmation by letter.*

WORKING ROAD FOREMAN.—February 21st.—Derbyshire County Council. 30s. per week.—Mr. J. W. Horton, county surveyor, County Offices, St. Mary's-gate, Derby.

CLERK OF WORKS.—February 22nd.—Stroud Urban District Council.—Mr. E. N. Witchell, clerk.

HIGHWAY SURVEYOR.—February 22nd.—Liskeard Rural District Council.—Mr. A. de Castro Glubb, clerk.

JUNIOR SURVEYOR AND DRAUGHTSMAN.—February 24th.—East Sussex County Council. £65 per annum.—Mr. F. J. Wood, county surveyor.

ROAD AND GENERAL FOREMAN.—February 24th.—Corporation of Hartlepool. 35s. per week.—Mr. A. P. Horsley, borough engineer and surveyor.

ARCHITECT.—February 25th.—Corporation of Swansea. £500 per annum.—Mr. H. Lang Coath, town clerk.

ASSISTANT SURVEYOR.—February 26th.—Hendon Rural District Council. £120—£150.—Mr. F. J. Seabrook, clerk.

ROAD FOREMAN.—February 27th.—Merton Urban District Council. £2 per week.—Mr. G. Jerram, surveyor, Council Offices, Kingston-road, Merton.

ASSISTANT EXAMINER OF TECHNICAL ACCOUNTS.—March 1st.—For His Majesty's Office of Works. £150—£300.—The Secretary, H.M. Office of Works, Storey's-gate, London, S.W.

CLERK OF WORKS.—March 1st.—Cardiff Education Committee. £3 10s. per week.—Mr. J. J. Jackson, Education Offices, City Hall.

CLERK OF WORKS.—March 3rd.—Teddington Urban District Council. £4 4s. per week.—Mr. G. H. Salmons, clerk.

TEMPORARY SURVEYORS (two).—March 3rd.—Mr. W. H. S. Dawson, city engineer and surveyor, Town Hall, Bradford.

SURVEYING ASSISTANTS.—March 7th.—Shanghai Municipal Council. 250 tael (a tael is nearly 2s. 9d. in British currency) per mensem.—Messrs. John Pook & Co., agents, 63 Leadenhall-street, London, E.C.

INSPECTOR OF NUISANCES AND SURVEYOR.—March 8th.—Bicester Urban District Council. £130 per annum, with free house.—Mr. Edward Foster Tanner, clerk.

ASSISTANT ENGINEERS.—May 1st.—Indian Public Works and State Railway Departments.—Secretary, Public Works Department, India Office London, S.W.

MUNICIPAL COMPETITIONS OPEN.

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LLANGOLLEN.—February 26th.—Designs for laying out a pleasure garden, for the Llangollen Urban District Council. A prize of 2 guineas is offered.—Mr. J. W. Hughes, surveyor.

RANGOON.—March 1st.—Designs for municipal buildings. Premiums are offered of £300, £200, and £100.—The Clerk to the Rangoon Municipality.

WINNIPEG.—March 1st.—Designs for city hall. Limited to British architects in Canada. Premiums are offered of 5,000 dols., 3,000 dols., and 2,000 dols.—The Clerk.

IPSWICH.—March 31st.—Designs for laying out 26 acres as a working-class suburb on the lines of a modified garden city. Premiums of 50 guineas, 30 guineas, and 20 guineas are offered.—Mr. W. Bantoft, town clerk.

DEVONPORT.—June 14th.—Designs for municipal buildings and a guildhall, for the Corporation of Devonport. Premiums of £350, £150, and £100 are offered. The assessor is Mr. Ernest Newton, A.R.A., F.R.I.B.A.—Mr. R. J. Fittall, town clerk.

MUNICIPAL CONTRACTS OPEN.

Official and similar advertisements received up to 4.30 p.m. on Thursdays will be inserted in the following day's issue, *but those responsible for their despatch are recommended to arrange that they shall reach* The Surveyor *office by noon on* **Wednesdays** *to ensure their insertion in the weekly list of summaries. Such advertisements may, in cases of emergency only, be telephoned (No. 1359 Holborn), subject to later confirmation by letter.*

Buildings.

BRITON FERRY.—February 22nd.—For the erection of sixty-two houses in rows of 9, 10, 11, 12 and 20 houses respectively, for the urban district council.—Mr. H. Alex. Clarke, architect and surveyor.

WEST RIDING.—February 22nd.—For the supply of masonry and steelwork affecting Glasburn Bridge, for the Highways Committee.—Mr. F. G. Carpenter, West Riding surveyor, County Hall, Wakefield.

BIRKENHEAD.—February 22nd.—For the construction of a covered service reservoir and ancillary works, for the corporation.—Mr. James Fearnley, town clerk.

ROCHESTER.—February 24th.—For the erection of engine-house and gas-producer house at waterworks, for the corporation.—Mr. W. Banks, city surveyor.

WARWICK.—February 24th.—For the erection of a boathouse and pavilion, for the corporation.—Mr. B. Campbell town clerk.

EDINBURGH.—February 24th.—For the erection of buildings for the treatment of phthisis, for the corporation.—Mr. T. Hunter, town clerk.

MALDON.—February 24th.—For the erection of a corrugated-iron engine shed, for the corporation.—Mr. F. H. Bright, town clerk.

ESSEX.—February 24th.—For the widening of Hey Bridge at Maldon, for the county council.—Mr. Percy J. Sheldon county surveyor.

RHONDDA.—February 25th.—For the erection of refuse destructor and electrical generating works, for the urban district council.—Mr. W. P. Nicholas, clerk.

SOUTHGATE.—February 25th.—For the extensions and alterations of the municipal offices, for the urban district council.—Mr. W. M. Ellenor, clerk.

MOUNTAIN ASH.—February 25th.—For building additions to the isolation hospital, for the urban district council.—Mr. H. P. Linton, clerk.

LISTOWEL.—February 25th.—For the erection of thirty dwellings, for the urban district council.—Mr. E. J. Gleeson, clerk.

WEXFORD.—February 26th.—For the erection of a reinforced concrete bridge at Deeps, for the county council.—Mr. W. F. Barry, county surveyor.

BRADFORD.—February 26th.—For the erection of an electricity sub-station, for the corporation.—Mr. F. Stevens, town clerk.

GLAMORGAN.—February 26th.—For taking down the present bridge and building a new ferro-concrete bridge at Pontwalby, for the county council.—Mr. W. E. R. Allen, deputy clerk.

GLASGOW.—February 26th.—For the erection of a dispensary, for the corporation.—Mr. J. Lindsay, town clerk.

HORNSEA.—February 27th.—For the erection of a pavilion, for the urban district council.—Mr. W. E. Warburton, surveyor.

YORK.—February 28th.—For additions to the municipal secondary school for girls, for the Education Committee.—Mr. J. H. Mason, secretary.

GLAMORGAN.—February 28th.—For the erection of a police station, for the county council.—Mr. W. E. R. Allen, deputy clerk.

CARDIFF.—March 1st.—For the erection of a technical institute, for the Education Committee.—Director of Education, Education Offices.

HALSTEAD.—March 1st.—For the erection of public baths, for the urban district council.—Mr. R. R. Morton, clerk.

CHELMSFORD.—March 3rd.—For the erection of new offices, for the rural district council.—Mr. Arthur S. Duffield, clerk.

BIGGLESWADE.—March 3rd.—For the erection of a filter-house, for the Water Board.—Mr. A. Chaundler, clerk.

COVENTRY.—March 3rd.—For the erection of 104 workmen's dwellings, for the corporation.—Town Clerk.

WILTS.—March 4th.—For the erection of new county offices and other works, for the county council.—Mr. J. G. Powell, county surveyor, Trowbridge.

FALMOUTH.—March 5th.—For the erection of twenty-two houses, with alternative prices for forty-four, for the corporation.—Borough Engineer.

NEW HUNSTANTON.—March 6th.—For the erection of boiler house, coal store, and other works, for the urban district council.—Mr. J. S. B. Glasier, clerk.

CARNARVON.—April 16th.—For the erection of a police station and court room at Llandudno for the Joint Committee.—Mr. A. Bodvel-Roberts, Clerk of the Peace, Carnarvon.

Iron and Steel.

BRADFORD.—February 22nd.—For the supply of tram rails and steel poles, for the corporation.—Mr. F. Stevens, town clerk.

WIGAN.—February 22nd.—For the supply of 500 galvanised sanitary pans, for the corporation.—Mr. W. H. Tyrer, town clerk.

WREXHAM.—February 24th.—For the supply of iron and cleft fencing, for the rural district council.—Mr. R. C. Roberts, clerk.

WEST HAM.—February 25th.—For the supply and erection of wrought-iron railings and gates, for the corporation.—Town Clerk.

WANTAGE.—February 28th.—For supplying and laying about 550 yds. of 2-in. and 3-in. cast-iron mains, the construction of service reservoir, syphon chamber, and brickwork to adits, for the rural district council.—Mr. E. B. Ormond, clerk.

HAMPSHIRE.—February 28th.—For the supply and erection of unclimbable iron fencing, for the county council.—Mr. H. Barber, clerk, The Castle, Winchester.

SWINDON.—March 1st.—For the supply of iron and wire fencing, for the corporation.—Mr. R. Hilton, town clerk.

MANCHESTER.—March 4th.—For the supply of steel girder tramway rails, for the corporation.—Chairman of the Tramways Committee, 55 Piccadilly.

WOKINGHAM.—March 4th.—For the supply of 1,200 yds. of iron fencing, for the corporation.—Mr. C. W. Marks, borough engineer and surveyor.

CHEPPING WYCOMBE.—March 5th.—For the supply of cast-iron pipes, wrought-iron tubing, and brass fittings, for the corporation.—Mr. T. J. Rushbrooke, borough surveyor and water engineer.

WIRKSWORTH.—March 7th.—For the supply of cast-iron manhole and lamphole covers, cast-iron pipes, ventilating columns, disc valves and other ironwork, and the supply and erection of three revolving sprinklers, for the urban district council.—Mr. J. Gratton, clerk.

BOMBAY.—March 25th.—For supplying and laying about 19 miles of 50-in. diameter steel main, for the municipality.—Mr. H. J. Trivess Smith, hydraulic engineer, Municipal Offices, Bombay.

Roads.

SOUTH SHIELDS.—February 22nd.—For providing and laying *in situ* concrete for footways and back streets, for the corporation.—Mr. J. Moore Hayton, town clerk.

GOSFORTH.—February 22nd.—For the supply of Northumberland whinstone, setts, cubes, chips, granite kerb, cement, cement concrete flags, and steam rolling, for the urban district council.—Mr. R. S. Holmes, clerk.

BELVOIR.—February 22nd.—For the supply of materials, cartage, and manual labour, for the rural district council.—Mr. A. E. Pearson, clerk for highway purposes, 4 St. Peter's-hill, Grantham.

SIBSEY.—February 22nd.—For the supply of broken granite, for the rural district council.—Mr. J. M. Simpson, clerk, 28 Wide-bargate, Boston.

BILLESDON.—February 22nd.—For the supply of broken granite and granite chippings, for the rural district council.—Mr. W. E. Richardson, clerk.

PONTYPRIDD.—February 22nd.—For making up certain streets, for the urban district council.—Mr. J. Colenso Jones, clerk.

BEDFORDSHIRE.—February 22nd.—For the supply of broken granite, slag, flints, gravel, and cartage, for the county council.—Mr. W. W. Marks, clerk, Shire Hall, Bedford.

CLAYPOLE.—February 24th.—For the supply of granite and slag, for the rural district council.—Mr. A. J. Franks, clerk.

ROTHWELL.—February 24th.—For paving 1,300 sup. yds. of paving, for the urban district council.—Mr. W. Dodgson, clerk.

EPSOM.—February 24th.—For the supply of road materials and road watering, for the rural district council.—Mr. Arthur R. Cotton, clerk.

LITTLE HULTON.—February 24th.—For the supply of broken granite, grit setts, granite setts, granite and limestone chippings, and grit kerbs, for the urban district council.—Mr. J. H. Heyes, clerk.

PENARTH.—February 24th.—For the supply of road metalling and gravel, or basalt or gravel, for the urban district council.—Mr. E. I. Evans, surveyor.

PRESTWICH.—February 24th.—For private street works, for the urban district council.—Mr. L. A. Orford, clerk.

WREXHAM.—February 24th.—For the supply of road stones, for the rural district council.—Mr. R. C. Roberts, clerk.

LYTHAM.—February 24th.—For the supply of 32,000 Jarrah wood blocks, for the urban district council.—Mr. Chas. A. Myers, clerk.

UTTOXETER.—February 24th.—For the supply of broken granite, limestone, and cold blast slag, for the rural district council.—Mr. F. S. Hawthorn, clerk.

SEATON DELAVAL.—February 25th.—For the supply of tarred whinstone, tarred slag, hire of steam roller, and team labour, for the urban district council.—Mr. Anthony Dorin, surveyor.

EPSOM.—February 25th.—For making-up Woodcote Park-road, for the urban district council.—Mr. E. G. Wilson, clerk.

WEST HARTLEPOOL.—February 25th.—For works of road extension, for the corporation.—Mr. Nelson F. Dennis, borough engineer and surveyor.

SMALLBURGH.—February 25th.—For the supply of flints, granite, marl, beach stones, clay, and team labour, for the rural district council.—Mr. Fairfax Davies, clerk.

WOODFORD.—February 25th.—For the supply of small granite, chippings, tar, pitch, and creosote oil, for the urban district council.—Mr. W. Farrington, surveyor, Woodford Green.

MALLING.—February 25th.—For the supply of quartzite, basalt, or granite, for the rural district council.—Mr. F. J. Allison, clerk.

GOSFORTH.—February 25th.—For road improvement works, for the urban district council.—Mr. R. Sheriton Holmes.

FOLESHILL.—February 25th.—For the supply of granite, for the rural district council.—The Surveyor.

NEW HUNSTANTON.—February 25th.—For making up certain streets, for the urban district council.—Mr. J. S. B. Glasier, clerk.

WILLESDEN. — February 25th. — For carrying out asphalt paving works, for the urban district council.—Mr. O. C. Robson, engineer, Municipal Offices, Kilburn, N.W.

MILTON.—February 25th.—For the supply of flints, gravel, broken granite, Kentish rag, and horse labour, for the rural district council.—Mr. E. C. Pearcy, district surveyor, 45 High-street, Sittingbourne.

SHOEBURYNESS.—February 25th.—For making up a certain road, for the urban district council.—Mr. F. Gregson, clerk, 46 Alexandra-street, Southend.

ROCHDALE.—February 26th. — For making up certain streets, for the corporation.—Mr. W. H. Hickson, town clerk.

MANCHESTER.—February 26th.—For works of widening and improvement, for the corporation.—Mr. Thomas Hudson, town clerk.

SWINTON.—February 26th.—For the supply of granite setts, macadam, grit setts, flags, kerbs, and limestone chippings, for the urban district council.—Mr. H. Entwisle, surveyor.

SALISBURY.—February 26th.—For the supply of stones and gravel, for the rural district council.—Mr. W. H. Jackson, clerk.

BATLEY.—February 26th.—For works of road improvement, for the corporation.—Mr. J. H. Craik, town clerk.

HULL.—February 26th.—For the supply of 8,000 tons of stone for macadamising, for the corporation.—Mr. A. E. White, city engineer.

LANARK.—February 26th.—For the supply of road metal for the Lower Ward.—Mr. J. A. McCallum, district clerk, 15 West George-street, Glasgow.

YARMOUTH.—February 26th.—For the supply of road materials, for the corporation.—Mr. J. W. Cockrill, borough surveyor.

HAMMERSMITH.—February 26th.—For re-paving the margins of certain carriageways, for the borough council.—Mr. L. Gordon, town clerk.

HAMPTON.—February 27th.—For the supply of hand-broken granite, chippings, Kentish brown flints, and Derbyshire limestone marble tar-paving material, for the urban district council.—Mr. S. H. Chambers, surveyor.

FRIERN BARNET.—February 27th.—For the widening of Colney Hatch-lane, for the urban district council.—Mr. Edwin Goodship, clerk.

STAINES.—February 28th.—For the supply of broken road stone and Tarvia compound, for the rural district council.—Mr. G. W. Manning, surveyor.

RHONDDA.—February 28th.—For making up certain roads for the urban district council.—Mr. W. J. Jones, engineer and surveyor.

WESTMINSTER. — February 28th. — For paving works, for the borough council.—Town Clerk.

BELPER.—March 1st.—For the supply of highway materials, for the rural district council.—Mr. R. C. Cordon, engineer and surveyor, Duffield, near Derby.

EAST RIDING.—March 1st.—For the supply of 7,000 tons of stone for macadamising the main roads, for the county council.—Clerk, County Hall, Beverley.

EAST RETFORD.—March 1st.—For the supply of broken granite and slag, for the rural district council.—Mr. C. B. Smith, clerk.

RICCALL.—March 1st.—For the supply of road materials, for the rural district council.—Mr. J. Townend, clerk, 1 Abbey-place, Selby.

REPTON.—March 1st.—For the supply of broken granite, limestone, slag, broken boulders, and local gravel, for the rural district council.—Mr. T. R. Sidgwick, surveyor, Willington, Derby.

GLANFORD BRIGG.—March 1st.—For making up certain streets and back roads, for the rural district council.—Mr. Frank C. Hett, clerk.

TOTNES.—March 1st.—For the repair of main and district roads, for the rural district council.—Mr. F. K. Windeatt, clerk, High-street, Totnes.

NORMANTON.—March 2nd.—For carrying out private street works, for the urban district council.—Mr. A. Hartley.

CHERTSEY.—March 3rd.—For the supply of Guernsey and Leicester granite, Hungry Hill flints, Farnham shingle and gravel, Mendip stone, chalk and macadam, for the rural district council.—Mr. Herbert Benney, surveyor.

SAWBRIDGEWORTH.—March 3rd.—For street

watering, for the urban district council.—Mr. W. Morris, clerk.

WEST LANCASHIRE.—March 3rd.—For the supply of hand and machine broken granite, tar-macadam, and tar mixtures, for the rural district council.—Mr. R. Rosbotham, chief surveyor, Town End, Ormskirk.

STAFFORD.—March 3rd.—For the supply of granite and slag, for the rural district council.—Mr. C. B. Wilton, clerk.

DROXFORD.—March 3rd.—For the supply and delivery of 2,300 tons of granite or hard stone, for the rural district council.—Mr. H. Godfrey Pearson, clerk.

WANDSWORTH.—March 3rd.—For the making up and paving of Birchwood-road, Streatham, for the borough council.—Mr. D. A. Nicholl, town clerk.

BLYTH AND CUCKNEY.—March 3rd.—For the supply of the best broken slag, for the rural district council.—Mr. F. Hopkinson, surveyor, 66 Bridge-street, Worksop.

EAST GRINSTEAD.—March 3rd.—For the supply of road materials, for the rural district council.—Mr. F. S. White, clerk.

GLASGOW.—March 3rd.—For the supply of four 10-ton compound steam rollers and two Tyne scarifiers, for the corporation.—Mr. J. Lindsay, town clerk.

LICHFIELD.—March 3rd.—For the supply of granite, slag, chippings, carting, tools, and oil, for the rural district council.—Mr. Thomas Moseley, clerk.

DROXFORD.—March 3rd.—For the hire of steam rollers and scarifiers, for the rural district council.—Mr. H. Godfrey Pearson, clerk.

WALTHAM.—March 3rd.—For the supply of granite, flints, gravel, hoggin, ballast, sand, tar-macadam and tar, for the urban district council.—Mr. F. C. E. Jessopp, clerk, Waltham Abbey.

HIPPERHOLME.—March 3rd.—For the supply of macadam, for the urban district council.—Mr. G. Wharton Thompson, engineer and surveyor.

FINCHLEY.—March 4th.—For the supply and delivery of grit for tar-painting, for the urban district council.—Mr. E. H. Lister, clerk.

PORTLAND.—March 4th.—For the supply of broken granite or basalt, for the urban district council.—Mr. R. S. Henshaw, engineer and surveyor.

POTTERSPURY.—March 4th.—For the supply of broken and unbroken granite and slag, for the rural district council.—Mr. W. R. Parrott, clerk, High-street, Stony Stratford.

DEVON.—March 5th.—For works of improvement on the main roads, for the county council.—Mr. F. Bailey, clerk, The Castle, Exeter.

BISHOP'S STORTFORD.—March 6th.—For the supply of 10,000 gallons of tar, for the urban district council.—Mr. C. J. Hancox, clerk.

WETHERBY.—March 6th.—For the supply of broken whinstone, limestone, granite, dross, tar-macadam, and cob limestone, for the rural district council.—Mr. E. H. Coates, clerk.

CAMBRIDGESHIRE.—March 7th.—For hire of steam rollers, for the county council.—Mr. J. E. Blackwall, county surveyor.

CHESTERTON.—March 7th.—For the supply of 5,000 tons of broken granite and 2,000 tons of slag, for the rural district council.—Mr. John F. Symonds, clerk.

KIVETON PARK.—March 8th.—For the supply of slag, broken granite, and tar-macadam, for the rural district council.—Mr. F. Hewitt, surveyor.

NEWARK.—March 8th.—For the supply of granite, slag and tar-macadam, for the rural district council.—Mr. R. Oakden, junr., 27 Winchel-sea-avenue, Newark.

DRIFFIELD.—March 8th.—For the supply of 7,000 tons of whinstone, 2,500 tons of broken slag, 600 tons of sea cobbles, 300 tons of sea gravel, and 150 tons of tarred chippings for the rural district council.—Mr. T. Casson Beaumont, surveyor.

CLOWNE.—March 8th.—For the supply of broken slag and granite, for the rural district council.—Mr. J. T. Pears, surveyor.

KING'S LYNN.—March 10th.—For the supply of road material, for the corporation.—Mr. Alfred J. Smith, borough surveyor.

EPSOM.—March 11th.—For laying 7,300 sq. yds. of wood paving, and 13,000 sq. yds. of tar-macadam, for the urban district council.—Mr. E. G. Wilson, clerk.

MAIDSTONE.—March 11th.—For the supply of Guernsey granite, Cornish elvan or stone of a similar nature, Cherbourg quartzite, tarred ragstone concrete, Portland cement and ballast, for the urban district council.—Mr. S. Lance Monckton, town clerk.

PONTEFRACT.—March 12th.—For the supply of road materials, for the rural district council.—Mr. J. D. Smith, clerk.

OSWESTRY.—March 14th.—For keeping in repair the district roads, for the rural district council.—Mr. C. H. Bull, clerk.

DARTFORD.—March 15th.—For the supply of broken hard stone of one of the following kinds: Rhenish basalt, Guernsey granite, Clee Hill basalt, Leicester granites, Cornish granites, Penmaenmawr or other North Wales granite, quartzite, or Quenast, for the rural district council.—Mr. E. J. Hobbs, clerk.

SOUTHGATE.—March 25th.—For works of street improvement, for the urban district council.—Mr. W. M. Ellenor, clerk.

TANGIER.—April 10th.—For the construction of a sewer and a road, for the Special Committee of Public Works.—Commercial Intelligence Branch of the Board of Trade, 73 Basinghall-street, E.C.

YEADON.—No date.—For the supply of various road materials, for the urban district council.—Mr. N. Houlden, surveyor

Sanitary.

STAFFORD.—February 22nd.—For the construction of a sewer, for the corporation.—Mr. R. Battle, town clerk.

WALTON-LE-DALE.—February 22nd.—For cleansing pails and removing nightsoil, for the urban district council.—Mr. W. S. Woodcock, clerk.

BROMLEY.—February 22nd.—For the removal of refuse, for the rural district council.—Mr. E. Haslehurst, clerk.

RUGBY.—February 22nd.—For the removal of house refuse, for the rural district council.—Mr. J. W. Pendred, clerk.

ERPINGHAM.—February 22nd.—For sewer extension, for the rural district council.—Mr. J. T. Willis, deputy clerk, Cromer-road, Sheringham.

LEYTON.—February 25th.—For the removal of house refuse, and the construction of a sewer, for the urban district council.—Mr. E. H. Essex, surveyor.

EPSOM.—February 25th.—For the removal of house refuse, and the supply of horses and men, for the rural district council.—Mr. W. T. Wooldridge, surveyor.

FOLESHILL.—February 25th.—For scavenging work, for the rural district council.—Mr. A. P. Oswin, clerk.

WILLESDEN.—February 25th.—For the erection of an underground and aboveground convenience, for the urban district council.—Mr. O. C. Robson, engineer.

PORTSMOUTH.—February 26th.—For laying storm drains with manholes, for the corporation.—Mr. G. Hammond Etherton.

MACCLESFIELD.—February 26th.—For sewering work in two roads, for the corporation.—Mr. S. C. Baggott, deputy borough engineer.

SOUTH SHIELDS.—February 26th.—For work of sewerage, for the corporation.—Mr. L. Roseveare, borough engineer.

STEYNING WEST.—February 26th.—For the removal of house refuse, for the rural district council.—Mr. A. Flowers, clerk, Shoreham.

LIVERSEDGE.—February 26th.—For carrying out sewage disposal works, for the urban district council.—Mr. A. Rothera, engineer and surveyor.

STROUD.—February 27th.—For work of drainage, for the urban district council.—Mr. G. P. Milnes, engineer.

NEATH.—February 28th.—For laying sewers, constructing manholes and connecting to main, for the rural district council.—Messrs. Cuthbertson & Powell, clerks.

PORT SAID.—March 1st.—For the construction of drainage works, for the municipality.—Mr. A. L. Webb, C.M.G., Queen Anne's Chambers, Broadway, Westminster.

SPRINGHEAD.—March 1st.—For the construction of sewage disposal works, for the urban district council.—Mr. R. Kilner, 25 Queen-street, Oldham.

GLASGOW.—March 1st.—For the construction of a public convenience, for the corporation.—Mr. J. Lindsay, town clerk.

ROTHERHAM.—March 1st.—For the removal of nightsoil and other refuse, for the rural district council.—Mr. B. Hey, surveyor.

BOLSOVER.—March 1st.—For work of scavenging, for the urban district council.—Mr. H. J. Watson, clerk, Gluman-gate, Chesterfield.

AUCKLAND.—March 3rd.—For the construction of sewage disposal works, and laying earthenware pipe sewers with manholes, for the rural district council.—Mr. S. Adams, clerk.

CROYDON.—March 4th.—For scavenging and street watering, for the rural district council.—Mr. E. J. Gowen, clerk, Katherine-street, Croydon.

FAREHAM.—March 4th.—For the removal of house refuse and street scrapings, for the urban district council.—Mr. Walter Butler, surveyor.

CROYDON.—March 6th.—For work of scavenging, for the rural district council.—Mr. E. J. Gowen, clerk, Katherine-street, Croydon.

BISHOP'S STORTFORD.—March 6th.—For the construction of a public convenience, for the urban district council.—Mr. R. S. Scott, engineer and surveyor.

DUBLIN.—March 6th.—For the construction of sewers, culverts and pumping mains, for the corporation.—Mr. J. S. Alford, 9 Victoria-street, Westminster.

WIRKSWORTH.—March 7th.—For the construction of about 12,000 lin. yds. of 15, 12, 10, 8 and 6 in. earthenware pipe sewers with manholes, settling tanks, storm-water tanks, filters, sludge beds, road making, and other works, for the urban district council.—Mr. J. Gratton, clerk.

WIRKSWORTH.—March 7th.—For the construction of sewers, manholes, tanks, filters, and sludge beds, for the urban district council.—Mr. H. A. Johnson, engineer, 15 The Exchange, Bradford.

WORSLEY.—March 8th.—For the supply of materials required for sewering a portion of the district, for the urban district council.—Mr. J. Pethean Monks, clerk.

CREWKERNE.—March 11th.—For the construction of storm overflows, screening chamber, detritus tanks, channels, and mixing race, precipitation and sedimentation tanks, circular bacterial filters, storm-water tank, and sludge lagoon, for the urban district council.—Mr. J. W. Munden, clerk.

Stores.

BELFAST.—February 24th.—For the supply of earthenware sewer pipes, timber, slates, hardwood, iron castings, plumbers' nails, iron, steel, paints, oils, glazing, mill furnishings, shovels, spades, graipes, buckets, scavenging brushes, glazed bricks, artificial flags, lime, pitch, felt, tar, sea sand, sea gravel, Lough Neagh sand, cement uniform clothing and hats, for the corporation.—Mr. R. Meyer, town clerk.

CAMBRIDGE.—February 25th.—For the supply of timber, stoneware pipes, Portland cement, gravel, sand, brooms, paint, haulage, and horses, for the corporation.—Mr. J. E. L. Whitehead, town clerk.

BELFAST.—February 25th.—For the supply of Portland cement and mill furnishings, for the corporation.—Mr. R. Meyer, town clerk.

MILTON.—February 25th.—For the supply of surface-picked flints, pit flints, fine gravel, broken granite, Kentish rag and horse labour, for the rural district council.—Mr. E. Cecil Harris, clerk.

STOKE NEWINGTON.—February 25th. For the supply of broken granite, flints, gravel, hoggin, hardcore, ballast and sand, and removal of old tinware from the refuse destructor, for the borough council. Mr. George Webb, town clerk.

MANSFIELD.—February 26th.—For the supply of granite, slag, tar-macadam, natural flags, kerbing, channelling and concrete flags, Portland cement, stoneware pipes, junctions, bends, timber, sewer ironwork and castings, coal, ironmongery and general stores, paints, oils, brooms, brushes, disinfectants, and harness, for the corporation.—Mr. J. Harrop White, town clerk.

SOUTHEND-ON-SEA.—February 26th.—For the supply of stoneware pipes, bends, flints, bricks, gravel, timber, ironmongery, paints, cement, team labour, forage, tar paving, tar-macadam, iron castings, granite kerb, channel, broken Guernsey granite, broken granite, pitch, harness, brooms, iron and steel, disinfectants, for the corporation.—Mr. H. J. Worwood, town clerk.

WINCHESTER.—February 27th.—For the supply of broken granite, chippings, bass brooms, Portland cement, coal, coke, stoneware drain pipes, and concrete paving slabs, for the corporation.—Mr. Thomas Holt, town clerk.

AUCKLAND.—February 27th.—For the supply of road, sanitary and general stores, for the rural district council.—Mr. Sam Adams, clerk.

HAMPTON.—February 27th.—For the supply of hand-broken granite, granite chippings, broken Kentish brown flints, Derbyshire limestone, marble, tar-paving material, forage, coal, coke, and bass brooms, for the urban district council.—Mr. Sydney H. Chambers, surveyor.

STOKE-ON-TRENT.—February 27th.—For the supply of Portland cement, blue paving bricks, common bricks, sanitary pipes, gullies, kerbs, setts, macadam, chippings, pitch, oil, cast-iron work, picks, shovels, general ironware, paints, oils, soap, soda, brooms, brushes, bath towels, ironmongery, disinfectants, and drawing office requisites, for the corporation.—Mr. E. B. Sharpley, town clerk.

SOUTH SHIELDS.—March 1st.—For the supply of Northumberland whinstone, Fifeshire whinstone, Aberdeen and Norwegian granite, slag, granite chippings, Caithness flags, Portland cement, cement concrete flags, cast ironwork, shovels, scavenger brooms and machine brooms, coal, coke, disinfectants, leather hose, sewer boots, jackets, sanitary pipes, paints, paint oils, glass, timber, iron, horseshoe nails, cart axles, springs, tar, pitch, oils, and general stores, for the corporation.—Mr. J. Moore Hayton, town clerk.

MIDDLETON.—March 1st.—For the supply of macadam, flags, setts (flag rock), kerbs, pipes, tipler closets, brushes, lime, alumino-ferric, press cloths, castings, pitch and oil, for the corporation.—Mr. Frederick Entwistle, town clerk.

EALING.—March 3rd.—For the supply of limes, pipes, cement, ironmongery, iron castings, paints, granite, gravel, disinfectants, refined tar, wood-paving repairs and slab laying, for the corporation.—Mr. Geo. E. Brydges, town clerk.

DERBY.—March 3rd.—For the supply of bar iron, bricks, brushes, castings, cement, lime, disinfectants, earthenware, freestones, gritstones, granite, hardware, ironmongery, glass, limestone, paints, oils, pitch, tar, slag, soap, soda, and timber, for the corporation.—Mr. John Ward, borough surveyor.

GUILDFORD.—March 5th.—For the supply of broken granite, chippings, granite setts, Durax cubes, brooms, brushes, cast-iron pipes, flints, galvanised steam tubes, disinfectants, horse hire, cartage, iron castings, ironmongery, oils, pitch, tar, Portland cement, lias lime, stoneware pipes, and shoeing, for the corporation.—Mr. A. D. Jenkins, town clerk.

PONTYPRIDD.—March 5th.—For the supply of road materials and other goods for the surveyor's department, for the urban district council.—Mr. J. Colenso Jones, clerk.

SUTTON COLDFIELD.—March 8th.—For the supply of granite macadam and kerb, limestone macadam and setts, gravel and broken pebble stones, Yorkshire or pennant kerb, Rowley setts, earthenware pipes, cement, lime, iron castings, iron, steel, timber, hardware, oils, paints, and bass brooms, for the corporation.—Mr. W. A. H. Clarry, borough engineer and surveyor.

BARNES.—March 10th.—For the supply of broken Guernsey or Alderney granite, broken pit flints and Thames ballast, hire of horses and carts, disinfectants, ironmongery, Portland cement, forage, litter, granite kerb, channel, paving slabs, oils, paints, and stoneware pipes, for the urban district council.—Mr. G. Bruce Tomes, engineer and surveyor.

NEWARK.—March 10th.—For the supply of 1,900 tons of slag and 150 tons of tar-macadam, for the rural district council.—Mr. A. J. Franks, clerk.

TWICKENHAM.—March 12th.—For the supply of broken granite, ballast, shingle, flints, gravel, granite kerb, channel, quadrants, granite cubes, setts, Portland cement, fodder, forage, oils, iron castings, street gullies, drain pipes, tar slag macadam, and Kentish rag tar-paving, for the urban district council.—Mr. H. Jason Saunders, clerk.

DARTFORD.—March 15th.—For the supply of broken hard stone of the best description, 6,790 cubic yards of unbroken flints, 1,020 cubic yards of broken Kentish ragstone or Sevenoaks rock, 500 yds. of gravel, labour, haulage, tar-painting and steam rolling, for the rural district council.—Mr. E. J. Hobbs, clerk.

TENDERS FOR MUNICIPAL WORKS OR SUPPLIES.

The Editor invites the co-operation of SURVEYOR *readers with a view to making the information given under this head as complete and accurate as possible.*

* Accepted. † Recommended for acceptance.

ALSAGER.—For the erection and completion of sewage disposal works, to include the building of all tanks, beds, and the work in connection therewith, and the supplying and laying of about 400 yds. of 9-in. stoneware pipe sewer, for the urban district council. Mr. H. V. Lynam, surveyor:—

W. Pullock, Stoke-on-Trent	£4,720
H. Wardle, Longport	4,502
Grant & Son, Burslem	4,440
Sanders & Torrance, Stoke-on-Trent	4,372
Clayton Brothers, Stockport	4,070
Taylor & Sons, Basford	3,764
F. Barke & Son, Stoke-on-Trent*	3,737

EASINGWOLD.—Accepted for the supply of whinstone and slag, for the rural district council.—Mr. G. Thompson, surveyor:—

WHINSTONE.

Summerson & Co., Cockfield.
Ord & Maddison, Darlington.
Markhouse & Peart, Cowshill.
G. Hodsman, York.
Pearson, Middlesbrough.

ANNEALED SLAG.

G. Hodsman York.
W. Clark, Darlington.
W. H. Musgrave, Middlesbrough.

FURNACE SLAG.

W. Clark, Darlington.
W. Chapman, Darlington.
Slag & Tar Company, Darlington.
J. N. Smith, Leeds.
Hanson, Brown & Co., Middlesbrough.
G. Hodsman, York.

TARRED SLAG.

J. N. Smith, Leeds.
W. Clark, Darlington.
W. H. Musgrave, Middlesbrough.
G. Hodsman, York.
Shackleton, Goole.

GOSPORT AND ALVERSTOKE.—Accepted for providing and laying an extension of the sewage outfall, Stokes Bay, in 36-in. cast-iron pipes, for the urban district council.—H. Frost, engineer:—
T. Wilkinson & Co., Bournemouth, £3,6.3.

HOLYHEAD.—For the construction of sewers, for the urban district council.—Mr. A. Asquith, engineer, Holyhead:—

J. & R. Owen, Holyhead	£1,293
R. & W. Williams, Holyhead*	901
W. H. Owen, Liverpool	815
T. Harris, Bootle	804

HOVE.—For the removal of house refuse and other works, for the corporation.—Mr. H. H. Scott, borough surveyor:—
Hudsons, Limited, Brighton, £1,270.
Building Boundary Walling, Portland Recreation Ground.—J. Parsons & Son, Hove, £148.
Ironmongery for 2 years.—Pryke & Palmer, London, 26¼ per cent off schedule prices.
Joiners' Ironmongery and Tools.—Pryke & Palmer, 31½ per cent off schedule prices.
Paints, Varnishes, &c.—Pryke & Palmer, 29 per cent off schedule prices.
Gas and Water Pipes and Fittings.—R. Wilson, Drew and Clydesdale, London, 15 per cent off schedule prices.
Portland Cement.—J. Bayford & Son, Ltd., Poplar, £1 13s. 5d. per ton.
Sale of Old Tramway Rails (about 140 tons).—A. W. Ward, Ltd., London, £2 17s. 8d. per ton.
Sale of Old Cast-iron Plates, Tie Rods, Bolts and Nuts (about 8 tons).—£2 15s. 4d. per ton.
Folding Garden Chairs (700).—Brown & Woods, Ipswich, 4s. per chair.

MALDEN AND COOMBE.—For works of making up and paving with artificial stone, for the urban district council.—Mr. R. H. Jeffes, surveyor:
Contract No. 1.—J. Mowlem & Co., Limited, Westminster, £2,589 (4 tenders received).
Contract No. 2.—J. Wainwright & Co., Limited, Shepton Mallet, £615 (8 tenders received).

PADDINGTON.—The following tenders have been accepted by the borough council:—
Scavenging, slopping, washing and gritting the Queen's Park district for one year.—H. Boyer, £1,079.
Street watering the Queen's Park district.—J. Latter, £325.
Removing and disposing of house refuse in Queen's Park district.—G. E. Clarke, £727, plus 5s. for special house collections.

PRESTWICH.—For the supply of granite setts, for the urban district council:—
Ord & Maddison, Limited, Darlington, 1,000 tons granite setts.

RAWTENSTALL.—Accepted for the erection of cottages, for the corporation.—Mr. J. J. Hutson, borough surveyor:—
W. Ashworth, Waterfoot.

ROCHDALE.—For levelling, paving, metalling and flagging, for the corporation:
Crowther-street.—J. B. Poole, Rochdale.
Cement Roads, Littleda'e and Hallwell Streets.—S. Kearsley, Leigh.

SEDGEFIELD.—Accepted for scavenging the townships of Chilton, Cornforth, and Ferryhill, for the rural district council:—

J. Robinson, Rushyford	£341
W. Hogarth, Ferryhill	276
T. Lainge, Cornforth	170
G. W. Mowston, Chilton	150
T. Moody, Chilton	140
H. Williams, Cornforth	132
J. Wearmouth, Ferryhill	130
H. Williams, Cornforth	109
T. Talbot, Cornforth	95
J. Newton, Cornforth	66
J. Newton, Cornforth	59
C. Wilson, Cornforth	41

STOKESLEY.—Accepted for the supply of whinstone, limestone, and tarred slag and whinstone, for the rural district council:

	Per ton. Hand broken.	Machine broken.	Unbroken.
WHINSTONE.	s. d.	s. d.	s. d.
Gribdale Mining Company, Middlesbrough	7 9	6 9	5 3
Cradock, Agnew & Co., Eaglescliffe	8 6	7 6	6 0
J. Pearson, Limited, Stainton	8 0	7 0	6 0
LIMESTONE.			
Ord & Maddison, Darlington	—	6 3	5 6
SLAG.	2 in.	1 in.	Fine.
Tees Scoriæ Brick Company, Middlesbrough	4 7	4 7	5 4

Railway carriage extra in each case.

MEETINGS.

Secretaries and others will oblige by sending early notice of dates of forthcoming meetings.

FEBRUARY.

21. Chadwick Trust Lecture: Mr. H. Percy Boulnois, M.INST.C.E., on "The Hygiene of the Home," Royal Sanitary Institute, 90 Buckingham Palace-road, S.W., 8.15 p.m.
22. Institution of Municipal and County Engineers: Meeting at Southampton.
22.—Institution of Municipal Engineers: Meeting at Newcastle-on-Tyne.
24.—Surveyors' Institution: Annual Dinner, Whitehall Rooms, 7 p.m.
27. Institution of Electrical Engineers: Fourth Kelvin Lecture; Dr. R. T. Glazebrook, C.B., F.R.S., on "The Ohm, the Ampère, the Volt; A Memory of Fifty Years, 1862-1912." 8 p.m.

MARCH.

1.—Institution of Civil Engineers: Students' Visit to Royal Albert Dock Extension (South).
3.—Society of Engineers: Presidential Address.
8.—Institution of Municipal and County Engineers: North Eastern District Meeting at Leeds.

APRIL.

23.—Royal Sanitary Institute: Ordinary General Meeting. 4 p.m.

MAY.

14-18.—Royal Institute of Public Health: Annual Congress in Paris.

APPOINTMENTS OPEN.

THE COMMISSIONERS OF HIS MAJESTY'S WORKS AND PUBLIC BUILDINGS give notice that seven vacancies will occur shortly in the Staff of Assistant Examiners of Technical Accounts in His Majesty's Office of Works. Application for nomination to compete at the Examination to be held by the Civil Service Commissioners for these posts must be made in the first instance by letter addressed to the Secretary, H.M. Office of Works, Storey's-gate, London, S.W., before the 1st March next.

The salary is £150 per annum, rising by annual increments of £10 to £300 per annum.

Candidates must be between the ages of 23 and 30, and will be required to show what technical education and practical training they have undergone to qualify themselves for a situation of this nature.

They must forward testimonials, and show (1) that they have served for at least five years in a public or private office under an Architect, Builder or Surveyor, and (2) that the works on which they have been engaged during those years were such as to afford them the opportunity of gaining a satisfactory knowledge of their profession.

If such evidence should prove satisfactory the Commissioners will consider whether they should receive nomination to compete at the examination, full particulars of which can be obtained on application.

SHANGHAI MUNICIPAL COUNCIL.

PUBLIC WORKS DEPARTMENT.

TWO SURVEYING ASSISTANTS.

Two thoroughly qualified Surveying Assistants, with experience in Town Surveys and Cadastral Work, are required in the Public Works Department.

Candidates should be about 25 years of age and unmarried. Salary, taels 250 per mensem, without allowances, under a three years' agreement, with first-class passage from home, half pay on voyage, and medical attendance. There is an excellent Superannuation Scheme.

The value of the tael at the present rate of exchange is about 2s. 9d., but it is liable to fluctuation.

Particulars of the appointment may be obtained of the Council's Agents, and applications, in candidate's own handwriting, stating qualifications, experience, &c., accompanied by copies of not more than three recent testimonials, and endorsed "Surveying Assistants," should be forwarded on or before 7th March to Messrs. John Pook & Co., Agents for the Shanghai Municipal Council, 63 Leadenhall-street, London, E.C.

February, 1913.

THE RURAL DISTRICT COUNCIL OF HENDON.

ASSISTANT SURVEYOR.

The above Council invite applications from persons between the ages of 25 and 35 years capable of filling the above Office.

The salary will be £120, rising £10 annually to a maximum of £150 per annum, and the person appointed will be required to devote the whole of his time to the duties.

Candidates must possess a good knowledge of building construction and materials, sewering and drainage works, and be capable to read plans and make sketches and reports, and also have had experience in making up of streets under the Private Street Works Act, 1892.

The person appointed will be required to give security through some approved Guarantee Society in the sum of £100.

Applications to be made on Forms, which can be obtained from the undersigned on receipt of a stamped addressed foolscap envelope, and the same must be returned not later than 10 a.m. on Wednesday, the 26th instant.

Canvassing in any form will be a disqualification.

(By order)

F. J. SEABROOK,
Clerk to the Council.

Union Offices,
Edgware.
February 13, 1913.

PUPIL.—The Borough and Waterworks Engineer of Leamington (A.M.I.C.E.) has a vacancy in his office for a Pupil.—Address, Town Hall.

WANTED, Two Surveyors (Temporary Employment), who must have had experience in Town Surveying, Theodolite practice, and detail work. Applications, stating age, experience, salary required, and accompanied by not more than three testimonials, to be addressed to Mr. W. H. S. Dawson, City Engineer and Surveyor, Town Hall, Bradford, not later than 3rd March next.

BICESTER URBAN DISTRICT COUNCIL.

APPOINTMENT OF INSPECTOR OF NUISANCES, SURVEYOR AND MARKET SUPERINTENDENT.

The above council invite applications from qualified persons, between the ages of 25 and 40 years, willing to undertake the joint duties of Inspector of Nuisances, Surveyor and Market Superintendent for the above District, which comprises an area of 3,612 acres, and a population in 1911 of 3,385.

The combined annual salary will be £130, together with House and Garden (valued at £15 per annum), rent and rates free. The appointment of Inspector of Nuisances will be from the 6th May, 1913, for one year, subject to the approval of the Local Government Board, with reappointment at the end of that period if the duties are carried out to the satisfaction of the Council.

The person appointed must hold the Certificate of the Royal Sanitary Institute, and must be a competent Surveyor. He will be required to perform all the duties prescribed under the Public Health and Housing and Town Planning Acts, and the various Acts incorporated therewith, the Factory and Workshops Acts, the Dairies, Cowsheds and Milkshops Order, and the Orders of the Local Government Board, to make all necessary inquiries and reports with regard to Petroleum and other Licences of a like character, and generally to perform all other duties appertaining to the offices of an Inspector of Nuisances and Sanitary Surveyor. He will also be required to discharge the duties laid down in the Council's By-laws as to Plans, New Buildings, Nuisances, Sewers, Drains and other matters therein mentioned, and must be competent to prepare Plans, Estimates, and Specifications in respect of Private Streets and other works, and possess a knowledge of Road Construction and Repairs.

He will also be required to supervise the Council's works of Water Supply and Sewage Disposal, and act as Market Superintendent and Toll Collector on the fortnightly Cattle Market days.

The appointment as Surveyor and Market Superintendent will be determinable by one month's notice on either side.

The person appointed will be required to devote the whole of his time to the duties of the offices, and to give security in the sum of £100 in an approved Guarantee Society.

Applications, in candidate's own handwriting, stating age, present and previous occupations, accompanied by copies of not more than three recent testimonials, must reach me on or before noon on Saturday, the 8th day of March, 1913, endorsed "Surveyorship and Inspectorship."

Canvassing will be a disqualification.

Selected Candidates will have notice of the date on which the appointment will be made, and will be required to attend before the Council.

Dated this 17th day of February, 1913.

EDWARD FOSTER TANNER,
Clerk to the Council.

Bicester,
Oxon.

COMPETITIONS OPEN.

COUNTY BOROUGH OF DEVONPORT.

PROPOSED MUNICIPAL BUILDINGS AND GUILDHALL.

The Corporation invite complete designs from Architects for Municipal Buildings and a Guildhall.

The conditions of the competition and a schedule of the requirements, with a plan of the site, may be obtained upon application to the undersigned, upon payment of a deposit of £2 2s., which will be returned to all persons who submit a *bonâ-fide* design.

A premium of £350 is offered for the design which may be placed first in order of merit, and further premiums of £150 and £100 respectively for those which are placed second and third in order of merit.

In the selection of the designs the Corporation will be advised by Mr. Ernest Newton, A.R.A., F.R.I.B.A., as Professional Assessor, whose decision will govern the award of the premiums, and be final and binding in all stages of the competition.

Sealed Designs (in strict accordance with the conditions and instructions), endorsed "Design for Municipal Buildings and Guildhall," to be addressed and delivered to the undersigned not later than 12 noon on Saturday, the 14th day of June, 1913.

(By order)

R. J. FITTALL,
Town Clerk.

Municipal Offices,
Devonport.
February 13, 1913.

TENDERS WANTED.

COUNTY BOROUGH OF STOKE-ON-TRENT.

The Council invite Tenders for the Supply of Materials and Goods for the year ending March 31, 1914, as under:—

1. Portland Cement.
2. Blue Paving Bricks and Common Bricks.
3. Sanitary Pipes and Gullies.
4. Kerbs and Setts.
5. Macadam and Chippings.
6. Pitch and Oil.
7. Cast-iron Work.
8. Picks, Shovels and General Ironware.
9. Paints and Oils.
10. Soap, Soda, &c.
11. Brooms and Brushes.
12. Bath Towels, Dusters, &c.
13. Ironmongery and General Stores.
14. Disinfectants.
15. Drawing Office Requisites.

Specifications, Conditions, and Forms of Tender may be obtained on application to the Borough Surveyor, Town Hall, Stoke-on-Trent, and Tenders, sealed and endorsed, must be delivered to him on or before 27th February, 1913.

E. B. SHARPLEY,
Town Clerk.

Town Hall,
Stoke-on-Trent.
February, 1913.

URBAN DISTRICT OF CREWKERNE, SOMERSET.

SEWAGE DISPOSAL WORKS.

NORTHERN OUTFALL.

TO CONTRACTORS.

The Urban District Council is prepared to receive Tenders from experienced Contractors for the construction of Storm Overflows, Screening Chamber, Detritus Tanks, Channels and Mixing Race, Precipitation and Sedimentation Tanks, Circular Bacterial Filters, Storm-water Tank, Sludge Lagoons, &c., and the provision and fixing of all necessary fittings, Penstocks, &c.

Persons desiring to Tender should at once apply to the Engineer, Mr. William F. Bird, C.E., of Midsomer Norton, Somerset, enclosing a deposit of Two Guineas (which will be returned on receipt of a *bonâ-fide* Tender), when he will furnish Bills of Quantities and Form of Tender.

Copies of the Specifications and the Working Drawings will be deposited at my Office, and at the Office of the Engineer, and may be inspected between the hours of 10 a.m. and 4 p.m., on and after the 24th inst.

Sealed Tenders, endorsed "Tender, Sewage Disposal Works," must be delivered to me at my Office on or before Tuesday, the 11th day of March. Any Tender received after that date will not be considered.

The Council does not pledge itself to accept the lowest or any Tender.

J. W. MUNDEN,
Clerk to the Council.

Council Offices,
Crewkerne.
February 18, 1913.

CHESTERTON RURAL DISTRICT COUNCIL.

CONTRACTS FOR GRANITE.

The Council will, at their Meeting to be held at the Board Room, at Chesterton, on Thursday, the 13th day of March, receive Tenders for about 5,000 tons of Broken Granite and 2,000 tons of Slag.

Persons willing to Contract are requested to send their Tenders (sealed up) to my Office before 6 o'clock p.m. on Friday, the 7th day of March.

The Council do not bind themselves to accept the lowest or any Tender.

Forms of Tender may be had upon application to the Surveyor, Mr. J. Dunn, Brunswick House, Cambridge, to whom Samples must be sent.

(By order)
JOHN F. SYMONDS,
Clerk.

9 Bene't-street, Cambridge.
February 18, 1913.

TWICKENHAM URBAN DISTRICT COUNCIL.

CONTRACTS.

The above council hereby invite Tenders for the undermentioned Goods or Materials for a period of one, two or three years from the 1st April next.

(1) Broken Granite.
(2) Ballast, Shingle, Flints and Gravel.
(3) Granite Kerb, Channel and Quadrants.
(4) Granite Cubes and Setts.
(5) Portland Cement.
(6) Coal and Coke.
(7) Fodder and Forage.
(8) Oil and Colourmen's Goods.
(9) Iron Castings.
(10) Street Gullies and Drain Pipes.
(11) Tar Slag Macadam.
(12) Kentish Rag Tar Paving.

Forms of Tender and Specification for the whole of the above may be obtained on application to Mr. Fred. W. Pearce, F.S.I., Surveyor to the Council, Town Hall, Twickenham.

Sealed Tenders, endorsed "Tender for ——," are to be delivered to me by hand, or by registered post, on or before noon of Wednesday, the 12th day of March, 1913.

The council do not bind themselves to accept the lowest or any Tender.

By Order,
H. JASON SAUNDERS,
Clerk to the Council.

Town Hall,
Twickenham.
February 14, 1913.

RURAL DISTRICT COUNCIL OF NEWARK.

TENDERS FOR ROAD MATERIALS.

The above Council invite Tenders for the Supply of about 1,000 tons of Granite, 1,900 tons of Slag, and 150 tons of Tar-macadam, to be delivered in such quantities and at such times and places in their District as the Council or their District Surveyor shall require and direct.

Sealed Tenders, marked "Tender for Materials," to be sent to me, the undersigned, on or before Saturday, March 8th, 1913, and Samples must be delivered, free of expense, to the Board Room, The Ossington, Newark, on or before Monday, the 10th day of March next.

The Council do not bind themselves to accept the lowest or any Tender, and they reserve to themselves the right to accept such part of any Tender as they may deem proper.

The Contractor will be required to enter into a bond for the due fulfilment of his Contract.

Further particulars, Specifications, and Form of Tender may be obtained from Mr. R. Oakden, junr., 27 Winchilsea-avenue, Newark, upon receipt of a foolscap stamped and addressed envelope.

(By order of the Council)
A. J. FRANKS,
Clerk.

Union Offices,
24 Lombard-street, Newark.
February 12, 1913.

MILTON RURAL DISTRICT COUNCIL.

CONTRACTS FOR MATERIALS, &c.

The Council invite Tenders for Supplying the following Materials, &c.:—

Surface Picked Flints.
Pit Flints.
Fine Gravel.
Broken Granite.
Kentish Rag.
Horse Labour.

Particulars and Forms of Tender may be obtained on application to the District Surveyor, Mr. E. C. Pearcy, 45 High-street, Sittingbourne.

Sealed Tenders to be delivered at my Office not later than four o'clock p.m. on Tuesday, 25th February, 1913.

The Council do not bind themselves to accept the lowest or any Tender, and reserve the right to accept any part of a Tender.

(By order)
E. CECIL HARRIS,
Clerk.

Sittingbourne.
February 12, 1913.

THE URBAN DISTRICT COUNCIL OF BARNES.

ANNUAL CONTRACTS.

The above Council is prepared to receive Tenders for the Supply of the following for the twelve months ending 31st March, 1914:—

1. Broken Guernsey or Alderney Granite.
2. Broken Pit Flints and Thames Ballast.
3. Horses and Carts on Hire.
4. Disinfectants.
5. Ironmongery, &c.
7. Portland Cement.
8. Forage and Litter.
9. Granite Kerb and Channel.
10. Paving Slabs.
11. Oils, Paints, &c.
12. Stoneware Pipes, &c.

Particulars and Forms of Tender may be obtained of the Engineer and Surveyor at the Council House, where Tenders, sealed and endorsed "Tender for ——," must be sent in not later than twelve o'clock noon on Monday, the tenth day of March, 1913. No Tender will be considered except on the prescribed Form.

The Council will not be bound to accept the lowest or any Tender.

By Order,
G. BRUCE TOMES, ASSOC.M.INST.C.E.,
Engineer and Surveyor.

The Council House,
High-street, Mortlake, S.W.
February 13, 1913.

The Surveyor

And Municipal and County Engineer.

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Minutes of Proceedings.

Road Administration in the Several States of the U.S.A.

Believing, as we do, that in the near future the subject of highway administration in the British Isles will overshadow for a time all questions relating to engineering and scientific matters in relation to roads, we have taken the opportunity presented by the publication of a useful report on road legislation, issued by the Iowa Engineering Experiment Station, to place before our readers, in as condensed a form as possible, the main features of highway administration in the several States of the American Union. The report is primarily on road legislation and administration in Iowa; but in our own summary we have made no special reference to the case of this State, confining our attention to the comparative studies of road administration in the several States. It must, of course, be recognised that the widely divergent conditions under which road administration is carried on in the different parts of the great area covered by the United States have led to the development of administrative systems presenting marked contrasts one with the other; but so many of the States have now some kind of central organisation that the examples we have given furnish most interesting studies of the different ways in which it is found practically convenient to establish or develop relations between the different authorities controlling the roads. It is, perhaps, significant that all three of the usual typical administrative units are represented in many of the States—namely, the State Department, the county, and the township or smaller local unit; and it is, further, noteworthy that in many cases the county itself is divided into districts.

On the whole, we see evidence in these studies of the vitality of the doctrine of threefold control, by authorities corresponding more or less to the State, the county, and the urban or rural district. The State, in the cases before us, is often a very small unit compared to the British Isles, or even compared with one of the three kingdoms, and this consideration must not be lost sight of in studying the administrative systems of the United States. The part played by the Federal Government, though important on the whole, does not seem considerably to affect the road administration of individual States. It must be observed, too, that the State Department of a more or less arbitrarily defined area cannot correspond closely with the Central Department of a departmental country, such as France or Italy. The main object which we have kept in view in the article referred to, which will be found elsewhere in this issue, is to provide material for answering the question: What is a State Department? There is danger lest, in seeking inspiration with regard to proposed administrative changes in this country, our legislators may too hastily base conclusions upon the results of administrative arrangements with which a part is played by such a small State as Bavaria, or New Jersey. On the other hand, there are some features which do not depend for their significance upon the precise relation between the different authorities controlling the roads. Among these are the repartition of costs of construction and improvement, the methods of raising funds, the devotion of the proceeds of motor taxation to maintenance, or other matters which it will be found claim attention in the reports relating to a considerable number of the cases cited in our article. Lastly, we specially draw attention to the significance of the means taken to ensure a high standard of qualification and suitable personality in the case of a person entrusted, administratively or technically, with the management of roads in the United States.

* * *

The Creep of Street Pavements.

The tendency to creep under traffic, which is sometimes a matter of importance in the case of a city pavement, is a subject which has, perhaps, received more attention than is usually supposed. In the case of a country road crust made in two or more courses the precautions taken to ensure that the crust will act as a whole, and that a top course of small thickness will not be lifted from that below it or shaken to pieces, amply secure the top course from any tendency to creep, such as may occur in the case of wood block or asphalt paving laid on concrete. To prevent wood blocks from creeping under traffic, with the initial aid of temperature effects, it is desirable to arrange for some general resistance over the whole area rather than to insert barriers at intervals. If the surface of the concrete be left a little rough a cement grout filler forming the bottom inch of each joint will make an effective key, if the work be carefully done. In other cases the bitumen joint—as may be judged from the state of old wood pavements when taken up—is probably sufficient to prevent creep when the road is not fully exposed to sunshine and frost effects. Definite anchorage, or what mechanical engineers would call "positive" anchorage, is to be avoided wherever there is much expansion and contraction. As regards asphalt pavements it is possible that a fully effective prevention of creep might result in a shortening of the life of the asphalt carpet, which, would be torn between two forces instead of submitting to one: but it seems desirable to place some check upon the rolling out tendency which sometimes results in the formation of a wavy pavement. This check should take the form of a continuous and general resistance over the whole area, which can be provided by roughening the surface of the concrete, on a small scale, or by finishing the surface in such a way that the tops of stones or chips project a little, and only a little, above the surface of the mass concrete. There are several ways of doing this: and the best of them are, no doubt, those which provide a single, homogeneous concrete crust in which the keying material is firmly bedded.

We learn from a recent issue of *The Contract Record* (U.S.A.) that a method has been "patented" in the United States, under the title "Anchor Concrete," which, it is stated, "is merely a slush coat of cement mortar spread half-an-inch deep upon the freshly laid concrete foundation. Before this slush coat has received its initial set, clean, hard, broken stone about 1½ to 2 in. in diameter is spread evenly over it and imbedded into the slush coat by light tamping." This seems to be a good method where the aggregate of the concrete is of large gauge: and where that aggregate is of a pebbly nature, other material, with sharp edges will be required to form the anchor course. What is described as a "paint coat" between the concrete foundation and the carpet layer is sometimes used in the United States, and is, of course, familiar to British municipal engineers, who often use it for wood paving, either as a general smear made in advance of the block laying, or by dipping the bottom as well as two sides of each block when it is laid. The whole subject is dominated by the basic fact that the life of any pavement is a life of "give and take" within a range determined by the circumstances, and the success of wood-paving with tar-pitch joints is largely due to the fact that the cellular resiliency of the wood and the range of properties of the bitumen at different temperatures together provide the necessary combination of local and general recovery of form under the stresses imposed by traffic and by changes in temperature.

* * *

Housing in London.

It is quite refreshing in the midst of the party controversies which are unfortunately raging round the municipal administration of the metropolis to come across a plain statement of what has been achieved in regard to the housing of the working classes since the London County Council was first constituted. Such a record is provided by a very instructive book which has been prepared by Sir Laurence Gomme, the clerk to the council, under the direction of the Housing of the Working Classes Committee. The book also briefly reviews the work which was accomplished by the old Metropolitan Board of Works, which was created in 1855—that is, within a few years of the very earliest housing legislation. It will be remembered that the principal statute in regard to housing—the Act of 1890—is divided into three parts, dealing respectively with large improvement schemes, reconstruction schemes, and the provision of lodging-houses. Under Part I. the county council have been enabled to remove many plague spots which in the old days obtained an unenviable notoriety, not merely as slum areas, but also as the resorts of undesirables of every kind. Such schemes as those dealing with the Boundary-street area in Bethnal-green, Clare Market off the Strand, and the Tabard-street area are standing monuments to the zeal and skill which have been brought to bear upon this phase of the housing problem. There have been ten such schemes in all, and it would be difficult to exaggerate the importance of the results which have been achieved. Mr. Gomme's book contains many plans and photographic illustrations which demonstrate that in place of the old rookeries there are now well-regulated and sanitary dwellings, which render it possible for the tenants to live reasonably decent lives. In the attempt which has been made to rid London of the reproach which she formerly bore, Part II. of the Act has also been found very useful, and some valuable reconstruction schemes have been carried out. Under Part III. of the Act, which relates to the provision of lodging-houses, the council have been able to provide not only buildings which are lodging-houses in the popular sense of that term, but also a large number of tenement dwellings and separate cottages. This branch of the work has been specially associated, perhaps, with such schemes as those which have been carried out on the White Hart-lane Estate at Tottenham and the Norbury Estate at Croydon. The report points out that there is every prospect that the population of outer London will continue to increase, so that it would appear to have been a wise policy to acquire these outer sites for housing development in good time, and while they were obtainable at a reasonable figure. It is interesting to observe that the pioneer of housing reform was the great Earl of Shaftesbury, and that it was owing to his work and influence that Parliament first devoted its attention to legislation which rendered it possible to deal with the overcrowded, filthy, and insanitary areas which abounded in the middle of last century. Much has been achieved, but much yet remains to be done, and it is to be hoped that no party considerations may ever be allowed to stand in the way of the continuation of a work which has had such beneficial results in the past, and which can do yet more in the future for the workers of the great metropolis.

* * *

Liability for Accidents.

An interesting question of law which is important to local authorities and contractors was decided by Mr. Justice Darling the other day in the case in which the Croydon Rural District Council and a contractor employed by them were joint defendants in the following circumstances. The action was brought under Lord Campbell's Act, and the plaintiffs were the widow and daughter of a gentleman who had lost his life by falling down an unlighted and unprotected hole left by the contractor at the side of a public highway. The contract contained a clause by which the contractor agreed to indemnify the council against any loss or damage arising by reason of accidents to third parties; and when the jury returned a verdict for the plaintiffs, assessing the damages in the aggregate at £1,200, it was naturally contended on behalf of the council that, having regard to the express terms of the contract, the liability for the whole of this amount should fall on the contractor. Mr. Justice Darling, in giving judgment, said that the point he had to decide was one of considerable difficulty, and there were expressions in the various authorities which had been quoted to him which might entitle him to form an opinion either way. It was contended on behalf of the contractor that a tort having been committed by both the council and the contractor, the rule applied that there could be no contribution between joint tort feasors, and that consequently it would be against public policy to give the council the indemnity they claimed under the terms of their contract with the contractor. That rule, however, was subject to exceptions, and he thought that the rural district council in the present case came within the kind of exception laid down by Lord Blackburn in *Hughes* v. *Percival*. It was held in that case that the defendant who employed a third person to fulfil a duty cast upon him by the law might take an indemnity to himself in case mischief came from that person not fulfilling the duty which the law cast upon the defendant, though the latter remained subject to the duty and liable to the consequences if it was not fulfilled. He was therefore of opinion that he could not say that it was against public policy that the Croydon Rural District Council should take an indemnity from the contractor and be allowed to enforce it against him, and he must therefore make a declaration that they were entitled to an indemnity under their contract with the contractor, such indemnity to include the costs of the action.

This decision—which was briefly recorded in last week's issue—is of the greatest importance, inasmuch as the indemnity clause appears in very many building and engineering contracts. The matter, however, appears to be one of some legal doubt, so that it is to be hoped that an opinion may be obtained from a higher tribunal. It may be urged that if the learned judge had held otherwise than he did he would have been refusing to give effect to a contract entered into with a full knowledge of the possible consequences. On the other hand, however, the

possible injustice to the plaintiffs if the contractor did not happen to be a substantial man must not be overlooked. It would be well for all parties if the matter could be authoritatively settled so that the legal position might be made quite clear.

* * *

Bituminous Road Materials: Resources of the United Kingdom.

One of the most important of the subjects at present engaging the attention of highway engineers in the United Kingdom is discussed in another part of the present issue in an article on "The Supply of Coal Tar, Tar Oils, and Pitch," written specially for The Surveyor by Mr. W. J. A. Butterfield, M.A., F.I.C. Various estimates of the quantities of such materials that will be available in the near future have been made in the course of the past few years; but important developments are taking place in their production as well as in their utilisation for road purposes, rendering it necessary to revise all such forecasts, or to make fresh estimates which take these developments into account. Mr. Butterfield points out, for instance, that the estimates of the value of these by-products for highway purposes must take into account the fact that their usefulness is to a large extent to be measured by the proportions of pitch which they contain. The oils in the tar may, perhaps, be regarded as having some value apart from their usefulness as vehicles in applying the pitch, but the latter is the more important constituent, especially in the case of bituminous bound crusts. Another aspect of the situation to which Mr. Butterfield directs our attention is the fact that in most cases the production of the materials in which road surveyors are interested may be affected in kind or in amount by the prices obtained for the main product and for other by-products, and by developments in the production of competing products. It certainly seems that the demand for bituminous materials which has arisen as the result of developments in road-crust construction ought to have a steadying effect upon the market for the whole group of products to which allusion is made in Mr. Butterfield's article; and the more so because the demands of road surveyors in this direction are steadied by the influence of competing materials and alternative methods. If the demand for road tar and road pitch became somewhat more definite by intelligent anticipation as to the developments of the next few years, the sources of supply of these materials would, no doubt, be somewhat more generally distributed over the country; but even then large areas would still depend upon sources of supply situated at considerable distances from the seat of operations. We cannot, in fact, contemplate as probable such developments in this direction as would be likely to affect prices to any important extent. On the other hand, it may be suggested that in some areas the quantities of tar used per square mile have about reached the reasonable maximum, and this ought to have a steadying effect on prices. Mr. Butterfield's article should be read carefully and in detail, for it contains many significant passages to which no reference is made here, though they have no small bearing upon the situation generally.

* * *

The Draining of Moor Roads.

The question of draining moor roads came indirectly into prominence as the result of an action brought last week by a cyclist against the Northallerton Rural District Council for damages as the result of injuries sustained while riding on what it described as a steep, sinuous moor road between Helmsley and Osmotherly, at a spot where a drainage channel or ditch crosses the thoroughfare diagonally. The defendant council pleaded contributory negligence on the part of the plantiff in riding down the incline—which was variously stated to be one in eight and one in nine—at too fast a pace, and stated that they had erected a notice at the top of the hill to warn the public of the existence of the ditch. Learning from defendant that he was travelling at a speed of twelve miles an hour, the county court judge of Darlington, who heard the action, without hesitation gave judgment for the Northallerton Council with costs. It was suggested in the course of the argument that the method of drainage known as a "grip" was an antiquated form of draining moor roads, and Mr. John Kilner, surveyor to the East Westmorland Rural District Council, was even more emphatic than the learned counsel in his condemnation, describing "grips" as "absolute deathtraps to cyclists." The safest method of drainage, he suggested, was to place channels on each side of the road, or narrow connecting inlets from the surface. Even if the "grip" system was necessary—which he denied—he maintained that instead of having one wide channel, as in this particular case, there should be several narrow ones, so that a cyclist might be enabled to cross over without danger of being overthrown. In Westmorland, he stated, they drained all moor roads by the system of side channels. As opposed to this view of one who may be accepted as an expert there was the evidence of Mr. John Parker, a consulting engineer of Newcastle-on-Tyne, on behalf of the Northallerton Council. Mr. Parker claimed to have had a very extensive experience in the construction and maintenance of rural roads, and his contention was that the "grip" system is the kind usually adopted, and with safety, for this class of road, and is, in fact, a system quite familiar throughout the North of England. The point at issue is manifestly of importance from the point of view of practice no less than of public safety, and some of our readers who have knowledge and experience of the draining of moor roads may be willing to throw some light upon the subject.

* * *

Steel Frame Buildings.

The development of building practice in the Metropolis has on more than one occasion been temporarily arrested by the rigidity of the law peculiar to London and the failure of the Legislature to keep pace with new ideas and novel methods of construction. An excellent example of this fact was afforded quite recently by the case of reinforced concrete, a material which only lately received statutory recognition in a private Act of Parliament passed at the instance of the London County Council. Another outstanding instance is that of the steel skeleton building—a class of work which was almost entirely neglected prior to the passing of the London County Council General Powers Act of 1909. Since that date, however, great progress has been made with the erection of steel frame buildings, and Mr. S. Bylander, who on the 13th inst. lectured on the subject before the Concrete Institute, has had a large experience in the design and supervision of such structures. Mr. Bylander's paper—some extracts of which are given on another page—was rendered possible owing to the wider policy upon which the Concrete Institute have determined to include among the topics for discussion at their meetings matters of structural engineering generally, instead of confining them to particular aspects of concrete and reinforced concrete construction. The adoption of this policy is certainly a step in the right direction, and will result in thoroughly sustaining interest in the proceedings of the institute. Mr. Bylander gave a description in detail of the procedure applicable to the design and construction of steel frame buildings, and his paper contained many valuable and original hints which will no doubt be taken to heart by other engineers. We may perhaps specially mention his wise insistence on absolute *accuracy* in calculations and drawings, his simplified method for calculations (including the 1,000 lb. unit or "kip"), and the instructions which he gives for securing systematic working during the erection of a building.

The Supply of Coal Tar, Tar Oils and Pitch.

By W. J. A. BUTTERFIELD, M.A., F.I.C., Assoc.Inst.C.E.

Attention has been drawn recently to schemes for the carbonisation or dry distillation of coal of which a chief object is the production of fuel oils. The fuel oils may be divided into two classes—viz., (1) those suitable for use as motor spirit in place of petrol, and (2) those suitable for use as fuel in engines of the Diesel type. It has been asserted that the coal resources of this country, if properly developed and utilised, would suffice to render the country in large measure independent of imported supplies of both petrol and petroleum fuel oils.

Independence of imported supplies is regarded in many circles as an essential condition of the adoption of liquid fuel in the larger vessels of the Navy; but naval requirements stand on a different footing to ordinary commercial and industrial requirements, because all that need be assured for the former is that an ample supply of liquid fuel shall be proved to be available in the emergency of imported supplies being cut off or curtailed, but it would matter little that this emergency supply would be obtainable only at prices which would be prohibitive for oil fuel for commercial and industrial uses. Hence the problem of a supply of liquid fuel to the Navy may be regarded as standing apart from the general question of the supply of fuel oils from coal.

This general question, however, cannot be dissociated from that of the supply of coal tar and pitch, in which the road authorities of the country are now keenly interested. It should therefore be of value to the latter to have before them a broad review of the sources of supply of coal tar and their bearing on schemes for the production of fuel oils from coal.

The supplies of coal tar available at the present time may be classified as coming from (1) gasworks, (2) coke ovens, (3) blast furnaces, (4) producer plant. There is also a certain amount of oil tar produced.

Gasworks Tar.

The quantity of coal tar produced in gasworks in the United Kingdom may be inferred from the quantities of coal carbonised in the works. Generally speaking, with present methods of carbonisation the average yield of tar per ton of coal carbonised on gasworks is, approximately, 10 gallons, or, say, 112 lb., which is 5 per cent of the weight of the coal carbonised. According to the official returns of gas undertakings issued by the Board of Trade, the quantity of coal carbonised in the gasworks of the United Kingdom for the year 1910 (or, in the case of gasworks owned by local authorities, for the twelve months ending March 31, 1911) was 15,397,783 tons. The production of coal tar on gasworks in 1910 must therefore have been, approximately, 154,000,000 gallons. In the year 1900 the quantity of coal carbonised on gasworks was 13,206,288 tons, corresponding with a production of coal tar of about 140,000,000 gallons per annum. The increase in the production of tar on gasworks in ten years has therefore been 14,000,000 gallons, which is at the rate of about 1·4 million gallons per annum. But this increase is not spread uniformly over the ten years.

Practically the same amount of coal has been carbonised on gasworks in each year for the four years 1907-1910, the required increase in the production of gas having been obtained partly by the adoption of methods of working which afford bigger yield of gas per ton of coal, and partly by an increase in the output of carburetted water gas. The same forces are likely to remain at work during the ensuing three or four years, so that it is improbable that there will be any very large increase in the annual production of tar on gasworks up to, say, the year 1915. The annual increase in the consumption of gas in these years will probably be met without a corresponding increase in the quantity of coal carbonised, and it is on this quantity that the production of tar chiefly depends.

In the gasworks of England and Wales alone the total production of coal tar in 1910 was about 137,000,000 gallons. The production of gasworks tar is, however, naturally concentrated near the big centres of population, and therefore is very unevenly distributed over the country—an unfortunate circumstance to road authorities in purely rural districts. Thus, in 1910, in the London district, seven gas companies carbonised 3,559,463 tons of coal, corresponding with a production of about 35,500,000 gallons of coal tar. In Lancashire, taking only those gas undertakings which carbonised over 10,000 tons of coal per annum, the total quantity of coal carbonised by thirty-four undertakings was 1,892,847 tons, corresponding with a production of about 19,000,000 gallons of coal tar. In the West Riding of Yorkshire twenty-six gas undertakings (carbonising over 10,000 tons of coal per annum) carbonised a total of 1,309,420 tons of coal, corresponding with a production of 13,000,000 gallons of coal tar. There is another big gas-producing area, of which Birmingham is the centre, but taking only the three districts of London, Lancashire and the West Riding of Yorkshire, which together have an area of nearly 3,250,000 acres, it will be seen that a production of considerably over 67,500,000 gallons of tar is concentrated in them. The area represented by them is only about one-twelfth of the total area of England and Wales, whereas the tar produced is one-half of the total production of tar in the gasworks of England and Wales.

The opposite phase is seen on turning to one of the more thinly populated districts of the country. Thus

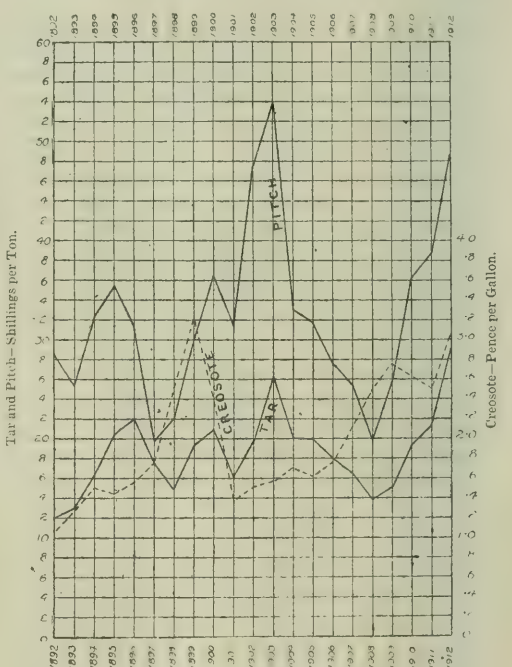


Diagram Showing Average London Price for Tar, Pitch and Creosote Oil During Last Twenty Years.

the counties of Lincolnshire and Norfolk have together an area of nearly 3,000,000 acres, or over one-thirteenth of the total area of England and Wales. The total amount of coal carbonised in all the gasworks, including small ones which were ignored in the case of Lancashire and the West Riding of Yorkshire, was 190,381 tons, corresponding with a production of tar of 1,900,000 gallons. This is only $\frac{1}{72}$ of the tar production in the gasworks of England and Wales. The uneven distribution of the producing centres of gasworks tar in the country, which is shown by these figures, places the more thinly populated districts at a great disadvantage in regard to the use of tar and pitch for road construction and maintenance, as comparatively heavy charges for freight from the tar-producing centres have to be incurred by the districts remote from them.

The figures given above refer only to the production of tar by gas undertakings authorised by statute. There are a number of gasworks belonging to undertakings not so authorised, and to railway companies, and the production of coal tar in these gasworks

amounts to about 9,000,000 gallons per annum. Taking this into account, the grand total of coal tar produced in gasworks in the United Kingdom in the year 1910 would be 163,000,000 gallons.

COKE-OVEN TAR.

The production of coke-oven tar in the United Kingdom cannot be estimated so precisely as that of gasworks tar. The coke produced in ovens in the United Kingdom amounted in 1910 to 11,925,115 tons, and in 1911 to 11,474,174 tons. But by no means all the ovens are fitted with tar-recovery plant, and the total amount of tar recovered from coke ovens in 1910 appears to have been about 90,000,000 gallons. If, however, tar was recovered from all the coke ovens in the country, the production of coke-oven tar would amount to something approaching 200,000,000 gallons per annum. It is in the conversion of non-recovery to recovery ovens that the best prospects lie of a considerable increase in the output of coal tar in this country. The high prices at present realisable for tar and sulphate of ammonia will encourage the installation of by-product recovery coke ovens.

It is to be noted, however, that the coke-oven installations occur only in a few districts—68 per cent of the oven coke produced in the United Kingdom is made in Yorkshire and the county of Durham. The remainder of the coke is produced almost wholly in the counties of Glamorgan, Monmouth, Lancaster, Stirling, Derby, Stafford, Cumberland, Lanark and Gloucester. Hence, even more than in the case of gas tar, the production of coke-oven tar is concentrated in a few restricted areas, for the most part not far removed from big centres of production of gas tar, but remote from purely rural districts.

BLAST-FURNACE TAR.

The production and recovery of blast-furnace tar is practically restricted to a small area in the West of Scotland. From 1,500,000 to 2,000,000 tons of splint coal are consumed per annum in the blast furnaces of the West of Scotland, and about 35,000,000 gallons of blast-furnace tar are produced. There is no prospect of any considerable increase in the annual production of blast-furnace tar.

PRODUCER TAR.

This tar comes from those gas and ammonia producers in which bituminous coal is used. Many of these are in use in different parts of the country, but the total quantity of tar yielded by them is probably not very great. The largest central producer plant of the kind is that of the South Staffordshire Mond Gas (Power and Heating) Company, at Dudley Port. This plant towards the end of last year was producing tar at the rate of 280 tons per month, which would correspond with an output of 3,360 tons, or, say, 675,000 gallons per annum. This is at the rate of about 190 lb., or, say, 17 gallons per ton of coal (bituminous slack) used in the producers. Since the plant also produces about 81 lb. of sulphate of ammonia per ton of coal used, there appears to be a reasonable prospect of a considerable extension in the use of Mond producers so long as tar and sulphate of ammonia have their present high market prices. The returns from these products, at these prices, appear sufficient to make the working of Mond producers remunerative close to the pit's mouth, irrespective of any use which may be found locally for the gas. If attention were concentrated on the obtaining of maximum yields of tar and ammonia, and the plant were worked at uniform load solely with this object, better results should be attained than at Dudley Port, where the load on the producers is made dependent on the demand for gas. It is likely that the production of tar from producers will increase appreciably in the course of the next few years.

OIL TAR.

In addition to coal tar from the sources named above there is also produced from oil used in gas-making a considerable amount of tar. This tar falls into two classes—viz., that produced in carburetted water gas plant on gasworks, and that produced in oil gas plant. In either case, however, the production of tar when separated from water bears a fairly constant proportion to the amount of oil used. The quantity of oil consumed in gas-making by both the gas undertakings and the railway companies is about 250,000 tons per annum, and the production of oil gas or carburetted water gas tar therefrom is about 9,000,000 to 10,000,000 gallons.

TOTAL TAR PRODUCTION.

The estimates given in the foregoing for the production of the different classes of tar in this country when added give approximately the total quantity of tar produced in the country, but so far as road maintenance and construction, as distinct from mere dust abating, are concerned the quantity of tar is less significant than the quantity of pitch contained in it. The oils in the tar, even when the tar is applied as such to roads or to stone for use on roads, must be regarded merely as the vehicle for applying the pitch. On this account it becomes important to consider the proportion of pitch in each class of tar. This may be taken approximately as follows: Gasworks coal tar, 70 per cent (by weight); coke-oven tar, 50 per cent; blast-furnace tar, 65 per cent; producer tar, 50 per cent; oil tar 40 per cent. The production of tar, with the quantity of pitch contained in it, is shown in the following table:—

TABLE I.
ESTIMATED PRODUCTION OF TAR IN THE UNITED KINGDOM IN 1910.

	Quantity of tar produced.		Pitch obtainable from the tar.
	Million galls.	Tons.	Tons.
Gasworks coal tar ...	163	860,000	602,000
Coke-oven tar	90	460,000	230,000
Blast furnace tar ...	35	180 000	117,000
Producer tar	3	15,000	7,500
Oil tar	9	43,000	17,200
Total	300	1,558,000	973.700

It must be remembered, however, that there are many uses of tar, and that only a small proportion of the total output can be available for use on roads. For instance, of coal-tar pitch about 140,000 tons are used per annum for briquette or patent fuel making in this country, and there is a very large export trade in pitch for the same purpose. In estimating the tar available for road use also it must be remembered that, although all classes of tar have been enumerated in the foregoing table, they vary greatly in their suitability for use in road construction and maintenance, quite apart from the proportion of pitch which they contain. It is obvious, therefore, that if the use of tar and pitch is to continue in road construction, &c., on a large scale, it is eminently desirable, from the road authority's standpoint, that fresh sources of tar should be opened up. It has been shown that an appreciable increase may be anticipated from coke ovens and a smaller increase from producers. The schemes which in recent years have attracted attention for the production of semi-coke for use as a domestic fuel in place of raw coal with sulphate of ammonia and tar or oils as by-products, become interesting as affording a possible supply of large quantities of tar and pitch, in addition to the fuel oils in regard to the production of which these schemes have been more prominently brought before the public. But in connection with all such schemes it must be remembered that the production of tar or oil by the destructive distillation of ordinary bituminous coal is commercially practicable only if the bulk of the other products of the process—viz., coke, gas and ammonia—can be disposed of at good prices or utilised on the spot.

COAL TAR AND COAL OIL IN THE EIGHTEENTH CENTURY.

The early attempts at manufacturing tar or oil from coal appear to have been commercial failures because the other products were not adequately utilised. Thus, prior to the period when coal was first carbonised for the manufacture of gas for public supply, a pamphlet, dated 1785, entitled "Account of the Qualities and Uses of Coal Tar and Coal Varnish," tells us that "The (ninth) Earl of Dundonald, in 1780, discovered a new and easy method of extracting tar from coal." The method was patented, and the pamphlet mentions that besides the coal tar other articles were "made, either immediately from coal or produced in processes that are connected with Lord Dundonald's discovery," such as pitch, essential oil of coal, coal oil, cinders (coke), lampblack, volatile alkali (ammonia) and sal ammoniac. "Rosin, dissolved in essential oil of coal," made "coal varnish," which "is preferable to turpentine varnish, inasmuch as the oil that it is made of is lighter and more penetrating than oil of turpentine." "Coal oil, when rectified, may be used to advantage in painting, to dilute or thin down lintseed oil."

It is clear from these quotations and other lines in

the pamphlet that Lord Dundonald produced, by the distillation of coal at low temperatures, a light coal-tar, from which various fractions were obtained. He appears to have mixed steam with the volatile products of distillation, and obtained the various fractions by serial condensation rather than by collecting the whole of the condensable products together and subsequently separating them by fractional distillation. Anyhow, he obtained a light coal-tar naphtha, which served as a substitute for turpentine, a heavier coal oil, coal tar, which, when "boiled to a proper consistence," was better than common tar—*i.e.*, Stockholm or wood tar—for the preservation of woodwork and ironwork, pitch, and a semi-coke which he termed cinders. Stress is laid on the waterproofing qualities of the coal tar, in which connection surveyors will be interested to learn from the pamphlet that "As raw coal tar penetrates stone to a considerable depth, it may be used for doing over houses that are built of a porous stone, apt to transmit the rain or moisture through the walls of the house. If the colour of the tar should be an objection, the house may be harled, or cast with small gravel and lime, and afterwards whitewashed. Lime takes better band or hold on stone payed with coal tar than on raw stone. Coal tar may be used for doing over tiles to prevent them from imbibing moisture or wasting by the weather."

In view of these observations it may be surmised that if waterproofed road surfaces had been called for in 1785 the Earl of Dundonald would have proceeded to recommend his coal tar to road surveyors as the best waterproofing agent.

The Earl of Dundonald's process becomes specially interesting at the present time because it may be regarded as the forerunner of all processes for the production of fuel oils, semi-coke and ammonia from coal, with gas as a quite subsidiary or negligible by-product. His "essential oil of coal" had all the qualities of a crude motor spirit; his coal oil those of a heavier fuel oil; his "cinders" those of a semi-coke, or "coalite" type of solid fuel, and his pitch those of a coal-tar bitumen. His process failed to achieve commercial success, probably because attention had been concentrated on the production and sale of tar and tar oils. Perhaps no good market could be found near the works for the "cinders" or semi-coke which was also produced, and certainly no attempt appears to have been made to utilise the gas which must have been given off in the process.

COAL TAR IN THE NINETEENTH CENTURY.

After the failure of the Earl of Dundonald's venture coal tar ceased to be a commodity until it was produced as a by-product on gasworks. The first gasworks for public supply was established in London in 1812, and the coal tar produced in the early days of the gas industry has been described by Accum in his "Practical Treatise on Gas Lighting," published in 1815. The specific gravity of this tar was slightly above that of water, and the amount of tar obtained per ton of Newcastle coal carbonised was from 110 lb. to 135 lb., or about 11 gallons to 13½ gallons. The extracting of tar by the apparatus of the day was, however, very imperfect, and no doubt the yield of tar has been understated. The tar, on distillation, yielded:—

Ammoniacal liquor...	... 28·0 to 25·5	per cent by weight
Essential oil or naphtha...	26·0 to 26·5	,, ,,
Pitch	46·0 to 48·0	,, ,,

Accum gave directions for firing the still in order to avoid the boiling up of the tar. The essential oil obtained was, he said, known to colourmen by the name of oil of tar, and was "a yellowish inferior kind of oil of turpentine, which is very useful in painting ships, or making varnishes, and other coarse outdoor work. As to the pitch, "A subsequent fusion, with a gentle heat, converts the coal pitch into a substance possessing all the characters of *asphaltum*."

These and other particulars given by Accum indicate that the gas tar of 1815 was very different in character from the bulk of the gas tar of the present day. It was a low-temperature tar, containing a large proportion of naphtha or light oil, which by rectification would have given a large yield of motor spirit. The light oil would not have contained much of the benzine and other aromatic hydrocarbons which give to the light oil of modern coal tar the chief part of its value to the tar products works, and any benzine which it did contain would have been difficult of separation from other hydrocarbons of less value. But as a material for the preparation of motor spirit the coal-tar naphtha of 1815 would have been as good or better than the light oil of ordinary coal tar of the present day, and the remaining tar oil would have been better than modern coal-tar creosote for use as a fuel in Diesel engines, or as a vehicle or solvent for pitch for use in road construction. The pitch, too, would have been much superior to modern coal-tar pitch as a binding agent, and, indeed, more like the asphaltum to which Accum compared it.

Coal tar, however, was but little appreciated in the early days of the gas industry, and the designers of gas-making plant set themselves to increase the yield of gas by gasifying as much as possible of the tar, either when already formed or while only in the course of formation. In the last century there have been periods in which coal tar has become relatively valuable, and in which it might have been a commercial proposition to carbonise a certain amount of coal for the sake of the tar mainly and of the coke and ammonia incidentally. But during the last ten years of the nineteenth and the first ten years of the twentieth century coal tar has generally been worth little or no more than its value as a fuel. In the last two or three years, however, the market value of coal tar has been steadily rising, and there is no indication that the peak has yet been reached. The consumption of tar and tar products for road treatment has been chiefly responsible for this rise, though there is also a continually increasing demand for tar and pitch in the briquette or patent fuel industry. It thus has become important to consider whether coal tar and coal oil are passing from the category of by-products to that of chief products; and, if so, whether there is now scope for the introduction of new processes (or pronounced modification of existing processes) of which one of the principal objects is the obtaining from coal of a large yield of tar of good quality.

RELATIVE POSITION OF TAR AND OTHER PRODUCTS OF DISTILLATION OF COAL.

As to the position of tar among the products of the distillation of coal, it may be said that, whereas ten years ago in London the receipts from tar paid 5 per cent of the manufacturing cost of coal gas, now they pay over 10 per cent, and amount to one-third of the receipts from the sale of coke on gasworks. The yield of tar in gasworks practice at the present time averages about 10 gallons per ton of coal carbonised. So long as this yield is not appreciably increased (and an increased yield of tar would imply a decreased yield of gas per ton of coal), it is unlikely that the receipts from tar on gasworks will amount to more than 12½ per cent of the manufacturing cost of the gas. On modern gasworks tar is, and is likely to remain, a product subsidiary to both gas and coke, but at prevailing market prices having a rather greater revenue value than the ammoniacal by-products. Gas tar may therefore be regarded as a by-product, the yield and quality of which are in themselves quite subsidiary to the production of the requisite quantity of suitable gas. The yield and quality of the tar from coke ovens are similarly subsidiary to the production of the requisite quantity of suitable coke. The production of blast-furnace tar is also incidental, and its yield and quality are quite subsidiary to the main purpose of blast-furnace working. With producers using bituminous coal, however, the receipts from tar may be proportionately greater, though much inferior to those from ammonia.

For instance, figures given recently by Mr. H. A. Humphrey show that Mond producers at Dudley Port, which are operated according to fluctuations in the demand for gas, yield on the average 190 lb. (or, say, 17 gallons) of tar and 81 lb. of sulphate of ammonia per ton of coal. The coal used is a bituminous slack from which, according to Mr. Humphrey's curves, about 112,000 cub. ft. of gas are made per ton. On this basis it appears that the receipts from the tar and sulphate of ammonia average about 19s. 2½d. per ton of coal, which costs about 7s. 4½d. delivered at the works. It is evident, as has been already indicated, that so long as the present high prices of tar and sulphate of ammonia prevail, it should be possible at a pit's mouth, where suitable bituminous slack of high nitrogen content is obtainable cheaply, to secure profitable working of producers solely for their output of tar and ammonia. In order to attain the best results in this respect, however, the quality, yield and utilisation of the gas from the producer should be as entirely subordinate to the working of the latter as are the production and utilisation of blast-furnace gas to the working of a blast furnace. But producers established with the object of furnishing tar and ammonia as the chief products from

bituminous slack could hardly be worked on a paying basis if the price obtainable for sulphate of ammonia fell below, say, £12 10s. a ton. Since, however, even in the last ten years, the price of sulphate has frequently been considerably lower than this figure, it is evident that a source of tar which is dependent for its continuance primarily on the maintenance of a high price of sulphate is not one on which much reliance may be placed for future supplies.

The tar generally obtained from producers at the present time is not, however, so suitable as gas or coke-oven tar for use in road construction. It more nearly resembles blast-furnace tar, in that it contains a high proportion of tar acids and comparatively little bituminous matter or pitch of high-binding quality. But some improvement might be effected in both the yield and quality of the tar if the producers were operated with this object as secondary only to that of obtaining the highest practicable yield of sulphate of ammonia. From a ton of ordinary bituminous slack, however, a yield of 20 gallons of tar is about the maximum that may be anticipated with the producer type of plant.

Modifications of the carbonising plant and mode of working on gasworks are being introduced which are giving a slightly increased yield of coal tar, and that of lower specific gravity than the coal tar generally produced. This tar contains less free carbon and naphthalene than ordinary gas tar, but it yields less pitch, so that for most modes of using tar in road construction and preservation it does not go so far as the same bulk of ordinary gas tar. No modification of gasworks plant or mode of working which is now being introduced or even seriously entertained is likely to give a higher yield of pitch per ton of coal carbonised than is at present obtained, though the pitch may be superior in that it may contain less free carbon.

Fluctuations in the Price of Tar and Pitch.

The commercial success of processes in which coal is carbonised at low temperatures with the object of obtaining a semi-coke of the coalite class, and the largest attainable yields of tar or oil and sulphate of ammonia will depend mainly on a good market being secured for the semi-coke, and on the prices of tar and sulphate being maintained at something approaching their present high level. To what extent the market prices of gas tar, pitch and creosote oil have fluctuated in the last twenty years may be seen from the diagram on p. 390, which shows the average London price for each commodity for each year. (The average has been deduced in each case from the figures given in the market reports in the *Journal of Gas Lighting* for the first week in March, June, September and December.) It will be noticed that the market for these products is extremely fickle, and it remains to be seen whether the new demand for them for use in road construction will serve to prevent a recurrence of the bad slumps of 1892-93, 1897-98, and 1908. Probably no such slump will occur for some years ahead owing to this new demand. The gasworks output of tar cannot be increased or decreased to any considerable extent according to the variations in the market price, but a high price tends to stimulate the recovery of tar from coke ovens and blast furnaces. The number of ovens and furnaces in action at any period depends, however, on other industrial conditions, and hence the quantity of tar from these sources also cannot be greatly increased merely to meet an increased demand for it. Undoubtedly the development of sources of tar, the output of which could be varied according to the variations in the demand for tar, would have a greatly steadying effect on the market prices of tar. But the development of low-temperature carbonisation processes must depend on fairly good prices being obtainable for the semi-coke and sulphate of ammonia as well as for the tar or coal oil which they yield.

Low-Temperature Distillation of Coal.

The author does not propose to refer to the relative merits of the different systems for obtaining products by the low-temperature distillation of coal, but merely to indicate the objects which they have in common and the conditions which he believes to be essential to the commercial success of any low-temperature distillation scheme. The scheme differs essentially from a producer process in that semi-coke will be formed in large and gas in small amount, whereas in the producer gas is formed in large amount and coke scarcely at all. A plentiful supply of cheap bituminous coal or slack is requisite in both cases; but whereas the producer gas may, if no use or market can be found for it without large expenditure of capital on thorough cleansing and distribution to a distance, be burnt to waste or blown away on the spot, the semi-coke from a distillation process is not so readily disposed of as a waste product. It is practically essential that distillation plant should be established only in places where a ready market is available for the semi-coke. It may be argued that if the plant is at the pit's mouth the freight charges are levied on the semi-coke instead of on coal to all town markets which will accept the former in place of the latter, but the charges are, in reality, higher for the semi-coke because the mass or weight of it is much less than that of the coal which a given railway truck or ship's hold can contain.

Thus, for a given fuel value transport charges are higher than for coal, while all cellars, scuttles, grates, &c., require more frequent replenishing. Hence the semi-coke must offer some very real advantage to the consumer over coal—may be in lower price per ton (which means still lower value than coal at the point of production), or may be in freedom from soot formation or some other æsthetic superiority on combustion. It is difficult to gauge to what extent consumers will pay for any real or fancied gains in the latter direction, and hence to be on the safe side the semi-coke should be valued at the place of production at, say, 25 per cent less per ton than the value there of house coal of good quality. The yield of semi-coke from a ton of coal is rather greater than the yield of coke on gasworks. The yield of sulphate of ammonia can never approach that obtainable from the same coal by producer processes, but should considerably exceed that realised on gasworks. The yield of gas will be only one-third to one-half that now obtained from a ton of coal on gasworks, and in most situations it seems likely that the best use for the gas will be to burn it for heating the distillation vessels and at the works power station, after ammonia, tar, light oils (benzol, &c.) have been extracted from it as completely as possible. The yield of tar, oil, &c., will be considerably greater per ton of coal than on gasworks, and appreciably greater than in producers. Moreover, these products will give a bigger yield of motor spirit and heavy fuel oil than gasworks tar, but much less pitch. The fuel oils will be of better quality than ordinary coal-tar oils for use both as fuel and as solvents or vehicles for pitch for road use, and the pitch will be an artificial bitumen of high grade. Though the tar or crude oil will contain less pitch than gasworks tar, yet, owing to the greater amount of the tar or crude oil obtained per ton of coal distilled, the yield of pitch per ton of coal will be greater than on gasworks. It is this fact which gives the low-temperature distillation schemes their chief interest to road authorities.

Provided the tar and sulphate of ammonia can be sold at something approaching their present market values, and provided the semi-coke can be sold at or near the point of production for not less than 75 per cent of the price payable at the same spot for the same weight of good coal, there seems to be good reason to suppose that a scheme for the low-temperature distillation of coal could be worked on a paying basis in many localities if the plant for the process were of good design. By good design the author means that the plant must admit of coal being distilled to the required degree at no greater expenditure, on account of capital charges, power and wages, than the corresponding expenditure on the carbonisation of the same weight of coal on gasworks. Obviously, any plant which does not allow the coal to be charged into the distillation vessels and the semi-coke removed from them entirely by mechanical means is unlikely to fulfil this condition.

Tar Spraying.—Tenders of the British Tar Spraying and Road Construction Company, 30 Baldwin-street, Bristol, for tar spraying, have been accepted by the Warwick and Glamorgan County Councils.

Vacuum Cesspool Emptying Plants.—With regard to the claim of Messrs. Merryweather & Sons, Limited—quoted in our issue of the 14th inst.—that they were the first to exploit the vacuum cesspool emptying system in this country, about fifteen years ago, Messrs. George Waller & Son, Phœnix Ironworks, Stroud, Glos., write pointing out that they supplied vacuum cesspool emptying plants to Tunbridge Wells in the early part of 1884.

Southampton's Open-Air Swimming Bath.

FERRO-CONCRETE WORK.*

By J. A. CROWTHER, assoc.m.inst.c.e., Borough Surveyor.

A bath, which was constructed some years before the writer of this paper came to the town, was presented to the Southampton Corporation by Mr. Tankerville Chamberlayne, Member of Parliament for the borough. The bath was originally 156 ft. by 30 ft., and had a depth of 6 ft. The ground proved to be very treacherous, and two forces had to be provided for: (1) When the tide is out and the bath full of water; (2) when the tide is high and the bath empty.

The Itchen is a tidal river, and the bath was and is filled by the rising tide. It is evident that the bath must be securely anchored to the bed of the river to ensure it remaining in position when the bath is empty and a high tide prevailing.

Soon after the old bath was brought into use, cracks in the walls and floors developed to such an extent that it was found to be impossible to keep the water in the bath when the tide was out. Tests were made by closing the inlet valve and allowing the tide to rise outside. The result was that as the tide rose a distinct tremor could be felt by any person standing on the edge of the bath. Again, wooden wedges loosely inserted at low water and with the inlet valve closed could not be withdrawn by hand when the tide had risen.

Under these circumstances the author could not advise the town council that it would be safe to use the bath even when there was sufficient water in it. In February, 1903, he submitted to the Baths Committee two schemes for reconstructing the bath, bearing in mind and attempting to provide for the two forces referred to. Scheme 1 was for ordinary elm piles with a concrete superstructure; Scheme 2 was for ordinary ferro-concrete on the Hennebique system throughout. The estimate for Scheme 1 was £1,069, and that for Scheme 2 £970, and as the difference in the estimated cost was so small, the author advised the town council to accept Scheme 2 (being now, from a variety of causes, distinctly of opinion that ferro-concrete work will last as long or longer than ordinary timber piling).

On account of expense and the necessity for obtaining better foundations it was decided to construct the new bath of less dimensions than the first one, and the desired end was obtained by curtailing the projection of the bath into the river.

The dimensions of the bath are 75 ft. by 30 ft. with a depth at the deep end of 7 ft. and at the shallow end of 4 ft. 6 in., the filter or straining chamber being 20 ft. by 10 ft. The greater part of the old bath was removed, but the side walls of the remainder were left so as to provide a promenade for the new part, care being taken to ensure the proper bonding of the old and new work.

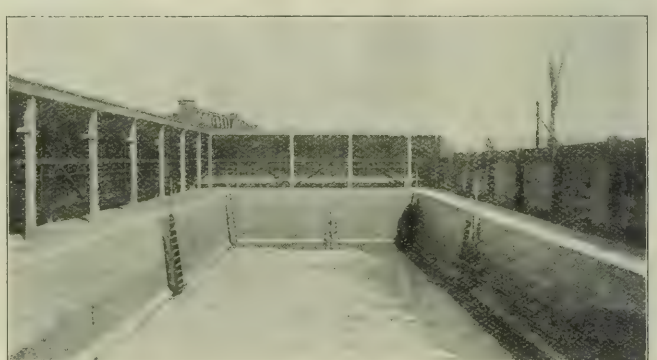
METHOD OF CONSTRUCTION.

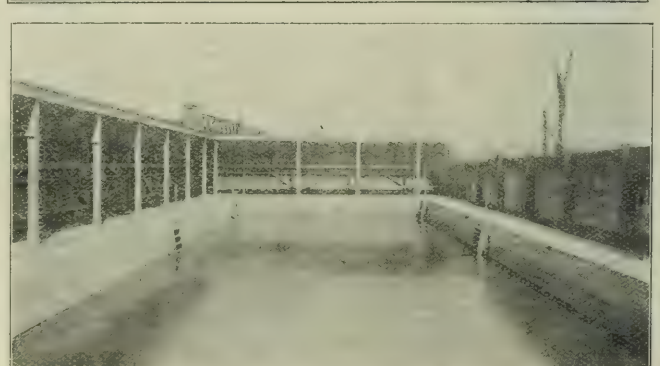
The whole bath and filter are carried on No. 22 ferro-concrete piles, 14 in. by 14 in. by 32 ft. long, 5 in. by 10 in. ferro-concrete beams, 4 ft. 10 in. centre to centre, laid longitudinally, and 7 in. by 13 in. ferro-concrete cross-beams laid 9 ft. 4 in. centre to centre. The specification provides that in the driving of the piles they must not exceed ½ in. set with a 30-cwt. monkey falling 30 in. for the last ten blows. The set of every pile was carefully observed and hereunder will be found a few examples:—

No. of pile.	Length of pile.	Length driven	Set.
11	32′ 0″	28′ 9″	⅛″
12	32′ 6″	28′ 0″	½″
13	32′ 6″	27′ 6″	½″
14	32′ 0″	26′ 9″	½″

It will be noted that although the piles were made 32 ft. in length the distance driven was from 26 ft. 9 in. to 28 ft. 9 in., at which depth we obtained the required resistance. The concrete was then stripped off the projection portion of the piles and the steel bars bent over and thoroughly interlaced with the horizontal and cross beams.

The floor and walls are 4½ in. thick. The concrete walls of the old bath (before referred to as being left as a promenade) are carried on the cross-beams, which are continued through the heads of the piles and about 15 in. under the old walls. A chase is then cut vertically in the old concrete wall, and the cross-beam continued upward on this chase as a counterpart. The steelwork of the whole, the piles, beams, floor and sides are all tied together, and interlaced by means of straps and the main bars, so that the whole is securely bound together.





Open-Air Swimming Bath, Northam, Southampton.

The piles were made in wooden moulds laid horizontally, and each pile was made up of four bars of 1¼-in. diameter, running the entire length of the pile, these being braced together with links or stirrups ⅜-in. diameter. The ironwork was first placed in position so as to leave a space of about 1½ in. and not less than 1 in. between the iron and wood framing, so that the concrete might entirely surround the metal and preserve it from the action of sea water. The mould was then filled up and carefully punned so as to make a solid mass.

The piles were turned in about fourteen days, and then left for further drying. When considered sufficiently set or hardened, the tiles were placed in an upright position for driving; in this position the atmosphere could play on all four sides of the pile and so quicken the process of seasoning. While in the vertical position each pile was watered every day before being driven. As it was necessary to complete the work as soon as possible, some piles were made up with an aggregate of 3 to 1, and driven three

* Paper read at the Southern District Meeting of the Institution of Municipal and County Engineers at Southampton on Saturday last.

weeks after being made. These piles showed no signs of fracture. The specification provided that the concrete for piles should have an aggregate of 5 to 1, and that for sides, floor and beams 4 to 1. The specification for concrete was very stringent, but the author does not propose to enlarge upon that part beyond saying that all the cement was carefully watched and tested, care being also taken to secure a clean aggregate.

Siemens-Martin mild steel was used in the ferro-concrete construction.

It was stipulated that a test piece, 1½-in. diameter, should be capable of bearing a tensile strain not less than 32 tons per square inch of sectional area, and that the elongation of such a test piece 8 in. in length, when subject to such a strain, should not be less than 20 per cent or more than 25 per cent before fracture; further, that a test piece, 1½-in. diameter, after being heated to a low cherry red and cooled in water at a temperature of 80 deg. Fahr., should be capable of being bent in a press without showing signs of fracture until the radius of the curve of the inner side of the test piece should not exceed 1½ times the thickness of the test piece.

Well knowing the difficulty of securing good concrete work in tidal waters, and as we have to contend with four tides every day, one conversant with this class of work will recognise the importance the author attached to securing a good contractor and a stringent specification, both as to workmanship and materials. The first was secured by adopting the Hennebique system of construction, as this firm insist upon their work being carried out by licensed contractors, which, of course, means that none but good, experienced men would be employed, and this we secured in Mr. F. Grace, a Southampton contractor. The specification provided that upon the completion of the work the bath was to be charged with water to high-water highest spring tide, and to remain so for at least forty-eight consecutive hours. Then it was to be left completely empty for the same period, and to remain perfectly watertight and sound in every detail under these conditions before the engineer gave his certificate as to final completion. The contractor had to maintain the bath in the same watertight condition for a period of twelve calendar months. Although the contractor experienced great difficulty in doing this, he succeeded, and left the bath as specified.

Lichfield Sewerage Extensions.—The Sanitary Committee of Lichfield Corporation reported recently that the whole of the sewerage extensions on the outskirts of the city had been completed at a cost slightly under the estimate of £3,350, and Mr. Deacon said he thought the congratulations of the council and city were due to Mr. W. B. Chancellor, the city surveyor, for the manner in which the work had been carried out. Almost insurmountable difficulties had been met with, but they had been successfully overcome, so that a very efficient little scheme had been provided in the Barry Hill district, and to have kept the cost within the estimate was a great credit to their surveyor.

"The Surveyor's" Coming-of-Age.—Mr. Edward Willis, engineer and surveyor to the Chiswick Urban District Council, writes: "May I add my congratulations to those you have already received from so many engineers and surveyors? I have been a subscriber to your paper for many years, and have on several occasions referred to my bound copies. I sincerely trust that THE SURVEYOR will continue to advance the interests of the profession in the future as it has done in the past, and should its high standard of efficiency be continued, there is little doubt that its future will be even more successful than its past career." Mr. Wm. C. Clifford Smith, engineer to the Asylums Committee of the London County Council, writes: "I should fail in courtesy if I were not to acknowledge the value that I have derived from the regular reading of your paper. It has kept me in touch with up-to-date works, with the latest that is doing in road construction and treatment of surfaces, with the pros and cons of the intercepting trap question, and, indeed, with the many matters that are dealt with and discussed in societies to which I belong and haven't the time to attend the meetings of; and as I have obtained many valuable hints from your pages, and have been put in touch through your advertisement columns with many matters that my committee have benefited by, I offer you my thanks and best wishes for the continued prosperity of your admirable paper."

ROAD IMPROVEMENTS IN SOUTHAMPTON.*

By J. A. CROWTHER, ASSOC.M.INST.C.E.,
Borough Surveyor.

We in Southampton, like many other places, have been compelled to change the construction of our roads so as to meet the requirements of modern traffic. Formerly the roads were constructed either of local gravel or flint. During the past few years we have used granite on the principal roads, but last year we decided to go one better, and have now in hand more than £20,000 worth of work on the Trinidad Lake Asphalt Company's system.

The Avenue was completed in December, 1911, the work being done in 3-in. Trinidad Lake asphalt-macadam, composed of 66 per cent Guernsey granite, 25 per cent of sand, cement, &c., and 9 per cent of Trinidad Lake bitumen. The Guernsey granite used is graded as follows: 50 per cent 1½-in., 25 per cent 1-in., and 25 per cent ¼-in.

This material is laid at a temperature of 250 deg., and rolled with a 4-ton roller (part was rolled with a 7-ton roller). A squeegee coat of Trinidad bitumen, suitably fluxed, is applied to the surface after rolling, and then sprinkled with ¼-in. granite chips. One ton laid and rolled 3 in. thick covers about 7 sq. yds.

The base is thoroughly rolled before the asphalt-macadam is laid, and any slurry that may be worked up is removed. The granite, &c., is heated to a temperature approximately 400 deg., and the Trinidad Lake bitumen, after refinement, is mixed while all is hot.

The asphalt-macadam can be conveyed from the works a considerable distance by road with the aid of motor lorries without losing much of its heat. The price paid was 5s. 2d. per yd. super., but, owing to increase in cost of freight, &c., it has now been raised to 5s. 6d. per yd. super., including excavating and carting away old material.

The company's plant at Southampton is capable of producing about 60 tons of asphalt-macadam per day.

Satisfactory work cannot be done in wet weather. The foundation must be thoroughly sound and dry; moreover, the material, granite, sand, &c., must be absolutely dry and free of clay or loam before being mixed with the asphalt, and if this is not attended to, failure must result.

Asphalt-macadam has been laid in Three Field-lane, one portion being 2½ in. thick with a 1-in. surface coat of finer graded ingredients.

The company guarantee the maintenance of their work for a period of five years without cost to the corporation.

Road Users and Road Regulations.—Road users met at the Great Central Hotel, Marylebone, recently, to take part in a conference convened by the National Cyclists' Union and the Cyclists' Touring Club for the purpose of discussing their rights, interests, and mutual obligations. Sir George Gibb, chairman of the Road Board, who presided, commented upon the indefiniteness of public rights on the highway, and suggested that they might profitably discuss the important question of the rules of the road. Dr. E. G. Turner, in a resolution, proposed the appointment of a committee to consider a number of points including the question whether the rules of the road should be altered, the advisability for increasing the minimum age of motor-cycle licensees from 14 to 18 years, the necessity for uniformity in warning signs, the establishment of a permanent central board of control, diminution of the camber of streets, and the amendment of the lights on Vehicles Act, 1907. Colonel R. E. Crompton, consulting engineer to the Road Board, seconded the proposition. Mr. H. Percy Boulnois, in a brief speech, deprecated the duplication of road boards, and insisted that what was necessary was to give the present Road Board—which had done very good work—further Parliamentary powers. The resolution was agreed to.

"The Civic Engineer's Who's Who."—The first issue of "The Civic Engineer's Who's Who" (London: St. Bride's Press, Limited, 24 Bride-lane, E.C., 2s. 6d. nett) gives wonderfully complete lists of the engineering officials of England and Wales. For a first issue it is very creditable.—*Glasgow Herald.*

* Paper read at the Southern District Meeting of the Institution of Municipal and County Engineers at Southampton on Saturday last.

Highway Administration in the United States.

STATE DEPARTMENTS : COMMISSIONERS : STATE ENGINEERS : COUNTY COURTS.

The important work in highway development which is being carried out in the United States often presents features which are of much interest to highway engineers generally from both administrative and technical points of view. The work done often suggests possible applications of the particular method employed in a given case, or may furnish an illustration of some principle of general importance. The fact that the climatic conditions of the United States differ from those of other countries may be an advantage rather than otherwise as a matter of comparative study, since an extreme of conditions, in one direction or another, often brings home facts which are overlooked when the influences at work are of a more ordinary character.

From the present point of view, and some others, it is a matter for regret that the boundaries of so many of the States of the Union are so placed that territories which would have formed natural areas are divided up among several States; while, on the other hand, the development of a centre of activity beyond the range of conditions which caused it has often led to the inclusion within the borders of a State of a country which has a character contrasting strongly with that which originally attracted the settlers who formed the nucleus of the modern State. The State of Maryland, for instance, has developed from what is a New World counterpart of our Viking or "Wicking" settlements, the natural features which attracted settlers and gave its character to Maryland being the "Wicks" or inlets giving access from Chesapeake Bay to the flat land of the great peninsula which sheltered it and of the opposite mainland, Potomac River is one of these inlets, and formed the natural western boundary of Maryland. So strongly marked is the "Wicking" character of Maryland that the State extends to-day across the peninsula to the eastern Atlantic coast only where that coast is protected by the long, narrow island which encloses Chincoteague Bay and its two small continuations, leaving to Delaware the unprotected coast to the north, with the portion of the peninsular not reached by the creeks running into the bays of its western side, and to Virginia the exposed and relatively creekless and bayless tail of the peninsular.

The State of Maryland has thus for the most part a definite character favourable to the formation of a characteristic system of highways, and the apparently unnatural division of the peninsular which it partly occupies is really a perfectly normal and advantageous development. When, however, we look at the north-western portion of the State, we find that following the boundary formed by the Potomac River the State of Maryland developed the country of stream and mountain along the left bank of that river, but extending to such small distances from it that the present straight-line boundary with Pennsylvania leaves Maryland with a narrow strip of territory swelling out at the far-distant end to a triangle with sides 35 miles long and with the river as its base.

The State of Maryland actually narrows down to a width of about 2½ miles some 35 miles east of this triangle, so that a State road system to serve an area which is roughly a triangle 75 miles by 35 miles has to pass through this administrative gorge, obviously an inconvenient condition in some respects, though the linking up of the different State road systems may, of course, provide practically all the highway communication which is required.

NATURAL AND ARBITRARY AREAS.

It is clear, then, that we cannot study the Maryland highway system to any purpose unless we recognise the vital difference between the service which it performs and that performed by a State system in a single area such as a peninsular, a river valley, or a State bordered by great natural barriers. California, for instance, is a State with a natural character favouring the establishment of a State highway system which can, to a large extent, be independent of other systems; for the State lies mainly between a great mountain range and the sea, and as the deserts which form a part of it are brought under cultivation by irrigation their roads will naturally form parts of the systems of Nevada and Lower California rather than extensions of a Californian system. Turning again to the group of small States in the north-east we see that New Jersey is definitely a maritime State, while the shape of Massachusetts, with its large development of important roads in the wide eastern portion, suggests that the inland part of the State is a territorial expansion of settlements originally of somewhat the same character as those of Maryland, Massachusetts Bay, Nantucket Sound, and the perfectly sheltered Buzzards Bay giving access to the creeks and low-lying country. But the boundaries between Massachusetts and the States to the north and south of it are, from the highway point of view, arbitrary and unnatural, leaving Connecticut with an area quite unsuitable for the development of a separate road system, and the "State" of Rhode Island in an even worse position, though both of these areas would have fallen naturally into that of a highway system developed as one with the road system of Massachusetts. Again, the State of Maine occupies an area of fairly consistent character; but New Hampshire, wedged between Maine and Vermont, is clearly an unfavourable area for a highway system, and it is possibly of significance in this connection that Vermont has no county system of road administration, the management of the roads being in the hands of town and village authorities and the State Highway Commission. These small States do not compare with European countries in area or population, and occupy a position in some respects intermediate between that of a whole country and that of a county; but some of the larger States occupy areas well suited to the development of distinct highway systems. California, where a State Highway Department has recently been instituted, has already been mentioned, and Florida, where there is no State Highway Department at present, offers, nevertheless, a favourable opportunity for the creation of a State road system. Illinois, lying for the most part between two great rivers, is also a natural area, as is Michigan, and the same may be said of Wisconsin, Louisiana, Georgia and Texas, and, if we recognise the relative unimportance of outlying portions, Washington may be included. To a less degree some other States are areas with boundaries of a natural character, or are partly contained within such boundaries—Ohio and Virginia for instance. In other cases the State boundaries are straight lines which have been set out with reference rather to the heavens than to the earth, and deny to the States which they divide the development of highway systems which are in any sense complete in themselves. Another point which must be considered when references are made to State systems of roads and State Highway Departments in America is that, though many of the States compare in area with countries such as England or France, their populations are very much smaller, those of some States being exceedingly small. Against this consideration we must set the fact that the use of motor vehicles now renders the establishment of a fairly complete main road system both a direct and an indirect economy even in the case of areas with population densities very much less than those hitherto necessary for the development of such a system.

Since, then, some of the States of the American Union are very small, and others very thinly peopled, and because in many cases the area covered by a State does not lend itself to the development of a system of roads which can in any sense be regarded as complete in itself, it is clear that the part played by the Federal Government is likely to be a very important one. The activities of the United States Office of Public Roads are both timely and well-directed, and it seems that such a central office is just what is needed in order that the development of roads in the whole country may be carried out efficiently and economically.

As regards individual States, the establishment of a State Highway Department, or of what usually amounts to nearly the same thing, a State Commission, seems to have been, in the first instances, the result of density of population and of commercial and industrial activity, other States having followed the example set them because the results were very satisfactory.

The following classification of the systems in operation at the present day is derived from the particulars

relating to the several States furnished in a bulletin of the Engineering Experimental Station of Iowa.

STATE DEPARTMENTS AND HIGHWAY COMMISSIONS.

The central highway department of a State is sometimes referred to as a "department" and sometimes as a "commission." In some cases there is only one commissioner. There does not seem to be any important distinction between departments and commissions. A single commissioner has wide powers and great authority in some States, while in others a commission consisting of a number of persons seems to have been given hardly any duties or powers of importance.

Alabama.—The State Highway Commission consists of a professor of civil engineering in the Alabama Polytechnic Institute appointed by the governing board of the institute, the State geologist, and three other members appointed by the Governor for a term of four years. The commission appoints a civil engineer as State highway engineer. There is an annual appropriation of £30,800 for State aid in addition to the allotment for office expenses. The State highway engineer keeps a record of the condition of the roads, with maps and other information, and supervises the construction and repair of roads and bridges improvements done with the aid of State funds. He also appoints engineers to supervise construction work.

California.—The department consists of the Governor, the State engineer, who is chief executive officer, the chief superintendent of State hospitals, and the chairman of the Board of Harbour Commissioners of San Francisco. The department acts as a central information office, may obtain rights of way by purchase or "condemnation," and may appoint State superintendents of highways. An important system of State highways is now being made.

Colorado.—In this State the department consists of six members appointed by the Governor for a term of six years. The secretary is a trained civil engineer who apportions the State funds among the counties, and maintains a central information department for highway work.

Connecticut.—A commissioner who is an "experienced road builder" is appointed by the Governor for a term of four years, and himself appoints a deputy and eight division engineers, and such other assistants as may be required. The State is divided into eight districts, one under each division engineer. The department makes roads and maintains them, and is responsible for State-aided roads being kept in proper repair. The State contributes liberally towards road construction and improvement in various ways, expending a bond issue of £900,000, at a rate not to exceed £150,000 a year.

Idaho.—The State Highway Department consists of the Governor, the State engineer, and the State mining inspector, and has general supervision over highways made wholly or partly with State funds. If the county communities fail to keep such a road in proper repair the State commission may make it a toll road for a period not exceeding five years. The State has recently allotted funds for the construction of State roads.

Illinois.—The State Highway Commission consists of three persons appointed by the Governor for a period of two years. The commission appoints a State highway engineer, carries out experimental and investigation work, and issues forms for office use. The State supplies expert assistance, road machinery and broken stone. The annual appropriation is £20,000.

Louisiana.—The State Board of Engineers appoints a State highway engineer and the assistants and staff necessary for the planning, construction and maintenance of roads and bridges. With the approval of the board the State highway engineer may purchase plant, machinery and draught animals for highway work.

Maine.—The Governor in Council appoints a civil engineer as commissioner of highways for a term of four years, and this official is invested with large powers and authority. He controls State road work, the disbursement of State funds, the appointment of inspectors, and the letting of contracts, and he maintains a central information office. The State contributions toward road construction are liberal.

Maryland.—The State Highway Department consists of the Governor (*ex-officio*), two hon. members who are officers of the State Geological and Economic Survey, and four other persons. The executive consists of a chief engineer and as many assistants as may be necessary, two assistant engineers having been appointed when the last report was issued. The department has large powers and authority, and is charged with the duty of preparing a definite system of State roads, and with the maintenance of all such roads after construction. Amounts up to half the cost of building a highway may be contributed by the State, on the basis of county mileage to total mileage.

Massachusetts. The State Highway Commission consists of three members appointed by the Governor for a term of three years. The members of the commission devote their whole time to the work of the department, and appoint as many engineers and clerks as are necessary. They have full control of State highways, and hold at least one meeting a year in each county "for the purpose of discussing the question of good roads." The expenditure derived from bond issues is limited to £100,000 a year, but additional large sums for road purposes are raised by taxation—£50,000 in 1909, besides £30,800 from the motor vehicle tax. This tax produced £63,200 in 1910. In 1911 the commission received a direct State appropriation of £40,000, and £60,000 from motor vehicle taxes. The town or city assessment for the maintenance of a State road may not exceed £10 per mile.

Michigan.—The State highway commissioner is elected by the people for a term of four years, and he has powers to appoint a civil engineer and assistants. The commissioner is invested with large powers of control and supervision. He can require local officials to furnish reports; he inspects road work, holds conventions, gives expert advice, and sends engineers to townships and counties when important highway work is being carried out. State aid may be withheld when roads are not satisfactorily maintained. There is a regular system of State aid.

Minnesota.—The three members of the State Highway Commission are appointed by the Governor for a term of three years. Not more than two of them may be members of the same political party. These officials are honorary, and they appoint a secretary who must be a "trained civil engineer and practical road builder," and such assistants as may be required. The commission studies road work in other States, holds meetings for the discussion of "the good roads question," records the location of road materials, organises the management of State roads, and exercises some measure of control over public roads generally. The funds derived from certain taxes are devoted to road purposes, and a special appropriation of £60,000 a year is made for bridges. The State does not contribute more than a third of the cost of any bridge. The last general assembly made an appropriation of £30,000 for State aid and the expenses of the commission.

New Hampshire.—In this State the Governor and council constitute the Highway Commission. A State highway engineer is appointed, and the commission also appoints engineers already in the service of the State for the purpose of furnishing expert advice. The commission provides plans and specifications for work done with the aid of State funds.

New Jersey.—A commissioner of public roads is appointed by the Governor, with the consent of the Senate, for a term of three years, and provision is made for the appointment of engineers and supervisors. The commissioner collects data relating to road improvement and construction, awards contracts for roads made with the aid of State funds, and plans and specifications have to be approved by him, including those prepared by the Board of Freeholders of a county. One-third of the cost of making county roads is paid by the State, and since 1891 more than £650,000 have been paid in State aid of road work.

New Mexico.—The State Highway Commission is composed of three hon. members—the Governor, the commissioner of public lands and the State engineer. The commission has supervision of all roads made or maintained partly or wholly out of State funds. The State engineer controls all county bridges costing more than £200 each. Every county is divided into road districts, not more than three in any county. All able-bodied men not exempted pay a road poll tax of 12s. 6d., or work for three days a year on the public roads.

New York State. Three commissioners are appointed by the Governor, with the consent of the Senate, for a term of six years. "At least one commissioner must belong to the minority party, and one is required to be a civil engineer and an experienced road builder." This State department has wide powers, including the supervision of all roads improved wholly or partly with State funds, and has a large measure of control

over the highway engineers and superintendents of local authorities. There are six divisions of the state the roads in each being under the supervision of an experienced "road builder." The State-aid policy is a liberal one; the cost of making State roads is borne entirely by the State, which also contributes 50 per cent of the cost of making county roads and gives other financial assistance in highway work.

Ohio.—A State highway commissioner is appointed by the Governor for a term of four years. This official approves appropriations for State assistance in road work, prepares plans and estimates, awards contracts, and apportions the cost between the State, the county, the township, and owners of land adjoining the roads. The State-aid fund is provided by an annual appropriation of £31,600, which must be equally distributed among the counties. To the cost of State-aid road work the State contributes 50 per cent, the county 25 per cent, the township 15 per cent, and the owners of abutting property 10 per cent. The State may maintain, out of any funds apportioned to a county, any road which is not kept in satisfactory repair by the county authority. All male persons who are not exempt must work for two days a year on the roads or pay 12s. 6d.

Oklahoma.—With the approval of the Senate the Governor appoints a State highway commissioner for a term of four years. The commissioner maintains a central information office, and prepares standard specifications. The funds are derived from a motor-vehicle tax of £1.

Pennsylvania.—The State highway commissioner is appointed by the Governor, with the consent of the Senate, for a term of four years. He must be an experienced road builder. Two deputy commissioners are also appointed, an accountant, a chief engineer, one assistant engineer, fifty superintendents of highways, and fifteen additional civil engineers. The department is a central information and consulting office, and the commissioner prepares plans and specifications, makes surveys and estimates, and may reject unsatisfactory tenders. He also apportions the State-aid fund. A sum of more than £1,250,000 was appropriated for the purposes contemplated in the Act which created this department. The State pays three-quarters of the cost of improving highways, and the county and township contribute one-eighth each. Ten per cent of the amount available for State aid is set apart for maintenance, and is distributed on a mileage basis.

Rhode Island.—This tiny State has a Board of Public Roads consisting of five members, one from each county, appointed by the Governor for a term of four years. State roads are made wholly with State funds, and a graduated tax on motor vehicles provides a fund for road maintenance.

Utah.—The State Highway Commission consists of five hon. members—namely, the Governor, the State engineer, the State treasurer, a member of the faculty of Utah Agricultural College, and a member of the faculty of the University of Utah. The commission controls the location of State roads, and acts generally in an advisory capacity in highway matters. An annual appropriation of £12,600 is made for the construction of State roads, and there is a road poll tax which must be paid in cash.

Vermont.—The State highway commissioner, who is appointed by the Governor with the consent of the Senate, controls the grants made from the State highway fund, and makes regulations as regards the spending of the money. He has power to appoint, with the consent of the Governor, one supervisor for each county to assist him in carrying out his duties. The counties thus form a part of the State system, but the county authorities have no control of highways. In 1910 an appropriation of £30,000 was made for highway improvement, and the motor-vehicle tax, which now yields about £12,000 a year, is devoted to maintenance.

Virginia.—With the consent of the General Assembly the Governor appoints a civil engineer as State highway commissioner for a term of six years. The highway commission also includes the professors of civil engineering in the University of Virginia, the Virginia Military Institute and the Virginia Agricultural and Mechanical College. The commission prepares plans and estimates for permanent highway improvements, and for new State roads, supervises the construction and repair of main roads, and the office is a central information department for the State. The commission has the further important power of approval or rejection of contracts after they have been awarded by the local authorities. A county applying for State aid must contribute half the cost of the work. An annual appropriation of £50,000 is made for highway purposes.

Washington.—The State Highway Board is composed of the Governor, the State auditor, the State treasurer, the State highway commissioner, who is appointed by the Governor for a term of four years, and a member of the State Railway Commission, appointed by the Governor. The highway commission acts in a consultative capacity, collects information and statistics, and gives help to local authorities. A part of the funds for highway purposes is derived from a tax on motor vehicles.

West Virginia.—The State highway commissioner is appointed by the Governor for a term of four years. He maintains a central information office, advises the Legislature with respect to roads, and exercises general supervision over roads which are made, improved or maintained with the aid of State funds. He also makes rules and regulations for county engineers, and examines the accounts and records of road officials generally. The State pays one-third of the cost of construction of county roads.

Wisconsin.—In this State the Highway Commission consists of the Dean of the College of Engineering of the State University, the State geologist, and three other members appointed by the Governor—all honorary. The commission appoints engineers and the staff of the department. An Act of 1911 appropriated £70,000 a year for road and bridge construction, and £8,000 for expenses. The county board of each county is required to appoint a competent man as county highway engineer. The new law provides for a continuous system of county roads or prospective State-aid roads. These may be made jointly by the town, county and State, each paying one-third of the cost. The State pays one-third or one-fifth of the cost of improvement. The cost of bridges of more than 6-ft. span is paid, two-fifths by the town, two-fifths by the county, and one-fifth by the State.

(To be continued.)

COMPARATIVE MEASUREMENT OF SMOKE.

THE "CARBOSCOPE."

The well-known firm of B. J. Hall & Co., whose head office is at Chalfont House, Great Peter-street, S.W., have recently placed on the market a new instrument for the comparative measurement of smoke. The instrument is intended to measure—*(a)* the apparent shade of the smoke as seen issuing from a chimney-top, also *(b)* the relative density of such smoke as compared with a unit density chosen for the purpose.

Messrs. Hall & Co. point out that present methods, which take no account of the diameter of the column of smoke examined, do not give results which permit of comparison either between chimneys of different diameter or with any standard of density. In the present instrument this factor is taken into account. The instrument is in the form of a small telescope, having fixed in the optical system, at a point which may be brought into the focus of both object-glass and eye-piece, a revolving eccentric disc containing a number of graduated smoked glasses arranged in cells around the centre. The glasses only fill half of each cell, so that by revolving the disc, as each cell with its glass is brought successively into the axis of the telescope, the smoke may be viewed through the open half of the cell, and matched to the glass in the other half. The smoked glasses are numbered in the ratio of their thicknesses—*e.g.*, glass numbered 20 is equivalent in transmission value to 20 unit thicknesses of the unit shade chosen. No. 40 is equivalent to 40 thicknesses, and so on.

The Sewage Commission's Eighth Report. Mr. George A. Hatt, sewerage engineer, Leeds, who was among the speakers at the recent meeting of the Royal Sanitary Institute, at which the Eighth Report of the Royal Commission on Sewage Disposal was under discussion, desires it to be made clear that in his remarks he said "the principal trouble which arose in considering the recommendations of the report appear to me to be the apparent lack of appreciation of the practical side of this difficult problem." The observation, we find, was not quite accurately reported in last week's issue.

THE SURFACE DRESSING OF ROADS.

THE "TARFLUX" PROCESS.

At Chislehurst, last week, a large body of road engineers and others witnessed a demonstration of a method of surface dressing which is likely, in the near future, to find considerable favour with both municipal bodies and the users of the public highways. The method is one which has already been subjected to the test of actual practice, and the opinions of surveyors in many of the localities in which it has been tried appear to leave no doubt as to its value as a means of prolonging the life of roads, and reducing to a minimum the trouble from dust and mud.

Road at Edwinstowe Notts, while Wet from Treatment with "Tarflux."

The process involves the use of the compound known as "Tarflux," which, by addition in certain proportions to tar and water, is applied in any reasonable state of the weather either by a special distributor or by an ordinary water cart adapted to the purpose, and the effect of the work is to solidify a substantial part of that crust of the roadway, the surface formed by the treatment somewhat resembling asphalt in appearance. A good grip is claimed to be afforded for both horses and mechanically propelled vehicles, the slightly rough condition in which the surface is left considerably reducing the possibility of slipping and skidding. At Chislehurst, on the occasion of the demonstration referred to, the compound was sprinkled over an ample space of road in Holbrook-lane, the operation, which was accomplished with the greatest ease and rapidity, leaving the surface of the road transformed in aspect from ordinary earthiness to that of having been asphalted. It says much for the simplicity of the process when it is stated that the work was carried out without fires having to be provided for heating the material applied, and without any special preparations whatsoever being necessary. The dressing flowed from the sprinkler in a semi-liquid form, and almost at once began to show signs of coagulation.

It is claimed for "Tarflux" that it hardens within a few hours, and that having been accomplished, it offers a tough and lasting surface which will withstand the heaviest traffic for a long period and show no ill-effects as a result of heavy rain, snow or frost. Beyond levelling and watering no special preparation of the road is stated to be required, and other noteworthy advantages attached to its use are that no stoppage of traffic—except where the latter is of a heavy nature—is necessary; heavy traffic can be allowed on roads shortly after their treatment with the compound; and it is non-poisonous—an all-important characteristic in districts where it is essential that fish life should not be affected by the surface drainage from highways.

Road Shortly After Treatment with "Tarflux."

Speed Limit on Thames Bridge.—It is understood that the Local Government Board have granted the application of the Richmond Corporation and the Middlesex County Council for a 5-mile speed limit over Richmond Bridge. The limit is to extend 83 yds. from the centre of the bridge on each side. The order, of course, only applies to motor 'buses and other heavy motor vehicles, and is stated to be the first order of the kind that has been issued.

Rebuilding of Southwark Bridge.—The rebuilding of Southwark Bridge is to be preceded by the demolition of the existing bridge, and the structure was closed last week to vehicular traffic. The work will occupy about three and a-half years, during which period foot passengers will be able to cross by means of temporary wooden gangways. The contract is in the hands of Sir William Arrol & Co., Glasgow, who widened Blackfriars Bridge and carried out the iron and steel work of Tower Bridge. Their tender amounts to £278,148, and the architectural and other charges will bring the total up to about £300 000. The three-arch bridge about to be demolished will be replaced by a five-arch bridge, on the same plan as the new St. Paul's Bridge and the present Blackfriars Bridge.

Comparative Reports of General Practice.—LXXX.

DUST COLLECTION IN AND AROUND THE METROPOLIS.—(2.)

The present comparative report of general practice—the first portion of which appeared in our issue of last week—deals with dust collection in and around the Metropolis, and is reproduced by the courtesy of Mr. Reginald Brown, M.INST.C.E., F.S.I., engineer and surveyor to the Southall-Norwood Urban District Council. Mr. Brown has collected information on the subject from no fewer than sixty-one districts.

District	Population.	Area in acres.	Storage.		Collection.						Disposal. How is your Refuse disposed of (in cubic yards) per annum.						Remarks
			Do you insist upon the provision of galvanised iron sanitary dustbins?	Do the owners or council provide same?	(a) How often is the refuse collected?	(b) Do you collect by contract or by your own staff?	(c) Is there a "house-to-house" collection, or is the "D" Card System adopted?	(d) What is the average number of men and carts employed daily?	(e) No. of cubic yards collected daily.	(f) Have you made any regulations as to assistance to be given by occupiers? If so, what?	Tip.	Brickfields.	Barging.	Destructor.	Other means	Cost.	
East Ham	150,000	3,326	Yes	Owners	Weekly	Contract for horses and drivers, who assist to fill vans. Engage our own fillers.	House-to-house	16 vans	48,728 collected annually (1911)	Yes (see remarks)	—	—	—	48,728	—	Estimated cost, 1912, £4,145. There will be a small balance, say £145	(f) Where the council themselves undertake or contract for the removal of house refuse from premises, and by a notice duly served upon the occupier of any premises specify the days on which, and the hours at which the council or contractor will remove house refuse from the premises, the occupier shall, on every such day and before every such hour, cause all such house refuse on the premises as is not intended to be removed for sale or for his own use to be collected in a movable receptacle, and shall cause the receptacle containing the house refuse to be placed in such a position on the premises as for the purpose of removing the contents of the receptacle will be most conveniently accessible from the nearest street used as a means of access to the premises for the removal of house refuse otherwise than through any dwelling-house.
Enfield	56,344	12,600	Galvanised iron dustbins are provided to practically all the houses in the district	Owners	Weekly	By own staff	House-to-house	6 carts, 1 van, 13 men	Average 45	See remarks	12,300	1,000	—	—	—	About 3/- per ton for collection and disposal	(f) We have circularised all occupiers, asking them to burn all vegetable refuse, &c.
Finchley	43,000	3,344	Yes	Owners	One collection weekly	Contract the contractor providing all men	House-to-house	7 vans (2 men and helper to each	27 tons	No	—	—	—	—	8,337 tons (burning in	1/9 per ton	

							directly employed by council, horse and man by contract	house	1 cart								
Friern Barnet	15,000, refuse collected from about 12,000	1,304	Yes	Owners	Weekly	Council's staff with hired horses & carmen	House-to-house	4 men including carters (2 carts)	6¼ tons	No	1,900 tons	—	—	—	—	See remarks	Total cost of dust collection and disposal about £430 per annum. (All refuse is weighed.)
Finsbury	87,923	586·6	See remarks 1	Owners	See remarks 2	Own staff	House-to-house	About 32 men and 19 vans	148 to 150	—	—	—	29,036	17,218	—	Barging 9½d. to 1,1; destructor 10¾d (excluding loans, &c.)	1. Only in those premises situate in certain of the main thoroughfares from which the refuse is collected daily. 2. Weekly from a portion of the district. Daily from premises in certain of main thoroughfares.
Fulham	153,000	1,856	No, but are mostly used	Owners	Weekly (see remarks)	Own staff	House-to-house	20 carts, 20 drivers, 20 dustmen. Paid 2/6 per ton collected	105 tons	No	—	—	—	19,299 roads = 31,642 tons	—	2/11 per ton destruction	Once a week, but in the case of mansions and blocks of flats, twice a week.
Greenford	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	The Council do not undertake the disposal of house refuse.
Greenwich	95,977	3,855	Yes	Owners	Weekly	Own staff	House-to-house	20 horses, carts and men, 20 carriers	See remarks	No	—	—	—	—	—	2/9 and 3/1½ per ton	(*e*) Daily collection varies. Average per week 280 tons (approx.).
Hendon (Rural) ...	16,000	11,321	Yes	Owners	Weekly	Contract	House-to-house	5	About 20	Yes (see remarks)	4,000-5,000	—	—	—	—	£610 per annum or a cost of 2/6 per yard	(*f*) The occupier of any premises shall deposit on the kerb-stone, or in a conveniently accessible position on the premises, a removable receptacle in which shall be placed the house refuse which has accumulated on such premises since the preceding collection.
Harrow	18,000	2,027	Yes	Owners	Weekly, but last summer twice a week	Own staff	House-to-house	6 regularly, extra carts and men when required	40	No	13,000	—	—	—	—	*1/10 per cubic yard. See remarks	* This includes collection and burning on refuse heaps Average cartage 2 miles. Now considering burning 4,500 cubic yards per annum at air compressing station by means of forced draught furnaces, which by saving of coal and cartage will reduce cost over whole collection to 1s. 6d. per cubic yard.
Hanwell	19,131	1,067	Yes	Owners	Weekly	Own staff	House-to-house	3 vans for 6 days. 3 carts for 3 days. 1 driver and 2 labourers to each vehicle	2,600 tons a year	No	—	—	2,600 tons	—	—	2/9 per ton	The council's men sprinkle carbolic powder in each tin after emptying.

(*To be continued.*)

STEEL FRAME BUILDINGS IN LONDON.*

By S. Bylander.

Chairman of the Junior Institution of Engineers.

The use of steelwork for the skeleton of the building before the passing of the London County Council General Powers Act of 1909 was relatively small. Considerable progress has taken place during the last ten years, and it is very interesting to compare the construction used ten years ago and that which is now gradually being introduced. In the year 1902 the usual construction was to employ some steelwork in the internal part of the building only, or to carry the external wall at the first-floor level on steelwork to permit large shop windows, and sometimes steel pillars were used to strengthen external walls. At that time there were no recognised standard sections, but each mill rolled their own particular shapes. These conditions made it very difficult for the structural engineer to select the most economical sections. Very great improvement has taken place through the standardisation of sections. The steel-makers' handbooks were not nearly so useful and complete as they now are, and the information at the disposal of the engineer was rather meagre.

The passing of the London County Council General Powers Act in 1909 has had a very good effect upon the method of construction. The introduction of recognised standard stresses and a general method of design and supervision will tend to simplification and economy in design and fairer competition and safer structures. No Act can be satisfactory to all, but it would have been better if the building code had taken the form of regulations by the London County Council instead of an Act of Parliament. All regulations in connection with engineering must necessarily be revised periodically as the science and practice advances.

ACCURACY OF CALCULATIONS AND DRAWINGS.

The chief point in connection with satisfactory and economical design is accuracy of drawings and calculations. Higher stresses can be used when all loads and stresses are accurately calculated, and when drawings are made so complete that no alterations, or very slight alterations, are necessary in the final work, and when the work is well supervised. A factor of safety is principally provided to make allowance for imperfections in material, workmanship and practical conditions, while very often it has also to cover inaccuracies of drawings and calculations; but, obviously, if the latter are more accurate the nominal factor of safety may be reduced, and the structure in both cases will still be equally safe. It is necessary to prepare more complete drawings, and give the work more careful and detailed supervision in the case of a structure of which the skeleton consists of materials, or composition of materials, which admit of high working stresses, such as steelwork as compared with stone or brick structures.

The economic use of materials necessitates stressing them as highly as possible consistent with safety, and in order to use high stresses great care and accuracy must be exercised. These rules apply equally well to steelwork and reinforced concrete. The plans for a structure should be laid out with due consideration to the employment of the materials intended. Spacing of pillars, depth and span of girders, spacing of beams, &c., affect the cost to a very considerable extent. It is hardly realised how much extra it costs to make the beams very shallow; very often double the material is put in beams because the original plans have been made with the assumption that shallow beams should be used in order to obtain greater head room. It can be said generally for steelwork, as well as reinforced-concrete work, the depth of beams of about $\frac{1}{18}$ to $\frac{1}{20}$ of the span is economical, and the spacing of pillars from 15 ft. to 20 ft. is also satisfactory. It is still more economical to place the pillars closer in one direction than the other in order to use only primary beams and no secondary beams. This, however, is seldom possible in ordinary buildings in London.

DRAWINGS.

The drawings required for the steel structure may be divided into three classes: (1) Plans, (2) constructional details, (3) shop details.

Plans.—The plans should show the general design, position of pillars and beams, and give all main sections and mark of every separate piece that is sent to the site.

Constructional Details.—Constructional details are required to illustrate and make clear the connections, riveting, machining, and all general requirements, the relative dimensions between steelwork and stonework, &c.

Shop Details.—These are made for use in the shop, and should show every dimension required to make the piece complete, and should not be merely constructional details leaving accurate position of rivets to be determined by the workmen in the shop.

It is of equal importance to have clear constructional details and shop drawings as to have carefully designed general plans. Unless the shop details are carefully worked out for dimensions given on the drawings, showing rivet spacing, sizes of rivets, edge distances, accurate position of open holes for field rivets, notes of special requirements such as cutting, machining, countersinking, &c., it is not possible to obtain satisfactory work on the site.

It may be argued that the men in the shop know perfectly well about rivet-spacing and details, and that the templet maker is more able to set out the work from a practical point of view than the draughtsman; but in reply I would say that the draughtsman should be in possession of all requirements of the shop, and unless he has a good knowledge of practical work he cannot make good shop details.

All details should be completed in the office by the draughtsman and properly checked before the orders are issued to the shop. The checking cannot be done so effectively in the shop as is possible in the office. If errors are not discovered until the steelwork is being erected it is then too late to rectify mistakes satisfactorily, and the result may be an unreliable and unsatisfactory structure. It may also be added that the cost of making alterations of the steelwork on the site is much greater than the cost of checking and correcting the details in the office.

PROGRESS OF WORK.

Systematic working throughout will prevent mistakes and difficulties, and procure satisfactory work and speedy erection.

Order Lists.—When the shop drawings are finished mill order lists are prepared giving section and size of material required, and the material is ordered from the rolling mills. Then shop order lists are prepared for all duplicate work such as cleats, brackets and stiffeners, and these order lists, together with the shop details, are sent to the shop and the work is put in hand.

During the process of rolling and manufacture an inspector supervises the work, tests the material, checks all dimensions from the detail drawing, inspects the finished member, and approves or rejects same before it is sent to the site for erection. The inspector sends weekly reports to the engineer giving the marks of the pieces, stating (1) material rolled, (2) pieces assembled, (3) pieces finished, and (4) pieces sent to site. In this manner the engineer can supervise the satisfactory progress of the work, and take precautions to avoid delay. The erection is a very simple matter if the pillars are set in accurate positions according to the pillar plan and the walls built to the dimensioned plans and details. The erection can proceed with great speed, as all pieces are made to exact dimension, and must fit when delivered, care being taken in making the design to allow for easy erection and the minimum amount of field riveting.

* Extracts from paper read at a meeting of the Concrete Institute on the 14th inst.

Refuse Collection Systems. A resolution has been passed by the Southampton Town Council to invite tenders for the removal of house refuse in the Portswood and Town districts. Councillor Weston stated that the saving by removing refuse by contract instead of by direct labour was £1,300 up to date, and the Watch Committee therefore recommended that the system should be extended. He had made inquiries as to the number of complaints made under the contract system compared with what they were under the direct labour system, and he was assured by the borough engineer (Mr. J. Crowther) and the wharf superintendent that there were not more complaints, and that the work had been well done. Under the old contract system the contractor was paid so much for collecting the refuse, and now they got a certain sum for a certain weight, which was why the system was so successful.

WILTSHIRE ROAD RECONSTRUCTION SCHEME.

COUNTY SURVEYOR'S STATEMENT.

The decision of the Wilts County Council to expend a sum of £74,700 upon the reconstruction and maintenance for nine years afterwards of the 35 miles of the London-Bath road which runs through the county was announced briefly in The Surveyor last week. The statement of expenditure, according to the report of the Roads and Bridges Committee, is as follows:—

Grant from Road Board	£34,700
A loan of £35,000, free of interest for eight years, such loan to be repaid at the rate of £4,450 per annum	35,600
County council payment towards work first year	4,400
Total	£74,700

These figures make the cost to the county £4,450 per annum for eight years. The cost of the road in 1912, exclusive of tar-painting, was £3,850, but up to March 31st next it is estimated at £4,072, and for the year ending March 31, 1914, at £4,323. It, however, the road is maintained on its present system, the county surveyor (Mr. J. C. Powell) says a continual increase may be expected, and he estimates that the cost nine years hence would be nearly £6,000.

"I have," he says in a special report dealing with the subject, "given a deal of thought and consideration of the matter of the maintenance of this important trunk road, and in doing so I have come to the conclusion that it is quite impossible efficiently to upkeep it to carry modern traffic with the material which is now being used. Without efficiency we could continue to repair it with local material as has been done in the past, but to do so, in my opinion, would prove to be not only unsatisfactory, but much more costly than at present.

"To attempt to effect an improvement in the condition of it by a further increase in the quantity of material, would, I think, be unwise. The present bulk of material used per annum, in my opinion, is ample for efficient upkeep, but the nature of 90 per cent of it is wholly unsuited.

"I would suggest that the use of flints and limestone laid on the water-bound system be abandoned, and that a bituminous-bound system should be adopted.

"The initial cost of the construction of a bituminous-bound road would be very much in excess of the cost of a water-bound road, but assuming the money forming the first cost could be obtained in the form of a loan, free of interest, repayable in, say, seven or nine years, together with a lump sum in the form of a grant in such a way as to make it an annual charge on the county rate, I am of opinion that the alteration would prove to be economical.

"As to the foothold which a tarred or bituminous-bound surface affords to horses, I readily admit that at certain times of the year, say in November and December mainly, when white or hoar frosts are frequent, the surface of such roads is more slippery than the surface of an ordinary macadam road; but by reducing camber and screening the surface of the tar, much of the danger occasioned by slipperiness has been obviated.

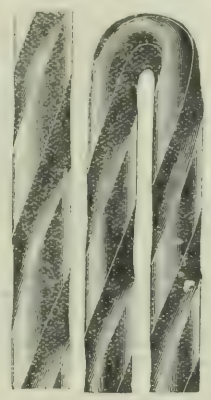
"With regard to hills or steep gradients, it is not intended that the surface for the entire width of the road should be formed with tarred material.

"Where the gradient of any hill exceeds 1 in 25, I suggest forming the surface of the road, which should be 20 ft. in width, as follows: The centre, 10 ft. in width, to be composed of bituminous-bound macadam; and on each side the surface to be bound with Ferromac 5 ft. in width, for the purpose of providing the necessary foothold for horses.

"The Bath road through Wiltshire is just about 35 miles in length (less 100 yds.), of which 30½ miles are in the rural districts of Ramsbury, Marlborough, Calne, and Chippenham, and the remainder in the boroughs of Marlborough, Calne, and Chippenham. The road referred to is that which at Beckhampton goes on to Calne and through Chippenham, not that which goes through Devizes and Melksham. Its highest point is along the Marlborough Downs, where it is 636 ft.; it drops considerably at Calne, where it is 240 ft., and reaches its lowest point in the Avon Valley at Chippenham, where it is only 95 ft. Its width varies from 17 ft. to 22 ft. From the Berkshire border until it begins to drop down to Calne it rests on a chalk subsoil, but coming off the chalk it goes over the upper greensand, the gault, Kimmeridge clay, Oxford clay, cornbrash, and oolite. On the Down it is at present chiefly surfaced with flint, with here and there an admixture of sarsen, limestone, or granite, but in the Chippenham district limestone and basalt with a little granite are used. With a tar binder on a few lengths."

SPIRAL BOND BARS FOR REINFORCED CONCRETE CONSTRUCTION.

We have received from the Spiral Bond Bar Company, Limited, of Caxton House, Westminster, an attractive booklet setting forth the advantages of the "Triseo" Spiral Bond Bars for reinforced concrete construction, which are the speciality of this firm. These bars are produced by a dual process of manufacture, from which they derive their peculiar qualities.



"Triseo" Spiral Bond Bar.

In the first place, straight bars of special section are rolled, and this having been done, the bars are gently and gradually twisted until they assume a spiral form. It is claimed that the result is a reliable and economical steel bar for reinforced concrete work, which provides an effective mechanical bond without giving rise to forces tending to split or crush the surrounding concrete. The booklet is illustrated with a series of excellent photographs, showing the works at which the bars are manufactured, and also several important buildings, &c., in the construction of which they have been used. The latter include factories, grain silos, warehouses, lodging-houses, wharves, and water towers. The main advantages claimed for these bars are economy and efficiency on account of the strength and high yield point of the steel, and the provision of a mechanical bond, avoiding any special precautions such as fishtailing and non-liability to set up hair cracks in the concrete.

TRAFFIC STATISTICS IN HOLBORN.

REMARKABLE FIGURES.

The Road Board have agreed to make a grant of £1,400 towards the cost of certain paving works to be carried out by the Metropolitan Borough of Holborn.

The traffic statistics prepared by the borough surveyor, Mr. E. F. Spurrell, give some surprising figures. In Gray's Inn-road the average vehicles per day of sixteen hours—6 a.m. to 10 p.m.—is 11,451, of which 6,900 are of heavy type. At midday the number per hour is considerably higher. The total weight in tons per yard width of carriageway is 1,090 per day. In Rosebery-avenue the average number per day is 6,700, of which 3,970 represent heavy-type vehicles. The total weight of all vehicles is 760 tons per yard width of carriageway. 1,200 motor omnibuses per day use Gray's Inn-road, and 1,100 motor omnibuses use Rosebery-avenue; 2,000 tramcars pass along Gray's Inn-road, and 1,300 in Rosebery-avenue. Excluding tramcars, the percentage of motor vehicles in Gray's Inn-road is 36 per cent, and in Rosebery-avenue 52 per cent.

Neither Gray's Inn-road nor Rosebery-avenue can be considered main roads; therefore, the amount of traffic is enormous.

Office Conversations.—The seventh of the series of articles under this heading is unavoidably held over until next week.

Assistants' and Students' Section.

Conducted by SYDNEY G. TURNER, Assoc.M.Inst.C.E.

All communications in regard to this page must be addressed to The Editor, St. Bride's House, 24 Bride-lane, Fleet-street, E.C. *Envelopes must be marked "Assistants' Section" in the top left-hand corner. Correspondents are invited to submit questions for consideration and answers to the questions which appear. For the contributions considered to be the most meritorious, one or more premiums in books will be awarded monthly. Diagrams must be drawn to scale on separate sheets, ready for reproduction.*

QUESTIONS.

This week answers are invited to the following questions:—

309. Water Supply.—In laying a large water main carrying water from a gathering ground several miles from an urban district, and also distributing mains in the district, where and at what points would it be necessary to place air and other valves? Give reasons. (W. L., *Ripley.*)

310. Decay of Timber.—What are the causes of decay in timber placed under water? How can it be prevented?

311. Surveying.—How would you draw a "give and take" line to an irregular boundary to facilitate taking out an area? (C. F. H., *Lincoln.*)

312. Design of Structures.—How can the weights of bridge members be allowed for when designing the structure? (H. V. O., *West Bromwich.*)

313. Mechanical Haulage.—What is the most suitable plant for hauling road metal over weak country roads by mechanical traction? How does the cost compare with horse haulage? ("Ehu.")

[The Editor is at all times glad to hear from readers who desire to submit questions regarding matters of general interest, points of daily practice, &c., for insertion in the "Assistants' and Students' Section." Questions which are published are taken into consideration, as well as other matter, in awarding the Monthly Premium.]

REPLIES TO QUESTIONS.

300. Retaining Wall.—A retaining wall is required to support a roadway having no footpath, and consequently heavy vehicles, such as steam rollers, &c., will seriously surcharge the wall. The height of the roadway above the adjoining ground is 8 ft., and the filling will be good clay. Design a suitable wall in mass concrete, and show calculations. (D. G. B., *Darlington.*)

Fig. No. 1 represents a retaining wall supporting a mass of earth. The line A B is the angle of repose of the earth, and C B is the line of rupture or of initial failure.

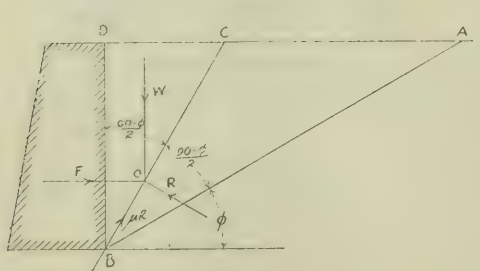


Fig. 1.

It is required to obtain an expression giving the horizontal force exerted by the wedge of earth C B D in terms of the weight of same.

F = reaction of resultant pressure acting ⅓ up the wall from B.

R = reaction on plane B C acting ⅓ up the plane from B.

μ R = frictional resistance to sliding acting along B C.

W = weight of wedge acting through c of g of same.

The lines of action of these forces all pass through the point o.

To reduce these forces to a triangle of forces, equate the two forces R and μ R.

Fig. No. 2 represents a parallelogram of these two forces.

$$\mu = \tan\phi \therefore \mu R = R \tan\phi$$

$$\therefore \tan d\,b\,c = \frac{\mu R}{R} = \frac{R\tan\phi}{R}$$

$$= \tan\phi$$

$$\therefore \text{angle } d\,b\,c = \phi$$

Then resultant R_1 makes an angle with the vertical $= 90° - \frac{90-\phi}{2} + \phi$

$$= \frac{90-\phi}{2}$$

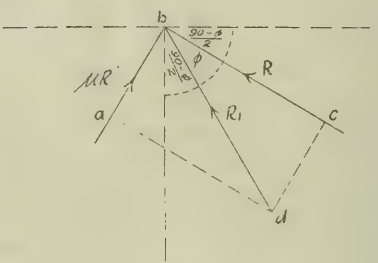


Fig. 2.

Fig. 3.—Construct a triangle of forces for F, W and R_1, then $F = W \tan \frac{90-\phi}{2}$

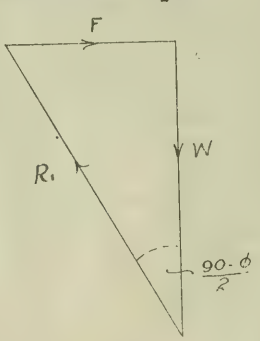


Fig. 3.

Fig. 4 shows the section of proposed wall. Consider the stability of same along line A B. The

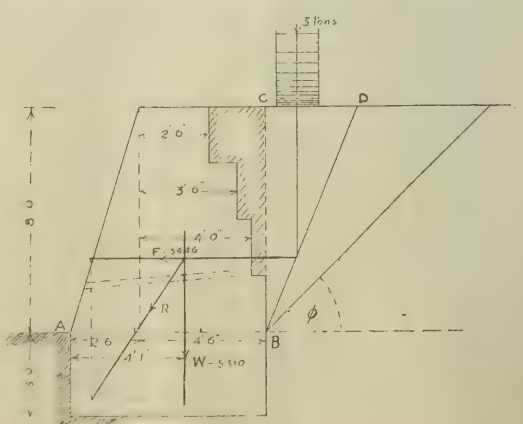


Fig. 4.

wall will be most adversely affected when the weight of a vehicle acts through the c of g of

The Surveyor

And Municipal and County Engineer.

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the wedge of earth B C D. The rear wheel of a steam roller will probably be the heaviest load to surcharge the wall. Assume this load to equal 3 tons.

The angle of repose for firm clay = 45°
The weight of concrete = 130 lb. per cub. ft.
" " clay = 120 lb. " "

Weight of wedge of earth BCD $= 3\frac{1}{3} \times 4 \times 120$
$= 1,600$ lb.

Weight of earth and load = 3 tons + 1,600 lb.
$= 6,720 + 1,600$
$= 8,320$ lb.

Horizontal force $F = 8,320 \tan \frac{90 - \phi}{2}$
$= 8,320 \times \tan 22\frac{1}{2}°$
$= 8,320 \times \cdot 4142$
$= 3,446$ lb.

Weight of wall $= (2\frac{1}{2} \times 2 + 3\frac{1}{2} \times 2 + 4 \times 2 + 4\frac{1}{2} \times 2 + 4 \times 2\frac{1}{2}) 130$
$= 39 \times 130$
$= 4,470$ lb.

Weight of earth directly carried by wall $= 3\frac{1}{2} \times 2 \times 120$,—shown cross-hatched in Fig. 4
$= 840$ lb.

∴ Weight of wall and earth acting with it = 4,470 + 840
= 5,310 lb.

To obtain position of c of g of wall, take moments of area about A.

As the clay weighs very nearly as much as the concrete per foot cube, we can, for the purpose of finding this c of g, assume the back of the wall vertical.

then $(8 \times 4\frac{1}{2} \times 4\frac{3}{4} + 4 \times 2\frac{1}{2} \times 1\frac{2}{3}) = (8 \times 4 + 4 \times 2)\ x$
$187\frac{2}{3} = 46\ x$
$\therefore x = \frac{563}{138} = 4 \cdot 08$
or 4′ 1″

We can now construct a parallelogram of forces by plotting the two forces F and W.

It will be seen that the resultant line of pressure passes just within the middle third of the base A B.

Fig 5.—We will now consider the stability of the wall about the line X Y, half way down the wall.

Weight of wedge of earth Y E F $= 2 \times 1\frac{1}{4} \times 120$
$= 400$ lb.

Weight of earth and load = 7,120 lb.

∴ Horizontal force $F = 7,120 \tan \frac{90 - \phi}{2}$
$= 7,120 \times \cdot 4142$
$= 2,949$ lb.

Weight of wall $= (2\frac{1}{2} \times 2 + 3\frac{1}{2} \times 2 + 2 \times 1\frac{1}{4}) \times 130$
$= 14\frac{1}{2} \times 130 = 1,885$ lb.

Weight of earth this part of wall actually carries $= 2 \times 1 \times 120$
$= 240$ lb.

∴ Weight of wall and earth = 2,125 lb.

The c of g wall is obtained as before, and position is 2 ft. 8 in. from X.

Plot parallelogram of forces F and W as before,

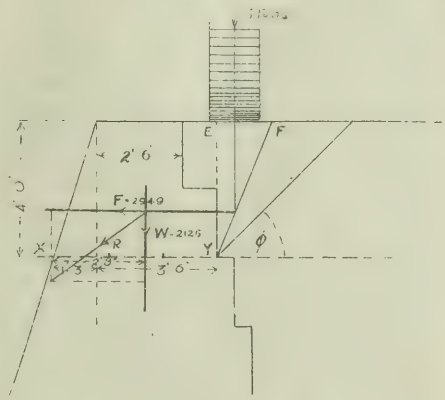

FIG. 5.

and this time it will be seen that resultant line of pressure falls outside the middle third.

This means there will be a certain amount of tension at the back of the wall.

In this instance, where the wall is to be constructed of mass concrete, a small amount of tension will do no harm; if, however, the question of cost is a secondary consideration, it would be as well to thicken the top half of the wall.

Were the wall constructed of uncemented blocks it would be absolutely necessary for the line of thrust to be kept within the middle third throughout the wall.

The foundations of this wall should be carried down at least 3 ft., but it will be unnecessary to have any footings, as the weight of the whole wall is only 2 tons per foot lin., and 7 ft. of earth will easily support this weight.

The clay filling behind wall must be well drained, as it is very liable to expand when wet. (A. V. C., *Nelson.*)

307. Hydraulics.—A stream is gauged over a rectangular weir or notch. The width of the notch is 3 ft. 6 in., and the height of the still water over the edge of the notch is found to be 14½ in. Find how many gallons pass over the weir per twenty-four hours, neglecting the velocity of approach. (D.)

We will employ Francis' formula. (For derivation, see Lea, or any other well-known hydraulics text-book.)

Let Q = Flow in cubic feet per second
L = Width of notch = 3·50 feet
H = Height of still water-level above sill of weir = 1·208,
N = Number of end contractions of stream. Here = 2

Then $Q = 3 \cdot 33\ (L - \cdot 1\ N\ H)\ H^{\frac{3}{2}}$
$= 3 \cdot 33\ (3 \cdot 5 - \cdot 1 \times 2 \times 1 \cdot 208)\ 1 \cdot 208^{\frac{3}{2}}$
$= 3 \cdot 33\ (3 \cdot 500 - 0 \cdot 242)\ 1 \cdot 328$
$= 14 \cdot 43$ cubic feet per second

Or in gallons per 24 hours
$14 \cdot 43 \times 60 \times 60 \times 24 \times 6 \cdot 25$
$= 7,790,000$ gallons.

(W. H. B., *Bocking.*)

INSTITUTION OF MUNICIPAL AND COUNTY ENGINEERS.

SOUTHERN DISTRICT MEETING AT SOUTHAMPTON.

A Southern District meeting of the Institution of Municipal and County Engineers was held at the Town Hall, Southampton, on Saturday last. Among those present were Messrs. R. Read (Gloucester), L. S. MacKenzie (Bristol), F. R. Phipps (Basingstoke), J. W. Webster (Cowes), L. A. Cozens (Isle of Wight), W. W. Candy (Eastleigh), G. B. Hartfree (Alton), Thomas Cole (Westminster), D. J. Brown (Cowes), H. C. Phillips (Hursley), F. Heather (South Stoneham), F. Dyson (Romsey), W. H. Masters (Southampton), G. O. Lockwood (Winchester), O. S. Webb (Newbury), J. A. Crowther (Southampton), A. Dixon (Southampton), C. Chambers-Smith (London), and H. C. Clifford (Southampton). Apologies for absence were received from the president, Mr. R. J. Thomas, J. S. Pickering (Cheltenham), L. S. Dashper (Sandown), and W. H. Bowen (Reading).

The members were very heartily received by the Mayor (Councillor H. Bower, R.N.R.), who much regretted the absence through illness of Sir James Lemon, an old member of the institution and of the corporation. Had Sir James been present he would no doubt have given the meeting some interesting comparisons between the Southampton of old and of to-day, especially as regards the improvements in drainage and flood prevention.

After partaking of hospitality in the mayoral parlour, a visit was made to the Trinidad Lake Asphalt Paving Company's works, where the process of heating and sifting the granite used, and the mixing with asphalt, cement and sand, was witnessed. Roads laid with this paving were traversed, the operation of laying and rolling the hot mixture being afterwards seen. A reinforced concrete bath on the bank of the river Itchen was also visited, Mr. Crowther explaining the difficulties presented in the carrying out of this work.

The mayor was later on present at a luncheon at Ward's Restaurant, and the Chairman, Mr. R. Read, proposed a hearty vote of thanks to his Worship for his kindness in allowing the use of the town hall and for his personal interest in the meeting.

The members proceeded to the formation of the District Executive Committee. This was made as representative as possible, and it is hoped that where the gentlemen elected were absent they will consent to serve. The following were elected—viz.: Messrs. J. S. Pickering (Cheltenham), S. Stallard (Oxford), W. J. Goodwin (Salisbury), S. J. L. Vincent (Newbury), J. A. Crowther (Southampton), J. W. Webster (Cowes), L. A. Cozens (Isle of Wight), T. J. Gulbert (Guernsey), J. H. Blizard (Southampton); ex-officio: R. Read (Gloucester), district chairman; L. S. MacKenzie (Bristol), district representative; F. R. Phipps (Basingstoke), hon. district secretary.

Papers giving particulars of road construction in Southampton, and describing the open-air swimming bath at Northam, were afterwards read by Mr. J. A. Crowther, the borough surveyor, and will be found enumerated elsewhere in this issue.

A discussion was opened by Mr. Chambers-Smith, who proposed a hearty vote of thanks to Mr. Crowther for his paper. Messrs. Hartfree, MacKenzie, Webster, Phipps and Read also spoke on the paper.

It is hoped to arrange for an early meeting in the Isle of Wight.

Rhyl Pier Sold at Auction.—Rhyl Pier is reported to have been purchased at auction by the Rhyl Urban District Council for £1,000, negotiations for sale to the council at a contract price of £7,250 having fallen through.

Proposed City Subways.—The city engineer of London, Mr. E. Sumner M.Inst.C.E., has been instructed to report on the feasibility of constructing a subway at Ludgate-circus. The difficulties which present themselves are almost entirely due to the existence at this point of the Fleet sewer, and to the dangerous nature of the ground owing to the course of the old Fleet River. Another subway is contemplated at or at King William-street, near London Bridge, which one is under construction opposite the Mansion House station.

HIGHWAY MAINTENANCE IN GODSTONE RURAL DISTRICT.

At the last meeting of the God-tone (Surrey) Rural District Council, the Highways and Finance Committee presented the report of Mr. G. E. Crowter, the highways surveyor, on the estimates for the year ending March 31, 1914.—The report stated: "I am able to report a reduction of the highway rate to the extent of 1½d. in the £, and this represents a sum of £937 14s., calculated on last year's assessable value of the district. The total estimates amount to £13,663 14s. 11d., and, deducting the county council's contributions towards the two contributory roads (a sum of £819 11s. 10d.), leaves a nett expenditure of £12,844 13s. 1d. The assessable value of the district for rating purposes at January 13th last was £152,227, and the proposed expenditure will necessitate a highways rate of 1s. 8¾d. in the £, being 1½d. in the £ less than the current year."

The estimates are made up as follows: Estimated cost of tar-washing, £3,450 8s. 4d.; a penny rate for improvements, £634 5s. 7d.; provision for manual labour for maintenance only, excluding repairs to roads and quarrying stone, £1,521; resurfacing with tar-macadam, £976; supply of materials and repairs to highways generally, £7,082 1s.; total, £13,663 14s. 11d.

VALUE OF TAR-WASHING.

Mr. Crowter says: "I consider the present decrease of expenditure is largely due to tar-washing, which undoubtedly preserves the road surfaces and prolongs the life of same, and I have arranged to still increase the area to be covered by 16,400 super. yds. Two years ago I advocated the use of tar-macadam for resurfacing, and since then Lingfield village, De Tillens-lane and Tidy's Green, Limpsfield, part of Limpsfield Common and Warlingham village, and a length on Wormsheath Common, have been treated with this class of material, and consequently the maintenance of these roads has been reduced to a trifle in comparison with former years. I have therefore again provided for further extensions of this system of treatment at Oxted and Lingfield."

WORKMEN'S WAGES.

The highway surveyor stated that he had given careful attention to the question of workmen's wages. He felt sure it was the wish of the council to pay fair wages to their workmen, and he thought the time had arrived when certain increases should be made, having regard to the advance in the cost of living and to the fact that in some cases the men were underpaid. The total money value of the increases he proposed would represent about £200 per annum, but it would not increase the highway rate, as he had been able to make reductions in other directions.

The report and estimates were adopted.

EXPENSIVE LITIGATION.

RURAL COUNCIL'S HEAVY BILL OF LAW COSTS.

Accounts were presented at the last meeting of the Godstone (Surrey) Rural District Council showing the taxed costs to the council of the proceedings in regard to the Lingfield roads case and the Rabies Heath alleged encroachment case. In the Rabies Heath case the council costs were £944, and the other side £740 11s. 6d.; total, £1,684 11s. 6d. In the Lingfield case the costs of the other side were £596 3s. 3d., and the council's £819 2s. 10d., a total of £1,415. The sum of £55 9s. 4d. had to be added for the cost of taxation, making the total to be paid by the council, for both cases, £3,155 6s. 11d. The sum of £31 8s. 2d. was taken off by the taxation. It was explained that the sum now due to be paid was £590, the other having been paid by instalments from time to time as the actions proceeded.

Talkin Waterworks.—The Local Government Board have sanctioned the scheme prepared by Messrs. Taylor & Wallin, civil engineers, Newcastle-on-Tyne and Birmingham, for supplying the village of Talkin, Cumberland, with water. The supply will be wholly by gravitation, and no pumping will be required. Tenders for the construction of the works will be invited at once.

CORRESPONDENCE.

For every ill beneath the sun
There is some remedy or none:
If there be one, resolve to find it:
If not, submit, and never mind it.
—Anon., 1760 (?).

LAND VALUATION BOARD APPOINTMENTS: A WARNING.

To the Editor of The Surveyor.

Sir,—Will you allow me, through your valuable journal, to counsel all young surveyors who hold positions under either county, town or urban councils to pause before accepting any position under the Land Valuation Board? Some may consider this advice as absurd; but let them hear.

A son of mine, who has served his articles and was doing very well under a certain urban district council, and was, as many are, anxious to improve his position, was attracted by an alluring advertisement requiring a fully qualified surveyor. This he duly answered. He was requested to attend before a Government official, who put him through a test examination in surveying, use of instruments, and geometry, &c., which he successfully passed. Later he was required to fill up a form asking a series of questions on exams. passed, and other information. Some time later—to be precise, six weeks—he was duly appointed as a temporary valuation assistant. Imagine his surprise after having been engaged some months, to find that his work had not, nor ever would, have any bearing on his profession. He has not as much as made a tracing, let alone done any surveying, with instruments or otherwise. Oh, the irony of it! His present duties consist chiefly of going from door to door asking questions such as the following: "Who is the landlord?" "Have you a flushing cistern?" "What is the rent?" &c., &c. Having obtained this and other such information, he proceeds to the office to make up what is known as a field book for the valuer—practically all clerical work.

Having been entrapped into accepting this so-called Government appointment he has received a serious check in his career. He has no chance whatever of showing his professional abilities—in fact, no ability is required. The work is dull and uninteresting, and of not the remotest use in his future professional career.

Why on earth are Government officials allowed to obtain young fellows under such false pretences, and blight their future? Why does the Chancellor of the Exchequer not fill such vacancies with ex-soldiers or ex-butlers, no professional knowledge or experience being necessary? What use will a young surveyer be either to himself or anyone else after a year in such a department? Or should he continue under this department in the capacity in which he is at present engaged, will the Chancellor, when the land valuation is completed, find him a berth? I fancy not. What is to become of the hundreds of professional young men who have been obtained under similar circumstances? Shall we see them out on the street? What does the Government care?

I sincerely trust that the publication of this letter will act as a warning to young professional men who are likely to be deceived in what they imagine as a progressive Government berth.—Yours, &c.,

A Disgusted Parent.

February 21, 1913.

Motor 'Buses and Damaged Roads.—The Hornsey Town Council recently obtained counsel's opinion regarding motor-'bus traffic as extraordinary traffic, and proposed to take action to recover damages from the motor-'bus company in respect of injury which has been done to the roads. At last Friday's meeting of the council it was stated that the managing director of the 'bus company had written that he and his legal advisers had arrived at the conclusion that the traffic conducted by the company was not extraordinary traffic. The development of the means of locomotion, he added, was such that it was the duty of the local authority to make a road strong enough to stand the traffic which could reasonably be expected to go upon it, such traffic, in so far as the roads in question were concerned, including motor omnibuses. That being so, while they did not admit that their omnibuses had done any damage, on the other hand, if such damage had been occasioned it was not due to extraordinary traffic, but to the fact that the roads were not of sufficient strength to carry ordinary traffic of the present day.

LOCAL GOVERNMENT BOARD INQUIRIES.

The Editor invites the co-operation of Surveyor *readers with a view to making the information given under this head as complete and accurate as possible.*

INQUIRIES HELD.

Doncaster T.C. (February 20th. Mr. Edgar Dodgson.)—This was an inquiry into an application by the corporation for compulsory powers to acquire certain properties in St. Sepulchregate for street improvements.—The town clerk, Mr. R. A. H. Toxey, said the corporation desired to continue the widening of St. Sepulchregate (Within and Without), Printing Office-street, West Laithgate, and Station-road, but it had been found impossible to get the property owners to agree to what the corporation deemed were reasonable terms. The total length of the proposed widening in St. Sepulchregate Within was 358ft., and the width contemplated was 60ft. throughout. St. Sepulchregate Without it was proposed to widen from 57ft. to 55ft. It was also proposed to double the tramway track. The inspector: It will be a very expensive improvement. The borough surveyor (Mr. F. O. Kirby). The estimated cost is £70,000. The town clerk: The corporation see no other way, and they feel it is absolutely necessary that the work should be done.

Kidderminster (February 19th. Mr. F. O. Stanton.)—£12,000 for the purchase of land for the purpose of the extension of their sewage farm. There was some opposition by the Bewdley Corporation on the ground that the irrigation of these lands might injuriously affect their water supply. Engineering and geological evidence was given by Mr. J. E. Willcox and Mr. H. Lapworth, and the opposition was withdrawn on the understanding that a portion of the lands proposed to be acquired would not be used for irrigation. In the course of the inquiry Mr. Willcox stated that the proposed scheme involved the provision of pumping plant, rising main, and laying out the sewage farm, involving a cost of some £27,000.

Larne U.D.C. (February 18th. Mr. A. D. Price.)—This was an inquiry into a petition by the urban council for a Provisional Order to enable them to put into force the powers of the Land Clauses Act with respect to the purchase and taking otherwise than by agreement of the lands set forth in the petition for the making of a new roadway, and for a loan of £5,000 for that purpose. Mr. Woods, engineer for the scheme, said he estimated the cost of taking over the ground and building at £4,400. The council allowed £1,200 for cost of work. The total length of the street was 800ft., and he thought he allowance a very generous one. The width of the street would be 35ft., and the extra ground it was proposed to acquire was necessary in the interests of the scheme.

Martley R.D.C. (February 14th. Mr. A. A. G. Maher.)—£4,300 for the purpose of sewerage and sewage disposal. The scheme was designed by Messrs. Willcox & Raikes, and embraces sewering a portion of the parish, and provides for the bacterial treatment of the sewage.

Monaghan R.D.C. (February 21st. Mr. H. M. A. Murphy).—£9,275 for the erection of fifty-three labourers' cottages under the Labourers Acts.—Mr. Patrick Toal, clerk to the council, stated that 105 cottages had already been built under former schemes, and the total amount of loan borrowed was £29,633. The expenses on repairs, insurance, &c., last year on the cottages amounted to £66. The receipts for rent amounted to £260, and the amount of Exchequer grant was £38. The annual loss to the ratepayers under the Acts was about £200, or about 1d. in the £.

Pembroke (Co. Dublin) U.D.C. (February 19th. Mr. J. F. MacCabe).—£6,000 for houses in the Poplar Lodge site at Sandymount, £10,960 for houses at Clonskeagh and Harmony-avenue, and £36,000 for houses on the Riverview and Irishtown road sites. The council also made application for sanction to a loan of £14,050 for the purpose of carrying out an improvement scheme at Ringsend and Irishtown under Part I. of the Act.—The town clerk, Mr. Manly, in reply to counsel, stated that the total number of houses the council owned was 354. All the houses are occupied?—Yes. All the rents are regularly paid, and you have no allowances to make for vacancies?—That is so. Witness added that he had 683 applications for houses after weeding out all the bad and doubtful ones.

Shipley U.D.C. (February 19th. Mr. Edgar Dudley).—£450 for the purchase of Woodlands, on the Hirst Wood estate, for the purposes of a public park.—The clerk, Mr. I. Lindow, said the land that it was proposed to purchase covered an area of 2½ acres, the price asked being £180 per acre. For some time the council had considered that they were not sufficiently well equipped with public parks and recreation grounds, and they felt that the present opportunity to purchase suitable land should be taken advantage of. Replying to the inspector, the clerk said the price of land in the neighbourhood of the Hirst Wood estate was from 2s. 6d. to 4s. 6d. per yard.

Wallasey T.C. (February 21st. Mr. F. H. Tulloch).—£100,775 for the purpose of building a new town hall on the North Mead site.—The town clerk, Mr. H. W. Cook, stated that the total area covered by the building would be 3,700 super. yds. It would have a frontage to the river and Brighton-street of 174 ft., and a frontage towards Queen's-road of 188 ft. The building would be set back a distance of 120 ft. from the buildings on the west side of Brighton-street, which would have the effect of forming a square in front of the town hall of about 300 ft. long from north to south and 120 ft. wide. On the river front the building would be set back a distance of about 125 ft. from the front wall of the esplanade, and it was proposed that the existing wall should be taken down for a distance of 230 ft., the central portion having a broad flight of steps the full width of the central feature of the river façade. To the left and right of these steps grass terraces would be formed. A large public hall would occupy the whole of the frontage to the square on the first floor level, with a total accommodation of 1,300 seats. The council chamber would form a fine apartment, 58 ft. by 32 ft., in the centre of the river front, capable of seating sixty-four councillors. The interior of the building was to be designed in the Renaissance style, and towards the river front a large tower had been designed, which, together with the steps and terraces, would give great dignity to the building as seen from the river. Mr. F. G. Briggs, the architect, in reply to Mr. A. W. Maxwell (in opposition), said that £7,500 of the £10,000 for the tower might be put down for ornament, but the lower part of the tower might be made use of. Mr. Kitchen, the Local Government Board architect, cross-examined the witness at considerable length as to the suitability of the tower. "Do you think," he asked, "that a tower is suitable for a building which may be described as being of Grecian influence?" Witness: I don't think the building would be sufficiently imposing without it. You will agree that the style is impure with the tower?—Well, if you are going to aim at having the building absolutely on the lines of a purely classical building, you will spend a lot of the £10,000 in general treatment spread over the rest of the building. But you will agree that academically a tower is not consistent with the elevation of a Grecian building?—We don't agree that it is Grecian. We call it Renaissance. At any rate, on a classical building don't you think a dome would be far more correct?—We don't think it would be preferable, and we have given the matter very careful consideration.

APPLICATIONS FOR LOANS.

Beckenham U.D.C.—£525 for the purchase of land to extend Kelsey Park.

Birmingham T.C.—£3,275 for a new school at Bartley Green.

Carlisle R.D.C.—£3,000 for the Blackwell drainage scheme.

Derby T.C.—£13,500 for electricity plant.

Egremont U.D.C.—£2,400 for footpath improvements.

Halifax T.C.—£7,757 for sewerage and drainage works at Ovenden.

Ledbury R.D.C. £1,200 for building six workmen's cottages.

Mansfield T.C.—£3,456 for street improvements, and £450 for the purchase of a site for a school.

Mexborough U.D.C. £5,730 for the provision of public baths.

Newry No. 1 R.D.C.—£8,160 for erecting forty-eight cottages under the fourth housing scheme.

Northwich U.D.C.—£7,938 for a housing scheme.

Ramsgate T.C.—£6,500 for new gas purifiers.

Selby U.D.C.—£8,200 for a housing scheme to consist of forty-two houses.

Stockport T.C.—£6,141 for the extension of the technical school.

Swansea T.C.—£10,000 for water mains extensions.

Wincanton R.D.C.—£1,090 for the Lovington water supply scheme.

LOANS SANCTIONED.

Barking U.D.C.—£425 for a bowling green.

Barrow-in-Furness T.C.—£1,059 for the purchase of a school site.

Bromsgrove R.D.C.—£300 for the Fairfield water supply.

Carnarvonshire C.C.—£4,354 for alterations and repairs to certain schools.

Cleethorpes U.D.C.—£31,394 for a sewerage scheme.

Horsham U.D.C.—£1,600 for the North-street improvement, and £2,000 for refuse-burning plant at the electricity works.

Mansfield T.C.—£300 for improvements in Bath-lane.

Plympton St. Mary R.D.C.—£569 for street repairs.

Rotherham R.D.C.—£4,478 for conversions to the water-carriage system.

Upton-on-Severn R.D.C.—£4,681 for sewage disposal works at Kempsey.

Youghal U.D.C.—£2,000 for a housing scheme.

FORTHCOMING INQUIRIES.

MARCH.

		£
3.	**Southend.** For electricity and street purposes (Mr. R. H. Bicknell)	14,166
4.	**Aberavon.** For street lighting purposes (Mr. R. H. Bicknell)	500
4.	**Bacup.** For works of private street improvement (Mr. H. S. Stewart) ...	565
4.	**Coole.** For works of water supply (Mr. M. K. North)	900
4.	**Cosport.** For the erection of a ladies' châlet (Mr. F. H. Tulloch)	250
4.	**Hanwell.** For the provision of a refuse destructor and disinfecting apparatus (Mr. W. O. E. Meade-King)	3,500
4.	**Hinckley.** For the construction of a new road (Major J. Stewart)	1,100
4.	**Leyton.** For street improvement purposes (Mr. Edgar Dudley)	6,750
4.	**Llantrisant.** For private street works (Mr. R. H. Bicknell)	1,522
4.	**Neston.** For providing a store yard (Mr. Courtenay Clifton)	500
4.	**Saxmundham.** For works of sewage disposal and water supply (Mr. A. A. G. Malet)	10,500
5.	**Altrincham.** For the provision of a shelter and convenience (Mr. H. S. Stewart) ...	400
5.	**Conway.** For the purposes of a water supply (Mr. Courtenay Clifton)	120
5.	**Croydon.** For street widening purposes (Mr. Edgar Dudley)	3,500
5.	**Selby.** For the purposes of a water supply (Mr. M. K. North)	630
5.	**Sheerness.** For street and water supply purposes (Mr. A. W. Brightmore) ...	19,552
5.	**Swansea.** For cemetery and paving purposes (Mr. R. H. Bicknell)	2,454
6.	**Guildford.** For street improvement purposes (Mr. Edgar Dudley)	8,000
6.	**Menai Bridge.** For the erection of council chambers and a fire station (Mr. Courtenay Clifton)	550
6.	**Scunthorpe.** For works of sewerage (Mr. M. K. North)	1,870
6.	**Sheppey.** For water supply purposes (Mr. W. Brightmore)	4,300
7.	**Dorking.** For the provision of public baths (Mr. F. H. Tulloch)	165
7.	**Skegness.** For sewage disposal works (Mr. M. K. North)	1,600
7.	**Towyn.** For the provision of sewerage, a public convenience, and stables (Mr. Courtenay Clifton)	1,100
7.	**Worthing.** For road widening purposes (Mr. Edgar Dudley)	1,940

London County Council Finances.—An abstract of the receipts and expenditure of the London County Council for the ten years ended March 31, 1912, together with other financial statements, has been issued at the price of 6d.

Municipal Work in Progress and Projected.

The Editor invites the co-operation of SURVEYOR *readers with a view to making information given under this head as complete and accurate as possible.*

The following are among the more important projected works of which particulars appear below: Buildings—Edinburgh £3,638, Middlesex, Staffs; housing and town planning—Annfield Plain, Ruislip-Northwood; roads and materials—Kent £2,312, Lewisham £15,918, Marylebone; sewerage and sewage disposal—Ashton-under-Lyne £20,000, Newquay £12,300; water, gas and electricity—Kirkcaldy, Linlithgowshire.—Particulars of other work projected will be found on our "Local Government Board Inquiries" pages.

BUILDINGS.

Aberdare U.D.C.—A site for a new isolation hospital is to be purchased for £8,750.

Bolton T.C.—A scheme has been approved for the provision of public baths in Moss-street.

Edinburgh T.C.—Public wash-houses are to be built at Fountainbridge at a cost of £3,638.

Middlesex C.C.—The tender of Messrs. W. Gibson & Co., Finchley, at £15,994, has been accepted by the Education Committee for the erection of a secondary school on the Golder's-rise estate, Hendon.

Portsmouth T.C.—A sum of £4,600 is to be paid for land for the extension of the infectious diseases hospital.

Staffs C.C.—The Education Committee have accepted the tender of Messrs. H. Gough & Son, Wolverhampton, at £13,468, for the erection of the county metallurgical and engineering institute at Wednesbury.

Twickenham U.D.C.—The tender of Mr. A. Roberts, at £597, has been accepted for the execution of works in connection with the construction of an inclined embankment along the river frontage of Radnor House Island.

HOUSING AND TOWN PLANNING.

Annfield Plain U.D.C.—Tenders are to be obtained for the erection of sixty workmen's houses.

Briton Ferry U.D.C.—The tender of Mr. David John, Pontypridd, at £13,189, has been accepted for the erection of an additional sixty-two houses under the Workmen's Dwellings Act.

Dungannon U.D.C.—The Local Government Board have forwarded the draft mortgage for £4,200 for the erection of twenty-four artisans' dwellings, the loan to be repayable in sixty years at 3½ per cent. The clerk said that the board were still engaged in considering the plans, but had not yet sanctioned the asbestos roofing, which would save £100.

Horncastle U.D.C.—It has been decided to build four workmen's cottages.

Linthwaite U.D.C.—Seventeen acres of land, including certain buildings, is to be purchased for £4,000 for the purpose of a housing scheme.

Richmond (Yorks) T.C.—The Local Government Board having agreed to corporation land being appropriated for the purpose, it has been decided to erect eight dwellings in the West Field.

Ruislip-Northwood (Middlesex) U.D.C.—Application has been made to the Local Government Board for sanction to a town-planning scheme in respect of an area comprising 6,000 acres.

Seaham Harbour U.D.C.—Plans and specifications for the new housing scheme have been completed, and tenders are to be advertised for shortly.

Sedgefield R.D.C.—It is proposed to build twenty-six houses, at a cost, approximately, of £170 each, the rent not to fall below 5s. a week or exceed 6s., and the council are asking for a loan repayable over a period of fifty years.

REFUSE COLLECTION AND DISPOSAL.

Deptford B.C.—With regard to the communication from the London County Council as to the revision of the by-laws relating to the collection of house refuse, the Works Committee reported that they had considered the question of a collection twice weekly from May 1st till September 30th, but to carry it out would involve a capital expenditure of £552 on the purchase of twelve new vans, and an additional expenditure of £1,100 per annum for extra horses and labour. They therefore considered that the present weekly collection was adequate, and the council approved the recommendation.

Exeter T.C.—A resolution has been passed that the Local Government Board be informed that in the event of a Provisional Order being issued granting an extension of the borough, and such order being confirmed by Parliament, the council would take the requisite steps to provide a refuse destructor for the enlarged city.

Penrith U.D.C.—A scheme for the removal of house refuse has been adopted, including the purchase of four new carts and one wagon, at an estimated cost of £100.

Steyning West R.D.C.—The following tenders have been accepted for the removal of house refuse: Lancing, Mr. Luckin, £39; Steyning, Mr. Green, £55.

Tenby T.C.—The borough engineer, Mr. B. Morley, having reported on the question of refuse disposal, the Sanitary Committee have agreed to recommend the removal of the refuse to Black Rock quarries, and that application be made for sanction to borrow £250 for the purchase of six carts and the erection of a shed for the same.

ROADS AND MATERIALS.

Bognor U.D.C.—The surveyor, Mr. O. A. Bridges, has received instructions to prepare an estimate for widening the esplanade.

Cambridge T.C.—The borough surveyor, Mr. J. Julian, has been asked to prepare plans and estimates for widening several thoroughfares.

Cardiff T.C.—The Public Works Committee have resolved that the work of reconstructing ten of the main thoroughfares should be carried out by direct labour.

East Preston (Sussex) R.D.C.—The Road Board is to be asked to make a grant of £350 towards the cost of the proposed road widening at Ferring, and the surveyor (Mr. H. Vail) has been instructed to prepare an estimate of the Littlehampton and Bognor road scheme, with a view to applying for a similar grant.

Falkirk T.C.—A sum of £1,500 has been paid for the purchase of various properties for the purpose of the new thoroughfare to be constructed between High-street and the residential districts in the southern part of the burgh.

Fulham B.C.—A scheme is under consideration for widening Fulham-road at the George corner, at an estimated cost of £13,000.

Holyhead U.D.C.—The council unanimously passed the following resolution at its last meeting: "That for the guidance of the Building and Works Committee, when considering the laying of new pavements and the restoring of pavements worn out and decayed, it be resolved—(1) That in all cases where it is desired by the owners of old property that a new pavement be laid where there has previously been no pavement, and the owners cannot be compelled to do so at their own expense, the work shall be done at the discretion of the council on the recommendation of the committee at its own expense, subject to the owners providing all necessary materials, and that this rule shall not be departed from except where there are special circumstances; (2) that all old pavements that have become decayed and ruinous shall, irrespective of whether the same are in main thoroughfares or in the streets where the poor dwell, be forthwith taken in hand and placed in order; and (3) that any expense necessary for the carrying out of this resolution be estimated for next month."

Kingsbridge (Devon) R.D.C.—The highway surveyor, Mr. W. R. Denbow, is preparing further plans and estimates of the proposed widening of the main road between Kingsbridge and Salcombe, towards the cost of which the Road Board and the Devon County Council are jointly contributing £650.

Kent C.C.—An estimate of £900 for kerbing and tarpaving certain footpaths, has been approved.—The

district road from Farnborough to West Wickham is to be made up at an estimated cost of £2312.

Kingston (Surrey) T.C.—The tender of Messrs. Kavanagh & Co., the lowest of five, has been accepted for the making up of Woodbines-avenue.

Lewisham B.C.—The Works and Highways Committee recommend that the carriageways of the motor-omnibus routes in the borough, where not already permanently paved, be resurfaced with bituminous-bound macadam during the ensuing year, at an estimated cost of £15,918, and that the offer of the Road Board to contribute £5,000 towards the cost, and to lend a further sum of £3,000 for one year free of interest, be accepted.

Lytham U.D.C.—The surveyor, Mr. A. J. Price, has submitted a plan and estimate for improving the awkward corners and making a proper footpath in Saltcotes-road from Shell Hill to Eastham Bridge. The cost is estimated at £1,000. The council have decided to ascertain whether a special grant or loan for carrying out the work can be obtained from the county council or the Road Board.—Market-square, from Clifton-square to Queen-street, is to be paved at a cost of £559.

Marylebone B.C.—It is proposed to spend the following sums on street repairs: Wood paving, £6,338; tar-macadam, £6,923; granite setts, £1,464. In addition £8,300 is to be provided in the estimates for new wood and asphalt pavings.

Peeblesshire C.C.—The county road surveyor, Mr. R. S. Anderson, has reported to the County District Committee that the Road Board have made a grant of £1,059 towards a proposed expenditure of £1,611 for works of road improvement in the county.

Sunderland T.C.—It is proposed to construct a new street between St. Mark's-road and Hylton-road, at an estimated cost of £4,500, and the Local Government Board is to be asked to sanction the borrowing of that sum for the purpose.

Wincanton R.D.C.—The council have agreed to the suggestions of the Somerset County Council with respect to the maintenance of main roads in the council's area. These are (1) discontinuance in the future of sub-contracting for manual labour required on main roads except (*a*) for certain piece-work labour, and (*b*) in such special cases as the County Works Committee may agree to; (2) that where practicable separate working foremen or permanent roadmen, approved by the county surveyor, be wholly engaged on the more important main roads, and that the terms of their employment be also approved by him. Both the district county surveyors were strongly of opinion that the direct system of manual labour would be far more satisfactory than contracting, and considered that the cost should not be more. Information had been obtained from several rural districts in the county where the direct system was in force, and the same were in favour of such system.

Worcestershire C.C.—The council have approved of the terms of a special report presented by the Highways and Bridges Committee, stating that the negotiations with the Road Board had been substantially completed, and an annual sum of at least £20,000 would accordingly be expended on the main roads in the county in addition to ordinary maintenance. The committee further stated that they had had to consider the question of the proper supervision of this extra work, and in their opinion it could only be properly carried out by an addition to the present staff, such as was proposed in the following recommendations, which was the least that would ensure the work being effectually done: (1) That the Road Board work should be under the charge of a qualified assistant surveyor, and that Mr. R. Fletcher the assistant surveyor for the North-Eastern district, should be transferred from Bromsgrove to Worcester for that purpose; (2) that an additional assistant surveyor should be appointed for the North-Eastern district in the place of Mr. Fletcher.

SEWERAGE AND SEWAGE DISPOSAL.

Ashton-under-Lyne T.C.—The borough surveyor, Mr. J. T. Earnshaw, has been instructed to report upon the proposed extension of the sewage disposal works. Provisionally the scheme is estimated to cost £20,000.

Bentley U.D.C.—Land is to be purchased for the erection of a sewage pumping station.

Carlisle R.D.C.—The tender of Mr. John Carrick, of Durham, at £226, has been accepted for sewerage works from the village of Blackwell to Wire Mire Beck.—The engineer, Mr. J. Graham, has been instructed to prepare plans for the drainage of Blackwell.

Chipping Norton T.C.—Messrs. Berrington, Son & Warney, of Wolverhampton and Westminster, have received instructions to prepare plans and estimates for a new sewerage and sewage disposal scheme.

Crimsby T.C.—The council have accepted the tender of Messrs. J. Spencer, Limited, of Wednesbury, for the supply of twenty-four ventilating columns, for the sum of £180, and the tender of Messrs. Earnshaw & Brumund, of Grimsby, for the supply and fixing of ninety vent shafts, for the sum of £295, for the ventilation of sewers of the Victoria and Alexandra Wards.

Kingston (Surrey) T.C.—The tender of the Dunluce and Glenta-k Iron Ore Company has been accepted for the supply, during twelve months, of 500 tons of lump ore.—In consideration of the corporation reducing from 2s. to 1s. per ton the amount to be paid by the Native Guano Company for press sludge, the company have agreed to deposit at the corporation's bank £500 as security for the carrying out, until December 4, 1915, of the present contract for the purchase of such sludge, and have agreed to the proportion of water being increased from 62½ per cent to 70 per cent in respect of 200 tons of the press cake each year.

Newquay (Cornwall) U.D.C.—The surveyor, Mr. J. Elnor, at the recent meeting, presented a report upon the work in connection with the main drainage scheme. He said that seventy-two plans had been prepared. The cost to the town and general district fund for engineering might be set down at the low sum of £115 to be paid to the council officers, instead of £500 that would have been paid to outside engineers for the same work. They believed that the scheme would be completed for the sum of £12,300. Mr. Vivian said Mr. Elnor was to be congratulated for the very excellent report he had submitted.

WATER, GAS, AND ELECTRICITY.

Bath T.C.—Conversions from gas to electric filament lamps are to be carried out in various thoroughfares, at a cost of £140.

Bingley U.D.C.—An agreement is to be entered into with the Keighley Corporation for the supply of electricity in bulk for ten years, and it has been decided to apply to the Local Government Board for borrowing powers for £5,500, the estimated cost of cables, sub-station, and machinery.

Driffield R.D.C.—Sir Tatton Sykes, Bart., has provided a system of water supply at Wetwang, at an acknowledgment of 1s. per annum, to be paid by the council.

Glasgow T.C.—The tenders of Messrs. Howden & Co., Govan, at £13,120 and £17,793, have been accepted for four water-tube boilers for the Port Dundas electricity station, and turbo-alternators and condensing plant respectively.

Ipswich T.C.—A contract has been entered into with Messrs. Sulzer Brothers, of 30 Norfolk-street, Strand, London, for the supply and erection of one Diesel oil engine, coupled to a high-lift centrifugal pump, capable of pumping 1,000,000 gallons per twelve hours from the well at Whitton to the Park-road reservoir. The contract price is £2,370, and the work is to be completed by November next.

Kingston (Surrey) T.C.—110 yds. of ·2 sq. in. high-tension concentric lead-sheathed and armoured cable is to be bought from the Craigpark Electric Cable Company for £52 3s. 9d.—To the British Thomson-Houston Company is to be given an order for the supply and fixing of a Tirrill regulator complete with all necessary condenser sections, triple-pole, and double-pole switches, equaliser rheostats, &c., for the sum of £150. The apparatus is for a portion of the equipment of the new main switchboard.

Kirkcaldy T.C.—Extensions to the gasworks are to be carried out at an estimated cost of £45,000.

Linlithgowshire C.C.—The Linlithgow District Committee who have in contemplation the introduction of a new supply of water for the district under their administration, have entrusted to Messrs. Wilson & Son, Inverkeithing, a contract for puddle trenching a portion of ground in connection with the Riccarton Burn, to the south of Linlithgow. The source is one

from which it is thought an adequate supply may be obtained should an agreement be come to between the negotiating parties.

York T.C.—The Electricity and Tramways Committee report that the total income of the undertaking for the nine months to December 31st was £19,901, an increase of £3,956 on the return for 1911. It is proposed to extend the generating plant to a total capacity of 7,700 kilowatts, and also mains, and provide a new battery room and battery at a total cost of £30,600.

MISCELLANEOUS.

Cardiff T.C.—Although there is still a month to run to complete the financial year, the figures of the tramway undertaking show that the council will be enabled to vote £4,000 from the income in relief of the rates, equal to 1d. in the £.

Southampton T.C.—The borough engineer, Mr. J. A. Crowther, has been directed to prepare a scheme for the filling in of the Western Shore to the Parliamentary boundary line in accordance with the following conditions: The land to be reclaimed in sections covering a period of five years; the filling in to be commenced at both ends of the land to be reclaimed, and a straight vertical wall to be provided.

INSTITUTION OF MUNICIPAL ENGINEERS.

COUNCIL MEETING.

At a meeting of the council of the Institution of Municipal Engineers, held at Newcastle-on-Tyne on Saturday last, the following applicants were recommended for admission to membership:—

To Membership: Mr. G. H. Connor, sanitary surveyor, Isle of Thanet Rural District Council.

To Associate-Membership: Messrs. J. G. Howard engineer's office, Great Berkhamsted Urban District Council; L. Tait, borough surveyor's office, Morpeth; S. L. Luker, assistant to H. J. Weaver, Esq., Northgate Mansions, Gloucester; and K. L. Loomba, assistant to Messrs. Taylor & Wallin, Newcastle.

(Under the new by-laws these elections will be ratified at the next council meeting if no written objections are lodged within fourteen days.)

NEW MEMBERS, &c.—From the applicants recommended for admission at the last meeting six members and four associate-members were elected, and one transfer was made to the membership class.

PROPOSED REVISION OF BY-LAWS.—A lengthy report of the Special Purposes Committee, with reference to certain proposals as to revision of by-laws, was considered. These proposals will shortly be printed, and circulated among the members of the institution prior to convening a special general meeting.

MUTUAL AID AND DEFENCE FUND.—The result of the postal vote taken on this matter is a practically unanimous vote in favour of the formation of a compulsory fund, but exempting foreign members from either contribution or participation. The matter is included among those to be taken at the proposed revision of by-laws referred to above.

"IDEAS" COMPETITION.—The papers of the various entrants in this competition were considered, and it was decided that the prize of two guineas be awarded to Mr. H. McCarter ("Progress"), member.

BADGE FOR MEMBERS.—The secretary was instructed to obtain designs and estimates for a button-hole badge for the use of members.

South Ockenden Sewerage Competition.—The first premium in this competition has been awarded to Messrs. Herbert Walker & Son, consulting engineers of Nottingham. There were sixteen schemes submitted, Mr. Gerald Swayne, of Westminster, taking the second premium. Mr. A. J. Martin, M.INST.C.E., of Westminster was the professional assessor.

Clacton-on-Sea Reinforced Concrete Bridge: "Piketty System" Adopted.—The Clacton Urban District Council are applying to the Local Government Board for sanction to a loan for a proposed new bridge to the Pier Approach. The bridge is to be of reinforced concrete on the "Piketty System," and of a span of 60 ft. and a width of 20 ft. The design is not only graceful and ornamental, but economical.

PERSONAL.

Mr. W. D. Telfer has been appointed consulting engineer to the Buckhaven Town Council, at a salary of £100.

Mr. N. H. Dawson, borough surveyor of Banbury, has tendered his resignation, to take effect in six months' time.

Mr. J. P. Jones has resigned his position as surveyor to the Gelligaer Urban District Council after a service of forty years.

Mr. T. T. Strongman, surveyor to the St. Germans (Cornwall) Rural District Council, is, we regret to state, suffering from serious indisposition.

Mr. W. Lawson, of Whitby, has been appointed highway surveyor and sanitary inspector to the Hinderwell Urban District Council.

Mr. J. Cowan, surveyor to the Egremont Urban District Council, has been granted £25 for his services as clerk of the works of the new gas-works.

Mr. W. Barlow, of Chipping Sodbury, has been appointed sanitary surveyor to the Barnstaple Rural District Council, in succession to Mr. E. G. Kingwell.

Mr. D. Maclean, assistant surveyor of the Middle Ward of Lanarkshire, has been appointed road surveyor for the First (Inverness) District Committee of Inverness-shire.

Mr. Clifford Whitworth, surveyor and inspector at Melton Mowbray, has been appointed sanitary surveyor and inspector to the St. Austell Rural District Council, at a salary of £150.

Mr. G. A. Rodley, of the borough engineer's department, Birkenhead, has been appointed clerk of works in connection with road reconstruction under the West Suffolk County Council.

Mr. G. R. Collinson, of the borough water engineer's office, Rotherham, has been appointed engineering assistant in the Swansea borough and waterworks engineer's department, at a salary of £160.

Major Macaulay, formerly borough surveyor of Kingston, Surrey, who was, recently, we regret to learn, taken seriously ill, was stated a few days ago to be progressing as satisfactorily as can be expected.

Mr. John Tunstall, who was for many years a district surveyor in the service of the Liverpool City Council, has been chosen as candidate for a vacancy in St. John's Ward for the Waterloo-with-Seaforth Urban District Council.

Mr. W. Herbert Johnson, assistant in the city surveyor's office, Manchester, was on Wednesday last appointed assistant surveyor for the city of Chester, at a salary of £120, rising to £150. There were seventy applications for the post.

Mr. Stratten Boulnois, of Chertsey (brother of Mr H. Percy Boulnois, M.INST.C.E., past-president of the Institution of Municipal and County Engineers), whose death at the age of seventy-six was recently reported in this column, left estate valued at £51,168.

Mr. W. G. Lane, borough surveyor of Dartmouth, who has been appointed to a similar position at Ludlow, Shropshire, has been presented with a framed illuminated address from the corporate officers and employees of Dartmouth, and a silver match-box from the officers.

Mr. C. Randall, assistant surveyor of the Weybridge Urban District Council, who has been appointed overseer of roads and sewers under the Public Works Department of Hong Kong, was before his departure presented with a cheque on behalf of the officers and employees of Weybridge, the presentation being made by the surveyor, Mr. J. C. Crawshaw. The council also presented Mr. Randall with an illuminated testimonial under seal.

Dr. Alfred Greenwood, M.D., CH.B., B.SC., L.R.C.P., D.P.H.—who has just been appointed medical officer of health for the county of Kent, at a salary of £800, with a motor-car allowance of £250—is not yet forty years of age, and was educated at Wakefield and at the Victoria University and Manchester Infirmary, Manchester. He has been deputy medical officer of Stockport and medical officer of Crewe, and at the time of his appointment to Kent was medical officer of Blackburn. In addition to his other distinctions he is a barrister-at-law. We congratulate the county—which already numbers among its officials a surveyor of wide reputation (Mr. H. P. Maybury)—in having secured a candidate of such remarkable qualifications and abilities.

FOR OTHER ADVERTISEMENTS

See End of Paper.

BOROUGH OF DONCASTER.

TOWN PLANNING ASSISTANT.

The Doncaster Corporation invite applications for the Appointment of Town Planning Assistant in the Surveyor's Department. Candidates must be quick and accurate Surveyors, Levellers, and good Draughtsmen. Salary at the rate of two guineas per week.

Applications, to be submitted on foolscap paper in candidate's own handwriting, stating age, qualifications, previous experience, and present employment, together with copies of not more than three recent testimonials, endorsed "Town Planning Assistant," should be delivered to the undersigned not later than noon of Wednesday, the 12th March.

(Signed) F. OSCAR KIRBY,
Borough Surveyor.

Mansion House,
Doncaster.
February 26, 1913.

URBAN DISTRICT COUNCIL OF ST. HELENS, ISLE OF WIGHT.

SURVEYOR.

Wanted, to carry out with the duties of that office, those of Water Inspector, Inspector of Nuisances, Inspector of Dairies, Cowsheds and Milkshops, Inspector of Hackney Carriages, and the duties of Inspector under the Town Planning Act.

Salary, £135 inclusive and residence.

He will be required to devote the whole of his time to the duties of the above-mentioned offices, and carry out the directions of the Council in reference thereto.

He must also hold a Sanitary Certificate, and keep all books necessary for the duties of the respective offices, and periodically report on all matters as required.

The appointment will be made subject to the approval of the Local Government Board.

The person appointed will have to obtain a guarantee of £200 from a recognised Office, and will be required to enter on his duties as soon as possible.

Applications, endorsed "Surveyorship," stating age and previous occupation, accompanied by not less than three recent testimonials, must be sent to me not later than the 11th March, 1913.

Canvassing will be a disqualification.

CHAS. G. VINCENT,
Clerk to the Council.

4 St. Thomas-street,
Ryde, Isle of Wight.
February 26, 1913.

URBAN DISTRICT OF FINCHLEY.

PRIVATE STREET WORKS.

The Council of the above-mentioned District invites Tenders for the Making-up of the following Private Streets, together with all works incidental thereto:—

CONTRACT No. 1.

Holly Park-gardens.
Fitzalan-road.
Salisbury-avenue (3rd portion).
Rosemary-avenue.
Dudley-road.
Bibsworth-road.
Street off Balfour-terrace.

CONTRACT No. 2.

Queen's-avenue.
Birley-road.
Netherfield-road.
Woodgrange-avenue.
Limes-avenue.

Plans, Specification and Conditions of Contract may be seen, and Forms of Tender and Schedules of Quantities obtained, on application to the Council's Engineer and Surveyor, Mr. C. J. Jenkin, M.INST.C.E., M.I.MECH.E., at the under-mentioned address.

Contractors may tender for either or both of the above-mentioned Contracts.

A deposit of £3 will be required in respect of each Contract, which will be returned on receipt of a *bonâ-fide* Tender, on the prescribed Forms, for all the Streets in the Contract tendered for, together with fully priced-in Schedules and the return of all papers issued.

Sealed Tenders, endorsed "Private Street Works, Twelfth Batch," to be addressed to the undersigned, and delivered not later than 4 o'clock p.m. on the 17th March, 1913.

The Council does not bind itself to accept the lowest or any Tender, and reserves to itself the right to accept a Tender for any of the Streets beforementioned.

E. H. LISTER,
Clerk of the Council.

Council Offices,
Church End, Finchley, N.
February 25, 1913.

CITY OF NOTTINGHAM.

TO CONTRACTORS.

The Works and Ways Committee are prepared to receive Tenders for the Construction of a Sewer from the junction of North-gate and Radford-road to the junction of Marshall-street and Mansfield-street, Sherwood, together with all appurtenant Works.

The Contract will consist chiefly of—

850 yards lin. of Circular Brick and Concrete Sewer, 4, 6″ internal diam. ... ... (in tunnel)
630 yards lin. ditto ditto ditto (in open cutting)
766 yards lin. ditto ditto 4′ diam. (in open cutting)
215 yards lin. ditto ditto 3′ 6″ diam. (in open cutting)
with Manholes, Junction Chambers, Storm Overflows, &c.

Drawings may be seen, and Specification, Bill of Quantities and Form of Tender obtained, on applying to Mr. Arthur Brown, M.INST.C.E., City Engineer, Guildhall, Nottingham, on payment of a deposit of Two Guineas, which will be returned on receipt of a *bonâ-fide* Tender and the copy of the Specification.

Sealed Tenders, endorsed "Sherwood Outfall Sewer," are to be delivered to the undersigned not later than 12 o'clock (noon) on Friday, 14th March, 1913.

The lowest or any Tender will not necessarily be accepted, and Tenders will only be accepted from persons who conform to the conditions of the Contract as regards paying the local standard rate of wages, &c., and to the working rules of the Nottingham district.

(By order)
W. J. BOARD,
Town Clerk.

Guildhall, Nottingham.
February 26, 1913.

URBAN DISTRICT COUNCIL OF CHISWICK.

TO CONTRACTORS AND OTHERS.

Persons desirous of Tendering for the Construction of the New 60-ft. Road leading out of Burlington-lane, including the Laying of Sewers and Construction of Culvert and Bridge over the Duke's Ditch, may obtain Form of Tender by application to Mr. Edward Willis, ASSOC.M.INST.C.E., Surveyor, Town Hall, Chiswick, where the Plans, Sections, Specification, Form of Contract and Bond, and other documents intended to form the basis of the Contract, may be inspected during Office hours after the 3rd March.

Tenders are to be made on the prescribed Form, and to be delivered in sealed envelopes (endorsed "New Road, Burlington-lane"), together with a Schedule of prices, to the undersigned not later than noon on Monday, the 17th March, 1913.

ERNEST F. COLLINS,
Clerk of the Council.

LANCASHIRE COUNTY COUNCIL.

LEYLAND HUNDRED.

PRESTON, CHORLEY AND BOLTON MAIN ROAD.

Tenders are invited for Repaving about 40,000 square yards with Granite Setts, and about 10,000 square yards with Granite Cubes on the Preston, Chorley and Bolton Main Road. The Setts and Cubes will be provided by the County Council.

The Specification and Quantities may be obtained from Mr. W. H. Schofield, County Surveyor, County Offices, Preston, to whom Tenders must be delivered not later than the 8th March, 1913.

(Signed) HARCOURT E. CLARE,
Clerk of the County Council.

County Offices,
Preston.
February 20, 1913.

Some Recent Publications.*

Cassell's Reinforced Concrete. Edited by Bernard E. Jones, assisted by Albert Lakeman and a staff of Specialist Writers. Price 15s. nett. London: Cassell & Co., Limited.

Although the editor of this work has wisely avoided the encyclopædic form—there being no attempt at an alphabetical arrangement—the book may fairly be described, having regard to its scope, as an encyclopædia of reinforced concrete construction in theory and practice. The book is largely concerned with those practical questions of construction which have to be answered by the engineer or contractor in the course of his daily work, so that it will be seen that it covers a wider field than the generality of works on the subject which are devoted almost exclusively to the theory and mathematical treatment of design. In addition to this practical matter, however, there are two excellent chapters of a theoretical character. The services of a number of expert writers have been secured, so that the reader may have full confidence that every branch of the subject is dealt with in an authoritative manner. The first two chapters are introductory in character, and are devoted to an explanation of the advantages of reinforced concrete, and to an historical survey of the subject. Then follow two chapters dealing with the materials which are used in reinforced concrete construction.

As regards the section dealing with cement, we could have wished for a rather fuller treatment of the subject of testing. Full emphasis is laid upon the important subject of mixing, and the illustrations of various types of mechanical mixers are very useful. The composition of and tests for steel are separately dealt with. The next chapter (for some reason the chapters are not numbered) is entitled "Stress Simply Explained," and introduces the reader to the theoretical part of the book. This will be much appreciated by many readers who have not sufficient knowledge of structural mechanics to enable them to pass directly to a consideration of the problems which are peculiar to reinforced concrete work. Much of it is of an elementary character—commencing with the principle of moments—and is not confined in its application to reinforced concrete work. Thus, the chapter comprises an explanation of moments of inertia and section moduli. Then follows an excellent chapter on the Theory of Reinforced Concrete, in which the writer sets out as simply and lucidly as possible the methods of calculation for beams, slabs, double reinforcement, T-beams, columns, and retaining walls. The use of the calculus is avoided, but there is no treatment of the arch. We may here mention that a key to the notation is provided on an extended page, so that it may be constantly before the reader. This is an exceedingly useful adjunct to the book.

The two following chapters are devoted to the methods employed in erecting a building, and the forms and centerings necessary to be used. These chapters are very practical in character, and are copiously illustrated with drawings and photographs, many of the former being isometric views showing clearly the details of construction, and being provided with figured dimensions. The next chapter is concerned with concise descriptions of the chief commercial systems, and subsequent chapters deal with architectural treatment, durability, waterproofing, arches and bridges, quantities, estimating, measuring and pricing. The whole is well illustrated and indexed, and is excellently produced in every way. It forms the most complete guide to construction in reinforced concrete which has come under our notice, and we have no hesitation in commending it to the student, the designer, the contractor, and the mechanic, all of whom will find in its pages much which is of interest and value to them.

Fire Prevention and Fire Protection as Applied to Building Construction. By Joseph Kendall Freitag. Price 17s. nett. New York: John Wiley & Sons. London: Chapman & Hall.

This is a handbook of theory and practice by one who knows his subject, and who has been assisted by many well-known American engineers who are authorities in the matter of fire protection. It is devoted very largely to details of design and construction with reference to the prevention and control of fires. Part I. treats of the general subject in four chapters on fire losses, the theory and practice of fire prevention and fire protection, the theory and practice of fire insurance, and a general description of the slow burning or mill construction. The fire problem is much more serious in the United States than in Europe, largely on account of the nature of the materials used in building construction. Nevertheless, the present handbook is one that will be found of value to all architects and engineers who have to do with building construction. Part II. treats of fire tests and materials. There is a chapter on experimental stations, descriptions of fires in fire-resisting buildings, and action of different fire-resisting methods when submitted to conflagration tests. There is also an interesting chapter on the permanency and corrosion of steel as used at the present time in the construction of buildings.

In Part III. the subject of fire-resisting design is taken up and considered under the heads of general design, faulty construction, fire-resisting floor and ceiling design, column protection, fire resisting partitions, shutters, windows and doors, fire escapes and elevator shafts. Part IV. relates to the installation of fire-resisting materials such as terra-cotta floors, concrete floors, wall construction, roofs, suspended ceilings and furring. The chapters above outlined constitute about two-thirds of the volume. Part V. discusses in a more general way the special problems involved in the protection of theatres, schools, residences, factories and garages.

Part VI. treats of the equipments necessary for extinguishing fires. There are chapters on sprinkler systems, automatic fire alarms, the use of fire extinguishers of various kinds, and the organisation of watchmen and employees for the purpose of fighting fire. There is also a chapter on fire drills, emphasising their importance in schools, department stores, theatres and factories. There is probably no more authoritative work on this important subject, and the author and publishers are both to be congratulated on this important contribution to the engineering profession.

The Law and Practice of Town Planning. By R. A. Glen, Barrister-at-Law, and Arthur D. Dean. Price 15s. London: Butterworth & Co. and Shaw & Sons.

There can be little doubt that this work will be very cordially welcomed by those members and officers of local authorities whose duties are particularly concerned with the preparation of town planning schemes. While many books have been written either from the legal or the administrative point of view, it has been left for the authors of this book to treat the subject of town planning comprehensively in a single volume. The work is divided into seven parts, the first of which is introductory in character, setting out clearly and concisely an outline of the procedure necessary from the adoption to the enforcement of a scheme. Part II. consists in a reprint of the text of those portions of the Housing, Town Planning, &c., Act, 1909, which are concerned with the subject in hand, together with copious notes. These notes are exceedingly valuable, inasmuch as they enable the reader to see at a glance the provisions of other Acts or regulations in force which deal with the same subject-matter. They also contain much matter which bears on the administrative aspect of the Act, and references to many decided cases which illustrate the principles of law which are involved.

If a small criticism of detail may be permitted, we would point out that the type used for the figures referring to the footnotes is inconveniently small—a matter to which attention might be given in any subsequent edition of the work. In Part III. will be found a complete collection of the circulars, memoranda and orders which have been issued by the Local Government Board and the Board of Agriculture, together with careful and valuable notes thereon. Part IV. is of great practical value, and will be much appreciated by officials. It consists of a series of draft precedents of resolutions, reports, notices, advertisements, statutory declarations, and statements, with

* Any of the publications reviewed, or referred to as received, will be forwarded by the St. Bride's Press, Ltd., on receipt of published price.

notes. The draft report of a surveyor to a Town Planning Committee may perhaps be specially mentioned as being of interest to our readers. Part V. contains a series of model clauses for a town planning scheme; Part VI. gives an outline of improvement and other housing schemes; and Part VII. contains a short account of town planning abroad. The book is well indexed; and it should certainly be in the hands of every official who is charged with the preparation or execution of a town planning scheme.

Elements of Hydraulics. By Mansfield Merriman. Price 4s. 6d. nett. London: Chapman & Hall.

Prof. Merriman is so well known to most engineers that no introduction of the author is necessary. This book is an abridgment of his standard treatise on hydraulics. A more exact statement, perhaps, would be that it is a rewriting of the larger work with the higher mathematics omitted. The intention has been to make it useful to students who are conversant with arithmetic, algebra, trigonometry, and elementary mechanics, but not with calculus. Hence the book is adapted not only to the upper classes in secondary technical schools, but also to many engineers who have occasion to use the principles of hydraulics, but who have become rusty in their mathematics. The very fact that many of the complicated demonstrations are omitted makes the book more useful to many people. Short, compact text-books of this character are coming more and more into vogue, and rightly so.

There are eight chapters in the book devoted to the following subjects: (1) Hydrostatics; (2) Theoretic Hydraulics; (3) Flow from Orifices and Tubes; (4) Flow through Pipes; (5) Flow in Conduits and Rivers; (6) Measurement of Water; (7) Hydraulic Motors; (8) Pumps and Pumping. Problems are introduced throughout the book, but not in large numbers. A fair criticism from the teacher's standpoint would be that not enough of these problems are given. The article on the flow of water in pipes might well have taken up more complicated problems in the flow of water through compound and complex pipes. The consideration of simple problems only does not sufficiently prepare the student to cope with the mixed problems that he will surely meet with in practice. This is also true of the study of loss of head through short bends, gates and valves, and the velocity head required at entrance. Generally speaking, the book is an excellent one, well arranged, well printed, and of a good size.

How to Estimate. By J. T. Rea. Price 7s. 6d. nett. London: B. T. Batsford.

The popularity of this excellent work—which is described in its sub-title as "an analysis of builders' prices"—is shown by the fact that a fourth edition has been called for within a comparatively short time of its predecessor. The general scope of the work is sufficiently well known to render any detailed description unnecessary. In addition to the several chapters, each of which is devoted to a separate trade, there are valuable introductory chapters, and a very useful appendix of memoranda. The demand for a new edition has enabled the book to be thoroughly revised throughout, and the bulk has been considerably increased without any corresponding rise in price. Among the many new features we may mention an entirely new section on Reinforced Concrete, and the inclusion of modern road construction in the chapter on Paving. Altogether there are forty extra analyses of prices, and 360 additional illustrations. Mr. Rea's work is considerably more than a mere price-book, and will be found specially valuable not only to the surveyor, builder, and estimating clerk, but also to the student, because of the explicit instructions which it contains in regard to every detail of the estimator's work. We have no hesitation in recommending it as a clear and reliable guide to current prices and introduction to the principles which govern the science and art of correct estimating.

Bells, Indicators, Telephones, Fire and Burglar Alarms, &c. By J. B. Redfern and J. Savin. Price 1s. 6d. nett. London: Constable & Co., Limited.

This little book forms one of Messrs. Constable's series of electrical installation manuals. It is essentially practical in character, and deals with the various subjects in a way which will appeal specially to the practical electrician. Commencing with a description of the construction and action of the ordinary trembling bell, the authors proceed to deal with various other types of bells and pushes, and the methods of connecting bells, battery and magneto generator. Fire alarm apparatus and burglar alarms and telephone installations also receive adequate treatment. A feature of this volume, as of others in the same series, is the clearly drawn diagrams illustrating the various circuits, &c. This book well maintains the high standard of the excellent series of which it forms a part.

Strength of Materials. A Text-book for Secondary Technical Schools. By Mansfield Merriman. Price 4s. 6d. nett. New York: John Wiley & Sons. London: Chapman & Hall.

This book is so well known to engineers that an extended review is not necessary. The fact that 16,000 copies have already been sold shows its popularity. It belongs to one of the series of small text-books which John Wiley & Sons are now issuing. In this edition a new chapter on combined stresses is added. Numerous changes have been made in the text, and many in the problems introduced. The following chapter headings show the scope of the book: (1) Elastic and Ultimate Strength; (2) General Properties; (3) Moments for Beams; (4) Cantilever and Simple Beams; (5) Columns or Struts; (6) The Torsion of Shafts; (7) Elastic Deformations; (8) Miscellaneous Applications; (9) Reinforced Concrete; (10) Combined Stresses; (11) Resilience of Materials.

A folder, in which is given a list of the leading markets abroad for British goods and the value of exports for the year 1911, has been issued by Sells, Limited, 168 and 167 Fleet-street, London, E.C. A copy of the publication will be forwarded to any reader who may desire one.

INSTITUTION OF MUNICIPAL AND COUNTY ENGINEERS.

President—Mr. R. J. Thomas, M.Inst.C.E., County Surveyor, Buckinghamshire.

NORTH-WESTERN DISTRICT.

A meeting of the North-Western District will be held at Stretford on Saturday, March 1st.

NORTH-EASTERN DISTRICT.

A meeting of the members of the North-Eastern District will be held in Leeds on Saturday, March 8th.

A meeting of the institution will be held in the North-Eastern District at Newcastle-on-Tyne on May 2nd and 3rd next.

ANNUAL MEETING: ALTERATION OF DATE.

The date of the annual meeting of the institution has been altered from July 23rd-26th to July 16th-19th.

SCOTTISH MEETING.

A meeting of the institution will be held in the Scottish District at Dundee on June 6th and 7th.

By order of the Council,

Thomas Cole,
Secretary.

11 Victoria-street, S.W.

SOCIETY OF ENGINEERS.

At an ordinary meeting, to be held on Monday, March 3rd, at the Institution of Electrical Engineers, Victoria Embankment, W.C. (south end of Savoy-street, near Waterloo Bridge), Mr. John Kennedy (president, 1912) will present the premiums awarded for papers published in the "Journal" during 1912. Mr. Arthur Valon, the president for 1913, will then deliver his presidential address.

The chair will be taken at 7.30 p.m.

A. S. E. Ackermann,
Secretary.

17 Victoria-street, S.W.

INSTITUTION OF MUNICIPAL ENGINEERS.

President—Mr. FRANK LATHAM, M.INST.C.E.I., F.S.E., Borough Engineer and Surveyor, Penzance.

COUNCIL MEETINGS.

The following council meetings have been arranged: March 26th, London; April 30th, London; May 31st, Manchester; June 28th, London; July 30th, London.

GENERAL MEETING.

A visit will be paid to the Building Exhibition at Olympia on April 12th, by kind permission of the promoters. Full particulars will be issued later.

EXAMINATIONS.

The next examination will be held in London and other centres during the week ending May 17th next. Copies of syllabus and forms of application to sit may be obtained from the secretary. Intending entrants are requested to make early application.

B. WYAND,
39 Victoria-street, S.W. *Secretary.*

Buxton Incorporation. An official intimation was received on Monday by Buxton Urban District Council from the Privy Council stating that their lordships are disposed to recommend to the King the granting of a Charter of Incorporation, and, if necessary, without the Urban District of Fairfield, but that they would prefer Fairfield to be included if possible.

APPOINTMENTS VACANT.

Official and similar advertisements received up to 4.30 p.m. on Thursdays will be inserted in the following day's issue, *but those responsible for their despatch are recommended to arrange that they shall reach* THE SURVEYOR *office by noon on* **Wednesdays** *to ensure their inclusion in the weekly list of summaries. Such advertisements may, in cases of emergency only, be telephoned (No. 1359 Holborn), subject to later confirmation by letter.*

ASSISTANT ROAD FOREMAN. February 28th. Corporation of Wolverhampton. £2 per week.—Borough Engineer, Town Hall, Wolverhampton.

ASSISTANT EXAMINER OF TECHNICAL ACCOUNTS.—March 1st.—For His Majesty's Office of Works. £150—£300. The Secretary, H.M. Office of Works, Storey's-gate, London, S.W.

ROAD FOREMAN.—March 1st. Selby Rural District Council. Mr. J. Townend, clerk, 1 Abbey-place, Selby.

SANITARY INSPECTOR.—March 1st.—Corporation of Stockport. 35s.—45s. weekly.—Dr. H. E. Corbin, medical officer of health, Town Hall.

CLERK OF WORKS.—March 1st.—Cardiff Education Committee. £3 10s. per week.—Mr. J. J. Jackson, Education Offices, City Hall.

CLERK OF WORKS.—March 3rd.—Teddington Urban District Council. £4 4s. per week. Mr. G. H. Salmons, clerk.

TEMPORARY SURVEYORS (two).—March 3rd.—Mr. W. H. S. Dawson, city engineer and surveyor, Town Hall, Bradford.

ASSISTANT NUISANCE INSPECTOR. — March 5th.—Corporation of Rawtenstall. £75 per annum. Mr. J. Whalley, town clerk.

SURVEYING ASSISTANTS.—March 7th.—Shanghai Municipal Council. 250 tael (a tael is nearly 2s. 9d. in British currency) per mensem.—Messrs. John Pook & Co., agents, 63 Leadenhall-street, London, E.C.

ASSISTANT DRAUGHTSMAN.—March 7th.—Corporation of Cambridge. £80—£120 per annum.—Mr. J. E. Whitehead, town clerk.

INSPECTOR OF NUISANCES AND SURVEYOR. —March 8th.—Bicester Urban District Council. £130 per annum, with free house.—Mr. Edward Foster Tanner, clerk.

BOROUGH ENGINEER AND SURVEYOR.—March 8th.—Corporation of Wigan. £350—£500 per annum.—Mr. William Henry Tyrer, town clerk.

ARCHITECTURAL ASSISTANT.—March 10th.—Corporation of Halifax. £140 per annum.—Mr. J. Lord, borough engineer and surveyor.

ASSISTANT ENGINEERS. — May 1st.—Indian Public Works and State Railway Departments.—Secretary, Public Works Department, India Office London, S.W.

MUNICIPAL COMPETITIONS OPEN.

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RANGOON.—March 1st.—Designs for municipal buildings. Premiums are offered of £300, £200, and £100.—The Clerk to the Rangoon Municipality.

WINNIPEG.—March 1st.—Designs for city hall. Limited to British architects in Canada. Premiums are offered of 5,000 dols., 3,000 dols., and 2,000 dols.—The Clerk.

IPSWICH.—March 31st.—Designs for laying out 26 acres as a working-class suburb on the lines of a modified garden city. Premiums of 50 guineas, 30 guineas, and 20 guineas are offered.—Mr. W. Bantoft, town clerk.

DEVONPORT.—June 14th.—Designs for municipal buildings and a guildhall, for the Corporation of Devonport. Premiums of £350, £150, and £100 are offered. The assessor is Mr. Ernest Newton, A.R.A., F.R.I.B.A. Mr. R. J. Fittall, town clerk.

MUNICIPAL CONTRACTS OPEN.

Official and similar advertisements received up to 4.30 p.m. on Thursdays will be inserted in the following day's issue, *but those responsible for their despatch are recommended to arrange that they shall reach* THE SURVEYOR *office by noon on* **Wednesdays** *to ensure their inclusion in the weekly list of summaries. Such advertisements may, in cases of emergency only, be telephoned (No. 1359 Holborn), subject to later confirmation by letter.*

Buildings.

CARDIFF.—March 1st.—For the erection of a technical institute, for the Education Committee.—Director of Education, Education Offices.

SMETHWICK.—March 1st—April 4th.—For the erection of a school, for the Education Committee. Applications for schedule of quantities to be made by March 1st.—Mr. F. J. Gill, architect, Lloyd's Bank Chambers, High-street.

HALSTEAD.—March 1st.—For the erection of public baths, for the urban district council. Mr. R. R. Morton, clerk.

CHELMSFORD.—March 3rd.—For the erection of new offices, for the rural district council. Mr. Arthur S. Duffield, clerk.

BIGGLESWADE.—March 3rd.—For the erection of a filter-house, for the Water Board.—Mr. A. Chaundler, clerk.

COVENTRY.—March 3rd.—For the erection of 104 workmen's dwellings, for the corporation.—Town Clerk.

HALIFAX.—March 3rd.—For the erection of a pavilion, for the corporation. Mr. C. G. Mason, borough surveyor.

TYNEMOUTH. — March 3rd. — For rebuilding stables and cart sheds, for the corporation. Mr. J. F. Smillie, borough surveyor.

WILTS.—March 4th.—For the erection of new county offices and other works, for the county council.—Mr. J. G. Powell, county surveyor, Trowbridge.

FILEY.—March 4th.—For the erection of a retort-house, for the Gas Committee. Mr. H. Tobey, engineer, Malton.

FALMOUTH.—March 5th.—For the erection of twenty-two houses, with alternative prices for forty-four, for the corporation.—Borough Engineer.

BIRMINGHAM.—March 5th.—For the extension of cottage baths, for the corporation.—Mr. J. Cox, superintendent engineer, Kent-street.

RATHDOWN.—March 5th.—For the erection of a public library, for the rural district council.—Mr. R. Cunniam, clerk, Loughlinstown.

NEW HUNSTANTON.—March 6th.—For the erection of boiler house, coal store, and other works, for the urban district council.—Mr. J. S. B. Glasier, clerk.

DUBLIN.—March 7th.—For the extension of boiler and engine house buildings at generating station, for the corporation.—Mr. F. J. Allan, secretary Electricity Supply Committee, 3 Cork-hill, Dublin.

SHEFFIELD.—March 7th.—For rebuilding tramways depot, for the corporation.—City Architect.

CHELMSFORD.—March 7th.—For the erection of a public convenience, for the corporation.—Mr. G. Melvin, town clerk.

BOURNE.—March 8th.—For the construction of two brick bridges, for the rural district council.—Mr. Cecil W. Bell, clerk.

EAST HAM.—March 8th—17th.—For the erection of a school, for the corporation. Applications for bills of quantities must be made to the architect, Mr. R. L. Curtis, 11 and 12 Finsbury-square, London, E.C., not later than March 8th.—Mr. F. R. Thompson, secretary, Education Office, Town Hall, East Ham.

SOMERSET.—March 10th.—For the erection of a school, for the county council.—Mr. C. H. Bothamley, county education secretary.

ABERAVON.—March 10th.—For the erection of arcade and municipal offices, and ferro-concrete construction, for the corporation. — Mr. M. Tennant, town clerk.

DONCASTER.—March 10th.—For the erection of retort-house and coal store extensions, for the corporation.—Mr. R. Watson, engineer, Gasworks.

BERMONDSEY.—March 10th.—For alterations at Rotherhithe Town Hall, for the borough council.—Mr. R. J. Angel, borough surveyor.

OXFORD.—March 10th.—For the erection of a girls' and infants' school, for the Education Authority.—City Estates Surveyor.

BARNES.—March 11th.—For building a thatched pavilion and a sanitary convenience (above ground), for the urban district council.—Mr. G. Bruce Tomes, surveyor.

MARGATE.—March 11th.—For the erection of cookery, laundry, and manual training centre, for the Education Committee.—Mr. E. A. Borg, borough surveyor.

SOUTHEND.—March 13th.—For the erection of a swimming bath, for the corporation.—Mr. E. J. Elford, borough engineer.

FARNBOROUGH.—March 31st.—For the erection of a refuse destructor, with buildings and chimney stack, for the urban district council.—Mr. J. E. Hargreaves, surveyor.

CARNARVON.—April 16th.—For the erection of a police station and court room at Llandudno, for the Joint Committee.—Mr. A. Bodvel-Roberts, Clerk of the Peace, Carnarvon.

Iron and Steel.

SWINDON.—March 1st.—For the supply of iron and wire fencing, for the corporation.—Mr. R. Hilton, town clerk.

COVENTRY.—March 3rd.—For the supply and delivery of cast-iron pipes, lead pipes, solder, and hydrant and valve boxes, for the corporation.—Mr. J. E. Swindlehurst, water engineer.

MANCHESTER.—March 4th.—For the supply of steel girder tramway rails, for the corporation.—Chairman of the Tramways Committee, 55 Piccadilly.

WOKINGHAM.—March 4th.—For the supply of 1,200 yds. of iron fencing, for the corporation.—Mr. C. W. Marks, borough engineer and surveyor.

CHEPPING WYCOMBE.—March 5th.—For the supply of cast-iron pipes, wrought-iron tubing, and brass fittings, for the corporation.—Mr. T. J. Rushbrooke, borough surveyor and water engineer.

WIRKSWORTH.—March 7th.—For the supply of cast-iron manhole and lamphole covers, cast-iron pipes, ventilating columns, disc valves and other ironwork, and the supply and erection of three revolving sprinklers, for the urban district council.—Mr. J. Gratton, clerk.

HALIFAX.—March 8th.—For the supply of cast-iron pipes, lead piping, pig lead, and gun metal fittings, for the corporation.—Mr. Percy Saunders, town clerk.

CARMARTHEN.—March 14th.—For the construction of a water tank, and providing and laying 3-in. cast-iron or steel water main, for the rural district council.—Mr. John Saer, clerk.

BASFORD.—March 17th.—For providing and laying about 6,000 yds. of 4-in. and 3-in. cast-iron water mains, with necessary special castings, valves, and service connections, for the rural district council.—Mr. Henry Stone, clerk.

BOMBAY.—March 25th.—For supplying and laying about 19 miles of 50-in. diameter steel main, for the municipality.—Mr. H. J. Trivess Smith, hydraulic engineer, Municipal Offices, Bombay.

Roads.

BELPER.—March 1st.—For the supply of highway materials, for the rural district council.—Mr. R. C. Cordon, engineer and surveyor, Duffield, near Derby.

EAST RIDING.—March 1st.—For the supply of 7,000 tons of stone for macadamising the main roads, for the county council.—Clerk, County Hall, Beverley.

EAST RETFORD.—March 1st.—For the supply of broken granite and slag, for the rural district council.—Mr. C. B. Smith, clerk.

RICCALL.—March 1st.—For the supply of road materials, for the rural district council.—Mr. J. Townend, clerk, 1 Abbey-place, Selby.

REPTON.—March 1st.—For the supply of broken granite, limestone, slag, broken boulders, and local gravel, for the rural district council.—Mr. T. R. Sidgwick, surveyor, Willington, Derby.

GLANFORD BRIGG.—March 1st.—For making up certain streets and back roads, for the rural district council.—Mr. Frank C. Hett, clerk.

TOTNES.—March 1st.—For the repair of main and district roads, for the rural district council.—Mr. F. K. Windeatt, clerk, High-street, Totnes.

GOOLE.—March 1st.—For the supply of stone, tar-macadam, asphalt and ashes, for the rural district council.—Mr. Geo. England, clerk.

DINAS POWIS.—March 1st.—For the supply of mountain limestone and team labour, for the rural district council.—Mr. J. Holden, 20 Park-place, Cardiff.

CARRICKFERGUS.—March 1st.—For the supply and rolling of stone and screenings, for the urban district council.—Mr. D. Law, clerk.

EAST COWES.—March 1st.—For the execution of repairs, for the urban district council.—Mr. A. E. Barton, surveyor.

BOLSOVER.—March 1st.—For the supply of road materials, for the urban district council.—Mr. W. G. H. Browne, surveyor.

NORMANTON.—March 2nd.—For carrying out private street works, for the urban district council.—Mr. A. Hartley.

CHERTSEY.—March 3rd.—For the supply of Guernsey and Leicester granite, Hungry Hill flints, Farnham shingle and gravel, Mendin stone, chalk and macadam, for the rural district council.—Mr. Herbert Benney, surveyor.

SAWBRIDGEWORTH.—March 3rd.—For street watering, for the urban district council.—Mr. W. Morris, clerk.

WEST LANCASHIRE.—March 3rd.—For the supply of hand and machine broken granite, tar-macadam, and tar mixtures, for the rural district council.—Mr. R. Rosbotham, chief surveyor, Town End, Ormskirk.

STAFFORD.—March 3rd.—For the supply of granite and slag, for the rural district council.—Mr. C. B. Wilton, clerk.

DROXFORD.—March 3rd.—For the supply and delivery of 2,300 tons of granite or hard stone, for the rural district council.—Mr. H. Godfrey Pearson, clerk.

WANDSWORTH.—March 3rd.—For the making up and paving of Birchwood-road, Streatham, for the borough council.—Mr. D. A. Nicholl, town clerk.

BLYTH AND CUCKNEY.—March 3rd.—For the supply of the best broken slag, for the rural district council.—Mr. F. Hopkinson, surveyor, 66 Bridge-street, Worksop.

EAST GRINSTEAD.—March 3rd.—For the supply of road materials, for the rural district council.—Mr. F. S. White, clerk.

GLASGOW.—March 3rd.—For the supply of four 10-ton compound steam rollers and two Tyne scarifiers, for the corporation.—Mr. J. Lindsay, town clerk.

LICHFIELD.—March 3rd.—For the supply of granite, slag, chippings, carting, tools, and oil, for the rural district council.—Mr. Thomas Moseley, clerk.

DROXFORD.—March 3rd.—For the hire of steam rollers and scarifiers, for the rural district council.—Mr. H. Godfrey Pearson, clerk.

WALTHAM.—March 3rd.—For the supply of granite, flints, gravel, hoggin, ballast, sand, tar-macadam and tar, for the urban district council.—Mr. F. C. E. Jessopp, clerk, Waltham Abbey.

HIPPERHOLME.—March 3rd.—For the supply of macadam, for the urban district council.—Mr. G. Wharton Thompson, engineer and surveyor.

MILTON REGIS.—March 3rd.—For the supply of broken Guernsey and other approved granite and crushed shingle, for tar-painting, for the urban district council.—The Surveyor.

FINCHLEY.—March 4th.—For the supply and delivery of grit for tar-painting, for the urban district council.—Mr. E. H. Lister, clerk.

PORTLAND.—March 4th.—For the supply of broken granite or basalt, for the urban district council.—Mr. R. S. Henshaw, engineer and surveyor.

POTTERSPURY.—March 4th.—For the supply of broken and unbroken granite and slag, for the rural district council.—Mr. W. R. Parrott, clerk, High-street, Stony Stratford.

FOOTS CRAY.—March 4th.—For the supply of road materials, including tar-paving and tar-macadam, for the urban district council.—Mr. W. A. Farnham, surveyor.

BARTON-UPON-IRWELL.—March 4th.—For the supply of setts, kerbs, macadam, flags, limestone chippings, sanitary pipes, and road brushes, for the rural district council.—Mr. A. H. Mountain, surveyor.

LEWISHAM.—March 4th.—For kerbing, channelling, and paving, for the borough council. — The Borough Surveyor.

CASTLE WARD.—March 4th.—For the supply of road materials, for the rural district council.—Mr. D. Hope, surveyor, Ponteland.

CHESTER-LE-STREET.—March 4th.—For the supply of whinstone and blast-furnace slag and carting, for the rural district council.—Mr. G. W. Ayton, highway surveyor.

HOLLINGBOURN.—March 5th.—For the supply of road materials.—Mr. H. J. Bracker, clerk, 33 Earl-street, Maidstone.

BINGHAM.—March 5th.—For the supply of granite and slag, for the rural district council.—Mr. R. H. Beaumont, clerk.

ISLE OF WIGHT.—March 5th.—For the supply of road materials, for the rural district council.—The Clerk, Newport.

DEVON.—March 5th.—For strengthening, draining and resurfacing main roads, for the county council.—Mr. W. P. Robinson, county surveyor, 22 Queen-street, Exeter.

BARNSLEY.—March 5th.—For work of making up, for the corporation.—Mr. J. H. Taylor, borough surveyor.

DEVON.—March 5th.—For works of improvement on the main roads, for the county council.—Mr. F. Bailey, clerk, The Castle, Exeter.

SOUTHEND.—March 6th.—For work of making up, for the corporation.—Mr. E. J. Elford, borough engineer and surveyor.

ERPINGHAM.—March 6th.—For the supply of road material and team labour, for the rural district council.—Mr. R. Mann, district surveyor, Cromer-road, Holt.

BISHOP'S STORTFORD.—March 6th.—For the supply of 10,000 gallons of tar, for the urban district council.—Mr. C. J. Hancox, clerk.

WETHERBY.—March 6th.—For the supply of broken whinstone, limestone, granite, dross, tar-macadam, and cob limestone, for the rural district council.—Mr. E. H. Coates, clerk.

GUISBOROUGH.—March 7th.—For the supply of whinstone, slag, and tarred slag, for the urban district council.—Mr. R. H. Kilburn, surveyor.

MANCHESTER.—March 7th.—For the execution of street work, for the corporation.—Surveyor to the Withington Committee, Town Hall, West Didsbury.

WIGAN.—March 7th.—For the supply of road materials, for the rural district council.—Mr. R. B. Marsh, highway surveyor, Parbold, near Southport.

OUNDLE.—March 7th.—For the supply of granite and slag, for the urban district council.—Mr. G. B. Chilvers, surveyor.

SOKE OF PETERBOROUGH.—March 7th.—For the supply of broken granite, broken slag, broken slag chippings, local stone and gravel cartage from railway stations, and team labour, for the county council.—Mr. A. C. Wallingford, county surveyor.

CAMBRIDGESHIRE.—March 7th.—For hire of steam rollers, for the county council.—Mr. J. E. Blackwall, county surveyor.

CHESTERTON.—March 7th.—For the supply of 5,000 tons of broken granite and 2,000 tons of slag, for the rural district council.—Mr. John F. Symonds, clerk.

KIVETON PARK.—March 8th.—For the supply of slag, broken granite, and tar-macadam, for the rural district council.—Mr. F. Hewitt, surveyor.

NEWARK.—March 8th.—For the supply of granite, slag and tar-macadam, for the rural district council.—Mr. R. Oakden, junr., 27 Winchelsea-avenue, Newark.

DRIFFIELD.—March 8th.—For the supply of 7,000 tons of whinstone, 2,500 tons of broken slag, 600 tons of sea cobbles, 300 tons of sea gravel, and 150 tons of tarred chippings, for the rural district council.—Mr. T. Casson Beaumont, surveyor.

CLOWNE.—March 8th.—For the supply of broken slag and granite, for the rural district council. Mr. J. T. Pears, surveyor.

HUNSLET.—March 8th.—For the supply of granite, limestone, dross, tar-macadam, kerbs, setts, flags, and steam rolling, for the rural district council.—Mr. W. B. Pindar, clerk.

HOLBORN.—March 8th.—For work of paving, for the borough council.—Borough Surveyor.

PANTEG.—March 8th.—For the supply of metalling and general haulage, for the urban district council.—Mr. H. R. Davies, Council Offices, Pontymoel.

STAFFS.—March 8th.—For the supply and cartage of road materials, tools, and road implements, for the county council.—Mr. J. Moncur, county surveyor, Stafford.

STOCKTON.—March 8th.—For the supply of whinstone and slag, for the rural district council.—Mr. W. Heslop, highway surveyor.

SELBY.—March 8th.—For the supply of road materials, for the rural district council.—Mr. J. Townend, clerk.

LANCASHIRE.—March 8th.—For repaving 40,000 square yards with granite setts, and 10 000 square yards with granite cubes, for the county council.—Mr. Harcourt E. Clare, clerk, Preston.

HOVE.—March 8th.—For paving and other works, for the corporation.—Mr. H. Endacott, town clerk.

HOYLAND NETHER.—March 8th.—For the supply of broken slag, granite and tar-macadam, for the urban district council. Mr. Fred. J. Thackray, engineer and surveyor.

KING'S LYNN.—March 10th.—For the supply of road material, for the corporation.—Mr. Alfred J. Smith, borough surveyor.

WEST SUFFOLK.—March 10th.—For steam rolling in connection with the Newmarket-Bury-Stowmarket road reconstruction, for the county council.—Mr. W. Lionel Jenkins, county surveyor.

LEAMINGTON.—March 10th.—For the supply of 3,000 tons of road stone, for the corporation. Road Surveyor.

OXENDON.—March 10th.—For the supply of broken granite, chippings and dust, broken slag, tar-macadam, and tar grouting and binding, for the rural district council.—Mr. W. J. Smith, surveyor, Rothwell House, Market Harborough.

TENTERDEN.—March 10th.—For the supply of granite or other approved macadam, picked flints, Kentish ragstone and beach, and carriage and steam rolling, for the rural district council.—Mr. W. L. C. Turner, district surveyor.

MOTTRAM-IN-LONGDENDALE.—March 10th.—For the supply of rock setts, for the urban district council.—Mr. S. Hudson, surveyor.

NORTON.—March 10th.—For the supply of materials and team labour, for the rural district council.—Mr. J. E. Moulding, clerk, The Edge, Sheffield.

CAISTOR.—March 10th.—For the supply of granite and slag, for the rural district council.—Mr. A. A. Padley, clerk.

WIMBORNE AND CRANBORNE.—March 10th.—For quarrying gravel and team work, for the rural

district council.—Mr. R. T. S. Seymour, district surveyor, Wimborne Minster.

WING.—March 10th.—For the delivery of 1,500 tons of granite and 1,500 tons of slag, sand and gravel, for the rural district council.—Mr. C. W. B. Calcott, clerk.

BOLTON-UPON-DEARNE.—March 10th.—For the supply of road materials, for the urban district council.—Mr. J. L. Hawksworth, clerk.

WEST SUFFOLK.—March 10th.—For steam-rolling work, for the county council.—Mr. W. L. Jenkins, Bury St. Edmunds.

MOUNTAIN ASH.—March 11th.—For the supply of broken limestone and gravel, broken native stone, and hauling broken stone and gravel, for the urban district council.—Mr. H. P. Linton, clerk.

FAVERSHAM.—March 11th.—For the supply of granite, broken pit flints, shingle, and fine gravel, for the rural district council.—Mr. J. G. Chitttenden, district surveyor.

ELHAM (Kent).—March 11th.—For the supply of flint and Kentish rag, for the rural district council.—Highway Surveyor, Lyminge, Kent.

DOCKING.—March 11th.—For the supply on hire of a 10-ton steam road roller, for the rural district council.—Mr. J. A. Stoughton, clerk.

BRIDGNORTH.—March 11th.—For the supply of road material, for the rural district council.—Mr. F. Richards, surveyor

EPSOM.—March 11th.—For laying 7,300 sq. yds. of wood paving, and 13,000 sq. yds. of tar-macadam, for the urban district council.—Mr. E. G. Wilson, clerk.

MAIDSTONE.—March 11th.—For the supply of Guernsey granite, Cornish elvan or stone of a similar nature, Cherbourg quartzite, tarred ragstone concrete, Portland cement and ballast, for the urban district council.—Mr. S. Lance Mouckton, town clerk.

RYE.—March 12th.—For the supply of materials, for the rural district council.—Mr. L. Amon, highways clerk.

HARTISMERE.—March 12th.—For the supply of 2,300 tons of 1½-in. granite, and 2000 tons of pit stones, for the rural district council.—Mr. Harold Warnes, clerk. Eye, Suffolk.

LANCASHIRE.—March 12th.—For the supply of granite macadam, limestone macadam, rubble, chippings, gravel for binding, and tarred slag or tarred granite macadam, for the county council.—Mr. Harcourt E. Clare, clerk, County Offices, Preston.

PONTEFRACT.—March 12th.—For the supply of road materials, for the rural district council.—Mr. J. D. Smith, clerk.

OSWESTRY.—March 14th.—For keeping in repair the district roads, for the rural district council.—Mr. C. H. Bull, clerk.

STAINES.—March 14th.—For the supply of granite and granite chippings, for the urban district council.—Mr. E. J. Barrett, engineer and surveyor.

BRIGHTON. March 14th.—For laying wood pavement, for the corporation.—Mr. H. Talbot, town clerk.

DARTFORD.—March 15th.—For the supply of broken hard stone of one of the following kinds: Rhenish basalt, Guernsey granite, Cloe Hill basalt, Leicester granites, Cornish granites, Penmaenmawr or other North Wales granite, quartzite, or Quenast, for the rural district council. Mr. E. J. Hobbs, clerk.

CHORLEY. March 17th. For the supply of broken granite and slag, rubble, chippings, setts, flags (natural), and concrete, kerbs, tools, implements, and pitch and oil, for the rural district council.—Mr. John Whitfield, clerk.

NORTHWICH. March 17th. For work of making-up, for the urban district council. Mr. J. Brooke, engineer and surveyor.

POCKLINGTON. March 17th. For the supply of the best blue stone and slag, for the rural district council. Mr. T. Robson, clerk.

SOUTHGATE. March 25th. For works of street improvement, for the urban district council. Mr. W. M. Ellenor, clerk.

TANGIER.—April 10th.—For the construction of a sewer and a road, for the Special Committee of Public Works.—Commercial Intelligence Branch of the Board of Trade, 73 Basinghall-street, E.C.

TANGIER. April 12th. For the construction of the second section of Casablanca-road, for the Special Committee of Public Works.—Commercial Intelligence Branch of the Board of Trade, 73 Basinghall-street, E.C.

Sanitary.

GLASGOW.—March 1st.—For the construction of a public convenience, for the corporation.—Mr. J. Lindsay, town clerk.

ROTHERHAM.—March 1st.—For the removal of nightsoil and other refuse, for the rural district council.—Mr. B. Hey, surveyor.

BOLSOVER.—March 1st.—For work of scavenging, for the urban district council.—Mr. H. J. Watson, clerk, Gluman-gate, Chesterfield.

DARLINGTON.—March 1st.—For work of scavenging, for the rural district council.—Mr. W. Pallister, Union Offices.

AUCKLAND.—March 3rd.—For the construction of sewage disposal works, and laying earthenware pipe sewers with manholes, for the rural district council.—Mr. S. Adams, clerk.

MANCHESTER.—March 3rd.—For the construction of main drainage work, for the corporation.—Mr. Thomas Hudson, town clerk.

SUNDERLAND.—March 3rd.—For work of scavenging for the rural district council.—Sanitary Inspector.

WATFORD.—March 3rd.—For the construction of storm-water drainage and sewerage works, for the urban district council.—Mr. D. Waterhouse, engineer and surveyor.

ROCHFORD.—March 3rd.—For the removal of refuse and the supply of disinfectants, for the rural district council.—Mr. F. Gregson, clerk, Southend.

HORNSEY.—March 3rd.—For the construction of intercepting sewer and ejectors, for the corporation.—Mr. E. J. Lovegrove, borough engineer and surveyor.

EARSDON.—March 3rd.—For work of scavenging, for the urban district council.—Mr. J. R. McMillen, surveyor, Council Offices, Shiremoor.

CROYDON.—March 4th.—For scavenging and street watering, for the rural district council.—Mr. E. J. Gowen, clerk, Katherine-street, Croydon.

FAREHAM.—March 4th.—For the removal of house refuse and street scrapings, for the urban district council.—Mr. Walter Butler, surveyor.

LISTOWEL.—March 4th.—For the construction of sewers, for the urban district council.—Mr. D. J. McMahon, surveyor.

MALDON (Essex).—March 4th.—For removal of house refuse and night soil, for the rural district council.—Mr. W. Almond, surveyor and inspector.

CAERPHILLY. March 4th.—For work of scavenging and street watering, for the urban district council. Mr. A. O. Harpur, surveyor.

REPTON.—March 5th.—For scavenging work, for the rural district council.—Mr. C. F. Chamberlin, clerk, Union Offices, Burton-on-Trent.

LLANDAFF.—March 5th.—For removal of refuse, for the rural district council.—Mr. M. Warren, clerk, Park House, 20 Park-place, Cardiff.

ISLE OF WIGHT.—March 5th.—For the removal of house refuse and contents of earth closets, for the rural district council.—Mr. H. E. Stratton, clerk, 30 Pyle-street, Newport.

CLEETHORPES. March 5th—17th.—For work of sewer construction, for the urban district council. The resident engineer will show the site of the proposed works on March 5th. Mr. J. S. Alford, engineer, 9 Victoria-street, Westminster.

CROYDON.—March 6th.—For work of scavenging, for the rural district council.—Mr. E. J. Gowen, clerk, Katherine-street, Croydon.

BISHOP'S STORTFORD.—March 6th.—For the construction of a public convenience, for the urban district council.—Mr. R. S. Scott, engineer and surveyor.

DUBLIN.—March 6th.—For the construction of sewers, culverts and pumping mains, for the corporation.—Mr. J. S. Alford, 9 Victoria-street, Westminster.

BARNSLEY. March 6th. For work of scavenging and emptying cesspools, for the rural district council.—Mr. D. Thompson, sanitary inspector.

WIRKSWORTH.—March 7th.—For the construction of about 12,000 lin. yds. of 15, 12, 10, 8 and 6 in. earthenware pipe sewers with manholes, settling tanks, storm-water tanks, filters, sludge beds, road making, and other works, for the urban district council.—Mr. J. Gratton, clerk.

WIRKSWORTH.—March 7th.—For the construction of sewers, manholes, tanks, filters, and sludge beds, for the urban district council.—Mr. H. A. Johnson, engineer, 15 The Exchange, Bradford.

BLACKBURN.—March 7th.—For cleansing earth-closets and privies, for the rural district council.—Mr. J. Birch, clerk.

WORSLEY.—March 8th.—For the supply of materials required for sewering a portion of the district, for the urban district council.—Mr. J. Pethean Monks, clerk.

PONTYPRIDD.—March 10th.—For the construction of 9-in. and 12-in. stoneware surface-water drain, for the urban district council.—Mr. J. Colenso Jones, clerk.

DURBAN (Natal).—March 10th.—For the supply of stoneware sewerage pipes, for the corporation.—Messrs. Webster, Steel & Co., agents, 5 East India-avenue, Leadenhall-street, London, E.C.

CREWKERNE.—March 11th.—For the construction of storm overflows, screening chamber, detritus tanks, channels, and mixing race, precipitation and sedimentation tanks, circular bacterial filters, storm-water tank, and sludge lagoon, for the urban district council.—Mr. J. W. Munden, clerk.

STALYBRIDGE.—March 12th.—For the supply of complete sludge-pressing plant, and mechanical screening plant in duplicate, for the Stalybridge and Dukinfield Joint Sewerage Board.—Mr. William Moss, clerk.

ROTHERHAM.—March 14th.—For the supply of disinfectants, for the rural district council.—Mr. B. Hey, surveyor.

Stores.

SOUTH SHIELDS.—March 1st.—For the supply of Northumberland whinstone, Fifeshire whinstone, Aberdeen and Norwegian granite, slag, granite chippings, Caithness flags, Portland cement, cement concrete flags, cast ironwork, shovels, scavenger brooms and machine brooms, coal, coke, disinfectants, leather hose, sewer boots, jackets, sanitary pipes, paints, paint oils, glass, timber, iron, horseshoe nails, cart axles, springs, tar, pitch, oils, and general stores, for the corporation.—Mr. J. Moore Hayton, town clerk.

MIDDLETON.—March 1st.—For the supply of macadam, flags, setts (flag rock), kerbs, pipes, tipler closets, brushes, lime, alumino-ferric, press cloths, castings, pitch and oil, for the corporation.—Mr. Frederick Entwistle, town clerk.

EALING.—March 3rd.—For the supply of limes, pipes, cement, ironmongery, iron castings, paints, granite, gravel, disinfectants, refined tar, wood-paving repairs and slab laying, for the corporation.—Mr. Geo. E. Brydges, town clerk.

DERBY.—March 3rd.—For the supply of bar iron, bricks, brushes, castings, cement, lime, disinfectants, earthenware, freestones, gritstones, granite, hardware, ironmongery, glass, limestone, paints, oils, pitch, tar, slag, soap, soda, and timber, for the corporation.—Mr. John Ward, borough surveyor.

GUILDFORD.—March 5th.—For the supply of broken granite, chippings, granite setts, Durax cubes, brooms, brushes, cast-iron pipes, flints, galvanised steam tubes, disinfectants, horse hire, cartage, iron castings, ironmongery, oils, pitch, tar, Portland cement, lias lime, stoneware pipes, and shoeing, for the corporation.—Mr. A. D. Jenkins, town clerk.

PONTYPRIDD.—March 5th.—For the supply of road materials and other goods for the surveyor's department, for the urban district council.—Mr. J. Colenso Jones, clerk.

STOKE-ON-TRENT.—March 7th.—For the supply of press cloths, lime, chemicals, oil and slack, petroleum for power purposes, and lubricating oils, for the corporation.—Mr. E. B. Sharpley, town clerk.

MORLEY.—March 7th.—For the supply of road materials, Portland cement, lime, sand, sewer and drain pipes, sewer ironwork, pitch and creosote oil, and brooms, for the corporation.—Mr. W. E. Putman, borough engineer and surveyor.

SUTTON COLDFIELD.—March 8th.—For the supply of granite macadam and kerb, limestone macadam and setts, gravel and broken pebble stones, Yorkshire or pennant kerb, Rowley setts, earthenware pipes, cement, lime, iron castings, iron, steel, timber, hardware, oils, paints, and bass brooms, for the corporation.—Mr. W. A. H. Clarry, borough engineer and surveyor.

BINGLEY.—March 8th.—For the supply of road materials, ironmongery, brooms, oils, pitch, distilled tar, sanitary pipes, and castings, for the urban district council.—Mr. H. Bottomley, clerk.

BARNES.—March 10th.—For the supply of broken Guernsey or Alderney granite, broken pit flints and Thames ballast, hire of horses and carts, disinfectants, ironmongery, Portland cement, forage, litter, granite kerb, channel, paving slabs, oils, paints, and stoneware pipes, for the urban district council.—Mr. G. Bruce Tomes, engineer and surveyor.

NEWARK.—March 10th.—For the supply of 1,900 tons of slag and 150 tons of tar-macadam, for the rural district council.—Mr. A. J. Franks, clerk.

COVENTRY.—March 10th.—For the supply of broken road stone, granite kerbs, granite setts, stoneware pipes, castings, and workmen's tools, for the corporation.—Mr. J. E. Swindlehurst, city engineer and surveyor.

EASTBOURNE.—March 10th.—For the supply of Portland cement, cast-iron goods, wrought-iron goods, tools, ironmongery, oils, colours, timber, broken granite, granite kerb and setts, bricks, pipes (stoneware) brooms and brushes, for the corporation.—Mr. A. Ernest Prescott, borough surveyor.

COLNE.—March 10th.—For the supply of Lancashire and local setts, flags, kerbs, channels, Portland cement, granite macadam, limestone macadam, lime, ironwork (street grates, manholes and lamphole covers), pitch, creosote oil, earthenware pipes, and brushes, for the corporation.—Mr. Alf. Varley, town clerk.

TWICKENHAM.—March 12th.—For the supply of broken granite, ballast, shingle, flints, gravel, granite kerb, channel, quadrants, granite cubes, setts, Portland cement, fodder, forage, oils, iron castings, street gullies, drain pipes, tar slag macadam, and Kentish rag tar-paving, for the urban district council.—Mr. H. Jason Saunders, clerk.

EXETER.—March 12th.—For the supply of bricks, bass brooms, and refilling stocks of sweeping machines, Portland cement, building lime and slates, cast-iron pipes, granite channelling and kerb, Yorkshire flags, concrete flags, painting work, stoneware pipes, miscellaneous iron castings, stone, sand, timber, ironmongery, oils, plumbers' material and labour, asbestos goods, and maunds or baskets, for the corporation.—Mr. H. Lloyd Parry, town clerk.

STOKE-ON-TRENT.—March 12th.—For the supply of 440 tons of Portland cement, 6,200 yds. of stoneware pipes, 18 tons of cast-iron pipes, and timber, for the corporation.—Mr. E. B. Sharpley, town clerk.

DARTFORD.—March 15th.—For the supply of broken hard stone of the best description, 6,790 cubic yards of unbroken flints, 1,020 cubic yards of broken Kentish ragstone or Sevenoaks rock, 500 yds. of gravel, labour, haulage, tar-painting and steam rolling, for the rural district council.—Mr. E. J. Hobbs, clerk.

HEYWOOD.—March 17th.—For the supply of setts, earthenware pipes, bends, junctions, taper pipes, traps, gullies, pitch, creosote oil, limestone chippings, hand-broken granite, granite chippings, kerbs, flags, granite setts, Portland cement, and waste-water closets, for the corporation.—Mr. Geo. G. Bouchier, town clerk.

GAINSBOROUGH.—March 19th.—For the supply of broken granite or whinstone macadam, granite or whinstone setts, broken and block slag, slag chippings and dust, York setts, kerbs, channels, flags, concrete flags, stoneware and earthenware pipes, gullies, cast-iron pipes, tar-macadam, pitch, and creosote oil, and Portland cement, for the urban district council.—Mr. Sam. W. Parker, engineer and surveyor.

TENDERS FOR MUNICIPAL WORKS OR SUPPLIES.

The Editor invites the co-operation of SURVEYOR *readers with a view to making the information given under this head as complete and accurate as possible.*

* Accepted. † Recommended for acceptance.

BLYTH.—For drainage works in connection with the extension of Cowpen Cemetery, for the urban district council.—Mr. R. Grieves, engineer and surveyor:—

J. W. Henderson, South Gosforth	£1,560
G. E. Simpson, Newcastle-on-Tyne	1,133
J. Thompson, Newcastle-on-Tyne	1,080
G. Mauchlen, Newcastle-on-Tyne	1,078
W. Robson, Newcastle-on-Tyne	1,035
J. McLaren, jnr., Gosforth	1,015
R. Baxter, Blyth*	1,000

BUCKINGHAM.—Accepted for the supply of materials, for the rural district council.—Mr. R. Curtis Cordon, surveyor:—

Granite.—C. Abell, Limited; Enderby & Stoney Stanton Company; Groby Granite Company; W. L. Ireland; Jees Hartshill Granite Company; Judkins, Limited; Mountsorrel Granite Company; Whitwick Granite Company.

Granite Chippings.—Enderby & Stoney Stanton Company: B. J. Forder & Son; Whitwick Granite Company.

Slag.—Exors. of P. Phipps.

Steam Rolling.—The Oxford Steam Plough Company.

BURY.—Accepted for the erection of shed, messroom, and stores, for the corporation:—

C. Brierley, Bury.

EASTBOURNE.—For additions to sanatorium, for the corporation.—Mr. W. C. Field, borough architect:—

R. Cook & Sons, Crawley	£1,647
Peerless, Dennis & Co., Eastbourne	1,327
M. Hookham, Eastbourne	1,115
R. N. Stanbridge, Eastbourne	1,035
A. J. Bessant, Eastbourne	1,000
J. Martin, Eastbourne	995
H. Martin, Eastbourne	975
F. W. Allcock, Eastbourne*	878

FARNBOROUGH.—The following tenders have been accepted by the urban district council:—

Associated Cement Company.—Cement at 34s. 7d. and 35s. 7d. per ton, delivered at Farnborough and North Camp stations respectively.

Bristowe & Co.—Tarvia at 5¾d. per gallon, delivered at Farnborough or North Camp stations.

Cooper & Co.—Clee Hill granite at 13s. 9d. per ton, delivered at Farnborough or North Camp stations.

Tarmac, Limited.—Tar-macadam at 16s. 9d. per ton for 2½-in., 16s. 9d. per ton for 1¼-in., 17s. per ton for ¾-in. tar paving, and 10s. 6d. per ton for binding, delivered at Farnborough or North Camp stations.

Eddison & Co.—Steam-rolling at 27s. 8d. per day with flagman, 25s. 5d. per day without flagman, and ¾d. per super. yard for scarifying.

Excelsior Stone Company.—Slab-paving at 3s. 8½d. per square yard.

FORFAR.—Accepted for the supply of highway materials, for the county council.—Mr. D. Ross, Brechin-road, Kirriemuir:—

Dunnichen.—D. Callander, Forfar, £136.
North Forfar.—G. Wishart, Forfar, £224.
South Forfar.—D. Callander, Forfar, £176.
Inverarity.—G. Wishart, Forfar, £587.
Rescobie.—D. Callander, Forfar, £154.
Glamis.—D. Duncan, Glamis, £151.
Kinnettles.—A. Callander, Forfar, £69.
Essie & Newtyle.—T. Mitchell, Kirkinch, Meigle, £213.
Cortachy & Clova.—T. Newton, Kirriemuir, £88.
Glenprosen.—A. McIntosh, Glenprosen, Kirriemuir, £84.
North Kirriemuir.—P. Clark, Kirriemuir, £122.
South Kirriemuir.—T. Newton, Kirriemuir, £148.
Kingoldrum.—P. Clark, Kirriemuir, £102.
Ruthven & Airlie.—T. Callander, Kirriemuir, £239.
Lintrathen.—A. Scrymgeour, Lintrathen, Kirriemuir, £212.
Glenisla.—District Committee of the County Council, £173.
North Kirriemuir Carting.—D. Callander, Forfar, £329.

HARPENDEN.—For the construction of sewerage works, for the urban district council.—Mr. J. H. Leverton, surveyor:—

J. Dixon, St. Albans	£4,637
Drever & Sons, Kettering	4,525
S. Johnson, Son & Marsh	4,422
F. W. Southorn & Co., Leicester*	3,947
A. Thompson, Whetstone	3,797

HORNCASTLE.—Accepted for the supply of granite and slag to the rural district council:—

F. Hodson & Son, Nottingham.—1,200 tons granite at 11s. 2d. and 10s. 7d.
Groby Granite Company.—2,000 tons at 11s. 10d. and 11s. 8d.
Ellis & Everard, Bardon-hill.—2,000 tons granite at 12s. 7d. and 12s. 5d.
Brooks, Limited, Halifax.—Slag and chippings.—860 tons at 6s. 6d. and 7s.
Renishaw Iron Company, Chesterfield.—2,000 tons ditto, 6s. 2d.
Stanton Iron Works Company, 1,200 ditto, 5s. 4d. and 5s. 1d.

ISLE OF ELY.—Accepted for the supply of broken materials for the repair of main roads, for the county council.—Mr. R. S. W. Perkins, county surveyor, Ely:—

Granite.—Enderby & Stoney Stanton Co., Narborough; Groby Granite Company, Groby; British Macadams, Limited, Gravesend.
Slag.—Lavender & Bateman, Sutton Bridge; Islip Iron Company, Thrapston.
Tar Macadam.—Lavender & Bateman, Sutton Bridge.

KNOTTINGLEY.—For excavating and draining works, for the urban district council.—Mr. A. Hartley, consulting surveyor:—

E. A. Greaves, Castleford, £614.

RUSHDEN.—For the construction of sewage disposal works, comprising alteration of existing works, new screening and detritus tanks, sedimentation tanks, storm-water tanks, humus tanks, percolating filters, culverts, drains, ejector house and plant, sludge-drying beds, laying out land, road making and incidental works, for the urban district council.—Mr. W. B. Madin, engineer and surveyor:—

F. Osman & Co., Southampton	£16,445
Hickman & Sons, Market Harborough	13,895
A. H. Price & Co., Nottingham	12,249
G. Henson & Son, Wellingborough	11,957
W. G. Wilmott, Rushden*	11,235

SLOUGH.—The following tenders have been accepted by the urban district council.

Tar Paving.—Tarmac Company, Limited.—(1) 1¼-in. coarse gauge tar bottoming in full truck loads at 15s. 3d. per ton; (2) ditto, tar topping, gauge, ½ to ¾ in., at 15s. 3d. per ton; (3) ditto, limestone or other approved dust, at 9s. 1d. per ton.

Tar Macadam.—Abdon Clee Stone Company.—19s. 7d., 21s. 7d. per ton; Tarmac Company.—15s. 3d. per ton; Northern Quarries, Limited.—18s. 2d. to 20s. 2d. per ton.

Stores.—Mr. F. Archer: For the supply of brooms; Messrs. Pryke & Palmer.—For the supply of other stores set forth in schedule A, and the whole of the stores set forth in schedule B of the tender.

SOUTHGATE.—For carrying out private street works, for the urban district council.—Mr. C. G. Lawson, surveyor, Council Offices, Palmer's Green, N.:—

Kelvin-avenue.—T. Adams, Wood Green, N.
Chimes-avenue (part of), and Haslemere-road (part of).—A. Thompson, Oakleigh-park, N.

SOUTHGATE.—For the supply of unclimbable fencing, for the urban district council.—Mr. C. G. Lawson, surveyor:—

J. Elwell, Limited, Birmingham.

SOUTHGATE.—For the construction of an open-air swimming bath, for the urban district council.—Mr. C. G. Lawson, surveyor:—

A. Thompson, Oakleigh-park, N.

MEETINGS.

Secretaries and others will oblige by sending early notice of dates of forthcoming meetings.

MARCH.

1.—Institution of Civil Engineers: Students' Visit to Royal Albert Dock Extension (South).
1.—Institution of Municipal and County Engineers: North-Western District Meeting at Stretford.
3.—Society of Engineers: Presidential Address.
3. Royal Institute of British Architects, Special and Business Meetings: Election of Royal Gold Medallist and Amendment of By-laws. 8 p.m.
6. Institution of Electrical Engineers (Manchester section): Messrs. S. L. Pearce and H. A. Ratcliff, on "Recent Developments in the Street Lighting of Manchester."
8.—Institution of Municipal and County Engineers: North Eastern District Meeting at Leeds.
17.—Royal Institute of British Architects: Mr. F. Billerey, on "Modern French Architecture," 8 p.m.

APRIL.

12.—Opening of Building Trades Exhibition, Olympia, by Lord Mayor of London.
21.—Royal Institute of British Architects: Messrs. F. W. Jackson and Bernard Dicksee, on "Modern Steel Construction." 8 p.m.
23.—Royal Sanitary Institute: Ordinary General Meeting. 4 p.m.

MAY.

14-18.—Royal Institute of Public Health: Annual Congress in Paris.

JUNE.

6-7.—Institution of Municipal and County Engineers: Meeting at Dundee.

APPOINTMENTS OPEN.

Official and similar advertisements received up to 4.30 p.m. on Thursdays will be inserted in the following day's issue, *but those responsible for their despatch are recommended to arrange that they shall reach* THE SURVEYOR *office by noon on* **Wednesdays** *to ensure their inclusion in the weekly list of summaries. Such advertisements may, in cases of emergency only, be telephoned (No.* 1359 *Holborn), subject to later confirmation by letter.*

SHANGHAI MUNICIPAL COUNCIL.

PUBLIC WORKS DEPARTMENT.

TWO SURVEYING ASSISTANTS.

Two thoroughly qualified Surveying Assistants, with experience in Town Surveys and Cadastral Work, are required in the Public Works Department.

Candidates should be about 25 years of age and unmarried. Salary, taels 250 per mensem without allowances, under a three years' agreement, with first-class passage from home, half pay on voyage, and medical attendance. There is an excellent Superannuation Scheme.

The value of the tael at the present rate of exchange is about 2s. 9d., but it is liable to fluctuation.

Particulars of the appointment may be obtained of the Council's Agents, and applications, in candidate's own handwriting, stating qualifications, experience, &c., accompanied by copies of not more than three recent testimonials, and endorsed "Surveying Assistants," should be forwarded on or before 7th March to Messrs. John Pook & Co., Agents for the Shanghai Municipal Council, 63 Leadenhall-street, London, E.C.

February, 1913.

PUPIL.—The Borough and Waterworks Engineer of Leamington (A.M.I.C.E.) has a vacancy in his office for a Pupil.—Address, Town Hall.

COUNTY BOROUGH OF WIGAN.

APPOINTMENT OF BOROUGH ENGINEER AND SURVEYOR.

The Corporation of Wigan invite applications for the position of Borough Engineer and Surveyor at a salary of £350 per annum, rising by annual increments of £50 to £500 per annum.

Particulars of the duties and conditions of the position may be obtained on application to the undersigned.

Applications, endorsed "Borough Engineer," and stating age, qualifications and experience, and accompanied by copies of not more than three recent testimonials, must be delivered to me on or before Saturday, the 8th March next.

WILLIAM HENRY TYRER,
Town Clerk.

Town Clerk's Office,
Wigan.
February 20, 1913.

BOROUGH OF CAMBRIDGE.

ASSISTANT DRAUGHTSMEN, &c.

Additional assistance is required in the Borough Surveyor's Department, chiefly for indoor work.

Applications are invited from Candidates, who should be neat and expeditious draughtsmen, accurate surveyors and levellers.

Salary, £80 per annum, rising by annual increments of £10, on approved service, to a maximum of £120.

Applications, stating age, qualifications and experience, accompanied by copies of not more than three testimonials of recent date, should be sent to the undersigned on or before Friday, the 7th March, 1913, endorsed "Assistant."

J. E. L. WHITEHEAD,
Town Clerk.

Guildhall,
Cambridge.
February 25, 1913.

WANTED, Two Surveyors (Temporary Employment), who must have had experience in Town Surveying, Theodolite practice, and detail work. Applications, stating age, experience, salary required, and accompanied by not more than three testimonials, to be addressed to Mr. W. H. S. Dawson, City Engineer and Surveyor, Town Hall, Bradford, not later than 3rd March next.

WANTED.—Traveller calling on Surveyors and Engineers to sell patent on commission. For full particulars apply Edward Bowyer, High-street, Slough.

TEMPORARY ENGINEERING AND SURVEYING ASSISTANT. March 8th. Wantage Rural District Council.—Mr. John W. Harris, Engineer and Surveyor, East Challow, Wantage.

TENDERS WANTED.

WEST SUFFOLK COUNTY COUNCIL.

MAIN ROADS.
NEWMARKET-BURY-STOWMARKET ROAD.

RECONSTRUCTION.
STEAM ROLLING.

Tenders are invited for Steam Rolling in connection with the above works.

Conditions of Contract, with Specification and Form of Tender, may be obtained on application to the undersigned.

Tenders to be sent in on or before Monday, the 10th March, 1913.

W. LIONEL JENKINS, A.M.I.C.E., F.A.S.I.,
County Surveyor.

Shire Hall,
Bury St. Edmunds.
February 13, 1913.

HOYLAND NETHER URBAN DISTRICT COUNCIL.

TO STONE MERCHANTS, CONTRACTORS, &c.

CONTRACTS FOR SUPPLIES.

The above Council invite Tenders for the Supply and Delivery of the following Road Materials for the year ending 31st March, 1914:—

Broken Slag.
Granite.
Tar-macadam.

Full particulars and Form of Tender may be obtained on application at my office.

Sealed Tenders (accompanied by samples), endorsed "Tender for Materials," addressed to the undersigned, must be delivered not later than Saturday, March 8, 1913.

The Council do not bind themselves to accept the lowest or any Tender.

(By order)
FRED J. THACKRAY,
Engineer and Surveyor.

Town Hall, Hoyland, near Barnsley.
February 25, 1913.

RURAL DISTRICT COUNCIL OF DARTFORD.

ROAD MATERIALS, MAINTENANCE, AND STEAM ROLLING.

The Rural District Council of Dartford invite Tenders for the Supply of the undermentioned Materials, and for the Maintenance and Repair and the Steam Rolling of the District Roads under their jurisdiction for One Year from the 1st April, 1913, to the 31st March, 1914, as follows:—

(1) MATERIALS.

(a) The Supply and Delivery to Wharves and Railway Stations, as required, of about 4,460 tons of Broken Hard Stone of one of the following kinds: Rhenish Basalt, Guernsey Granite, Clee Hill Basalt, Leicestershire Granites, Cornish Granites, Penmaenmawr or other North Wales Granite, Quartzite, Queenast, or other equally durable material.

The Hard Stone to be supplied must be of the best description, and samples of the same must be deposited with the Tenders. Each sample to be marked with the name of the Contractor and the description of the material.

(b) The Supply and Delivery to Roadsides of about 6,790 cubic yards of Unbroken Flints, about 1,020 cubic yards of Broken Kentish Ragstone or Sevenoaks Rock, and about 500 yards of Gravel. The Ragstone or Rock and Gravel to be squared ready for measurement.

(2) MAINTENANCE AND REPAIR.

(a) All Labour in connection with the proper scavenging and removal of mud, &c.; water tabling, with removal of silt sidings, &c., breaking and yarding of Flints, and spreading of all the material, and all other labour in connection with the proper maintenance of the Roads and the Footpaths adjoining them.

(b) The haulage of Broken Hard Stone from the wharves and stations, and other Materials from the depots to the required places in the District.

(c) The Tar-painting of Roads, Paths and Channels where required at per superficial yard.

(3) STEAM ROLLING.

The Steam Rolling and Setting of the above-mentioned quantities of materials (more or less). Tenders to include the providing of Rollers, Water, Coals, Engine Driver and Attendant.

Contractors must provide an approved surety for the due performance of the Contract.

Forms of Tender, with Specification (which will show the Sub-division of the District), can be obtained upon application to the Surveyor, Mr. John Hookins, "Gartly," Dartford.

Sealed Tenders, endorsed "Tender for Highways," must be sent to the undersigned (upon the prescribed Form) not later than 12 o'clock noon, on Saturday, the 15th day of March, 1913.

The Council do not bind themselves to accept the lowest or any Tender, and reserve to themselves the right to accept the whole or any portion of a Tender.

(By order)
EUSTACE J. HOBBS,
Clerk to the Council.

Offices, Dartford.
February 14, 1913.

HARTISMERE RURAL DISTRICT COUNCIL.

GRANITE AND PIT STONES.

The above-named Council invite Tenders for the Supply of about 2300 tons of 1¼-in. Granite, and 2,000 tons of Pit Stones, to be delivered as required at the following stations: Diss, Eye, Finningham and Mellis on the Great Eastern Railway, Aspall, Mendlesham and Brockford on the Mid-Suffolk Light Railway. Samples of materials to be sent, carriage paid, to the Master of the Workhouse, Eye. Tenders to be sent to the undersigned not later than Wednesday, the 12th March, 1913. No Form of Tender is issued.

The Council do not bind themselves to accept the lowest or any Tender.

HAROLD WARNES, Solicitor,
Clerk to the Council.

Eye, Suffolk.
February 24, 1913.

COUNTY BOROUGH OF EASTBOURNE.

The Town Council of Eastbourne invite Tenders as follows:—

For the Supply of Portland Cement.
.. .. Cast-iron Goods.
.. .. Wrought-iron Goods.
.. .. Tools, &c.
.. .. Ironmongery (Miscellaneous).
.. .. Oils and Colours.
.. .. Timber.
.. .. Broken Granite.
.. .. Granite Kerb and Setts.
.. .. Bricks.
.. .. Pipes, Junctions, &c. (Stoneware).
.. .. Brooms, Brushes, &c.

Specifications may be seen, and Forms of Tender obtained, at the Borough Surveyor's Office, Town Hall, Eastbourne.

All Tenders must be received by the undersigned on or before Monday, the 10th day of March, 1913, at noon.

No Tender will be considered unless sent in on the proper Form.

The Council do not bind themselves to accept the lowest or any Tender.

(By order)
A. ERNEST PRESCOTT,
Borough Surveyor.

Dated this 20th day of February, 1913.

SOKE OF PETERBOROUGH COUNTY COUNCIL.

MAIN ROADS.

The Roads and Bridge Committee of the County Council invite Tenders for the Supply of:—

(1) Broken Granite, Broken Slag, Broken Slag Chippings, Local Stone and Gravel, to Railway Stations and to Roadside.
(2) Cartage from Railway Stations to Road-sides.
(3) Team Labour,
(4) Hire of Steam Rollers,

for the year ending 31st March, 1914.

Forms of Tender may be obtained from the undersigned, applicants to state which Form of Tender they require (1, 2, 3, or 4).

Applications for Tender Forms should be accompanied by a stamped addressed foolscap envelope.

Sealed Tenders, endorsed "Tenders for Materials," or "Tenders for Cartage," or "Tender for Hire of Steam Rollers," to be delivered to the undersigned on or before the 7th March, 1913.

The Committee do not bind themselves to accept the lowest or any Tender.

A. C. WALLINGFORD.
County Surveyor.

County Surveyor's Office,
Peterborough.
February, 1913.

BOROUGH OF HEYWOOD.

The Corporation of this Borough are prepared to receive Tenders from persons willing to Contract for the Supply of the following Materials for a period of twelve months ending 31st March, 1914:—

Setts, Kerbs (Haslingden), Flags (Haslingden).
Granite Setts, 4 in. by 5 in.
Earthenware Pipes, Bends, Junctions, Taper Pipes, Traps, and Gullies.
Pitch and Creosote Oil.
Limestone Chippings (white).
Hand-broken Granite and Granite Chippings.
Portland Cement (English Manufacture).
Water-waste Closets.

Samples and Specifications may be seen, and Form of Tender obtained, on application to Mr. J. B. Nuttall, Borough Surveyor. Applications to be made before the 8th March.

Contractors tendering for this Work must pay their workpeople at least the standard or Trade Union rate of wages, and observe the trade conditions which attach to the various kinds of work for which Tender is sent in.

Sealed Tenders must be delivered at my Office not later than Monday, the 17th March, endorsed in accordance with the Specification.

The Corporation do not bind themselves to accept the lowest or any Tender.

(By order)
GEO. G. BOUCHIER.
Town Clerk.

RURAL DISTRICT COUNCIL OF DOCKING.

Tenders are invited for the Supply on Hire of a 10-Ton Steam Road Roller, to commence work on or about November 1st next, for a period of about 3 months. Contractors to state price per day (including firing, oil, water cart, driver and flagman).

Tenders, addressed to the undersigned, The Workhouse, Docking, Norfolk, endorsed "Steam Rolling," to be delivered on or before Tuesday, March 11, 1913.

The Council do not bind themselves to accept the lowest or any Tender.

J. A. STOUGHTON.
Clerk.

Fakenham, Norfolk.
February 25, 1913.

COUNTY BOROUGH OF STOKE-ON-TRENT.

BURSLEM STORM-WATER DRAINAGE SCHEME.

TENDERS FOR MATERIALS.

The Corporation invite Tenders for the Supply and Delivery of Materials required in connection with the above works as under:—

Contract No. 2. For the supply of about 440 tons of Portland Cement.
Contract No. 4. For the supply of about 6,200 yds. of Stoneware Pipes, 6-in. to 18-in. diameter.
Contract No. 5. For the supply of 18 tons of Cast-iron Pipes.
Contract No. 7. For the supply of Timber.

Conditions of Contract, Specification and Forms of Tender may be obtained on application to Mr. A. Burton, Assoc.M.Inst.C.E., F.S.I., Borough Surveyor, Town Hall, Stoke-on-Trent.

Sealed Tenders, endorsed "Burslem Storm-Water Drainage. Contract No. —," to be sent to the Borough Surveyor not later than 12 noon on Wednesday, the 12th day of March, 1913.

The successful Contractors will be required to conform to the Council's Regulations as to the payment of Standard Rate of Wages.

The Corporation do not bind themselves to accept the lowest or any Tenders, and reserve to themselves the right to divide any Contract.

E. B. SHARPLEY.
Town Clerk.

February 25, 1913.

CITY OF EXETER.

The Exeter City Council invite Tenders for the Supply and Delivery of the following Goods for twelve months ending 31st March, 1914:—

(1) Bricks.
(2) Brass Brooms and Refilling Stocks of Sweeping Machine.
(3) Portland Cement.
(4) Building Lime and Slates.
(5) Cast-iron Pipes.
(6) Granite Channelling and Kerb.
(7) Yorkshire Flags.
(8) Concrete Flags.
(9) Painting and Paperhangers' Work.
(10) Stoneware Pipes.
(11) Miscellaneous Iron Castings.
(12) Stone and Sand.
(13a) Timber (Foreign).
(13b) Timber (English).
(14) Ironmongery.
(15) Oils.
(16) Plumbers' Material and Labour.
(17) Asbestos Goods.
(18) Mauds or Baskets.

Printed Schedule, Specification and Form of Tender can be obtained from the City Surveyor, Municipal Offices, Exeter. Tenders may be submitted for all or any of the articles required, and the Council reserve the right to accept a portion of a Tender only.

Sealed priced-out Schedules, endorsed with the heading to which the Tender applies, must be sent to me before 10 a.m. on Wednesday, the 12th March, 1913.

The lowest or any Tender will not necessarily be accepted.

H. LLOYD PARRY.
Town Clerk.

Exeter.
February 22, 1913.

The Surveyor

And Municipal and County Engineer.

Vol. XLIII. MARCH 7, 1913. No. 1,103.

Minutes of Proceedings.

Professional Ethics and the Technical Press.

The manner in which a professional engineer should act in his relations with his employers, the public, and his fellows is a subject which admits of discussion only as regards a few subtleties of definition and some matters of minor detail. The object of drafting rules relating to professional conduct is rather to shut out the unworthy than to guide the worthy. Everyone knows the difference between right and wrong, but not everyone cares, and it is necessary, as much for the protection of the public as for the advantage of the profession, that there shall be some formal code to which every engineer is understood to subscribe and which may be used as a standard by which doubtful actions may be judged. Honour itself must be higher than a code of honour, just as a code of honour is, in some respects, higher than the law, which grosser instrument of justice must be invoked when the finer distinctions of right and wrong are obliterated by distrust or anger.

The importance of principle in these matters is recognised, and well expressed, in the first paragraph of a proposed code of ethics for engineers drafted by a committee of the American Society of Mechanical Engineers. "It is an axiom" we read "that engineers in all their professional relations should be governed by principles of honour, honesty, strict fidelity to trusts imposed upon them, and courteous behaviour towards all." As most of the rules are beyond cavil, little need be offered by way of comment. It is as well, however, to state clearly the interpretation which we put on sections 20 and 21. In the words of section 20, "Technical discussions and criticisms of engineering subjects should not be conducted in the public press, but before engineering societies or through technical publications." We take it that the last term includes professional journals, and that the committee regards such journals as providing a suitable field for discussion and criticism. Possibly the term "technical publication" might be given a somewhat narrower meaning in section 21, which runs: "The first technical discussions of inventions or other engineering advances should not be made through the public press, but before engineering societies or through technical publications." One reason for suggesting a narrower interpretation of the term "technical publications" in the case of section 21 is that when inventions or advances are first made public through the technical or professional press the medium chosen should be, both professionally and technically, one especially concerned with the particular subject and chiefly read by the class of engineers particularly concerned with it. There are subjects which may properly be discussed in any of a large number of journals, but when advances or inventions in these subjects are first discussed the proper journal for the purpose should be chosen. In England, for example, *The Engineer* would be a suitable journal for the putting forward of new ideas with regard to railway engineering, and in the case of highway engineering a suitable journal is THE SURVEYOR: assuming that the person taking the initiative did not first bring his subject before an engineering society, or that, as sometimes happens, his own society thought that the matter was unimportant, or were for some other reason not willing to give him an hearing. It is a fact that considerations now regarded as of great importance in highway engineering, after having been kept before road engineers for some years in our own pages, would have been regarded by any of our older engineering societies as unworthy of notice at the time when they were first put forward. The same might be said of matters first made public in other engineering journals, and the technical press is, in fact, charged with the important duty of providing a field for discussion entry to which is at the discretion of unbiassed and disinterested judgment.

* * *

Good Illumination.

More than a quarter of a century ago a small boy, walking one evening along an old turnpike road from which the gates had not long been removed, was faced by a bright light shining straight in his face from a table lamp placed near the window of the toll house. The small boy was struck by the fact that this light was a danger to traffic, since it made it impossible to see the road ahead or to judge of one's position with regard to the hedge. He also found it a considerable inconvenience, since it prevented him from seeing where he was walking, and made it difficult to avoid treading on the loose stones and stepping into the puddles which abounded in the locality. This incident provided material for the first of a series of observations which led, in the year 1907, to the appearance in our pages of an article on lighting. In this article the elements of good street lighting and of the design of lamps for vehicles were dealt with in a manner which provided a foundation for nearly everything which has since been written on this subject. The subject of reasonable illumination has been taken up in earnest by the Illuminating Engineering Society, of which the "small boy" is a member, and among many aspects of this important subject which receive the attention of the society street illumination is that most generally interesting to our readers. A paper read lately before the Society of Arts by Mr. Leon Gaster, hon. secretary of the Illuminating Engineering Society, deals mainly with the lighting of buildings, but the principles underlying the illumination of interiors are the same as those which form the basis of outdoor lighting, and the general applicability of Mr. Gaster's paper to illuminating problems should not be missed. With one passage we are unable to find ourselves in accord. "Of late years," said Mr. Gaster, "the question has arisen whether the multiplication of these very bright sources, with their dazzling effect on drivers and pedestrians, is not sometimes responsible for accidents . . ." But it is not the multiplication of street lamps which causes accidents, or creates the often intensely inconvenient conditions which must almost certainly be a factor tending to accidents; but it is rather their "division." If there were more lamps, each lamp could be less brilliant, the diminution in brilliancy

being to some extent in proportion to the cubes of the distances between the lamps, and to some extent in proportion to the squares of those distances, and depending, partly at least, on the proportion of more or less light coloured vertical surfaces within range of the lamps.

Mr. Gaster does not say whether he regards as practicable the device of screening the direct rays from the eyes of people in the street, nor does he allude to the article already mentioned, in which the adoption of such a device was definitely recommended. There is all the difference in the world between saying that "the question has arisen whether" and making a definite recommendation; and if this matter is really one of importance, due credit should be given to the originator of the idea. As regards the glare from shop windows, or from lamps outside shops, it is a matter for surprise that the public, and especially the drivers of vehicles, have so long put up with what is in many towns a very serious inconvenience, and must tend to increase the dangers of traffic. The City of London is to be congratulated on having made it a rule that such lamps should be screened on the side facing the street. Mr. Gaster deserves praise for the energy which he shows in keeping this important matter before the public, and his last paper, which was entitled "The Economic and Hygienic Value of Good Illumination," is worthy of his reputation for literary composition in this important subject.

* * *

The Engineering Profession.

It is no easy matter in these days to introduce much that is novel into a presidential address delivered before an engineering society. It will be generally conceded, however, that the profession is entitled to look for some guidance from its leading members when speaking officially as heads of the different institutions upon those broad questions which affect the general and financial status of engineers. It was therefore very appropriate that Mr. Arthur Valon, Assoc.M.Inst.C.E., should have confined himself to such topics in delivering his inaugural address on Monday last as president of the Society of Engineers. At the outset he called attention to the modern tendency towards specialisation, and clearly indicated some of the dangers which are inevitably attached to the consequent narrowing of a man's outlook. One corrective of this tendency is to be found in standardisation, which, by removing the necessity for a great deal of detailed study on the part of the practitioner, enables him to cover a wider field of work. Standardisation itself, however, has certain dangers which should constantly be borne in mind and guarded against, although they cannot be compared with the advantages which have accrued from the work of such a body as the Engineering Standards Committee. Thus, it must not be too rigidly applied to matters which are fairly open to differences of opinion; neither must a standard ever be regarded as settled for all time, but it should always be open to any revision rendered necessary by the advance of knowledge. Mr. Valon dealt at some length with the rather vexed question of professional education. The relative importance of practical and theoretical training will, we suppose, be discussed so long as engineering science exists. The need to-day is for men of high technical attainment, and it must be remembered that it is impossible to produce an engineer by merely theoretical training, however excellent it may be. Dealing next with the organisation of the engineering profession, so as to secure adequate remuneration and reasonable remuneration, Mr. Valon discussed the desirability of some form of registration. It does, of course, seem anomalous that there is at the present time no compulsory standard of qualification to practise as an engineer. The "closing" of the profession, however, is a matter which is beset with difficulties, and before it can be accomplished the authorities must be convinced that it will be for the good of the community as well as in the interests of engineers. It is not possible to discuss the matter fully in this place, however, and we must refer our readers to Mr. Valon's very able paper (which is summarised on another page) for a fuller treatment of this and the other matters indicated above.

* * *

Housing Progress in Ireland.

Rehousing in Ireland is making such giant strides that it is not surprising to find public opinion on this side of St. George's Channel expressing itself somewhat seriously thereupon. The *Irish Builder and Engineer*, in its latest issue, reproduces the successful designs in the recent competition for working-class dwellings in Belfast, the architects of which are Messrs. Chillingworth & Levi, of Cork and Dublin. It is noteworthy that the designers have avoided the "model" type of dwelling—which is nothing less than a misnomer—and that they rely upon two descriptions of houses, the separate cottage, or "maisonette," and two separate dwellings or flats in two separate floors of one house. This latter type, if a compromise, is at least free from the serious objections to the "model" or barrack system. Each flat is self-contained and approached by separate entrances, the only thing held in common being the yard. Both types combine the three-roomed and two-roomed tenements in one building, and the estimated cost of each block—maisonette type—exclusive of railings and laying out of ground at rear, is £352, or an average of £88 per tenement; and that of the cottage type £180, or £90 per tenement. The scheme provides for 262 tenements, and the architects estimate that it can be carried through for the sum of £23,000, available for buildings. Our contemporary also directs attention to the inquiry into the Pembroke scheme (briefly reported in last week's Surveyor), which contemplates the provision of between 400 and 500 new houses. In this instance Mr. George L. O'Connor, the architect, has designed an excellent type of dwelling, and a strong case appears to have been made out for the scheme. It is stated that—notwithstanding the absence, to a large extent, of the "very poor" in this locality—the people have perforce to dwell under the most appalling conditions, and that the usual rent for a single room in the slum area is something like 3s. That sound progress is being made in Ireland in the clearing of slums and the rehousing of the people under improved conditions is a very gratifying sign of the times. The need for such schemes is urgent both in this country and in Ireland, and if, as has been stated, the measure of progress in the sister isle exceeds what has been attained here, we are constrained to regard rivalry in such a matter as not merely legitimate, but praiseworthy.

* * *

Road Improvement in the United States.

A pamphlet recently prepared by the United States Office of Public Roads, and issued by the Department of Agriculture as a Farmers' Bulletin, is devoted to a consideration of the "Benefits of Improved Roads." It is by no means of the missionary type of road literature, for although a very strong case is made out for road improvement in rural areas, the subject is dealt with critically, and road improvement is viewed in proper perspective. Some very convincing examples of the reduction in the cost of hauling which is brought about by making good roads are cited. The pamphlet includes a few generalisations with regard to gradients and the proper location of roads, the most important being one which was referred to some little time ago in these columns. This is that the need for having a low maximum grade is much greater on a good road than on a bad one. The primary fact on which this consideration depends is that the resistance on the level is mainly that due to friction, while on the gradient it is that due to gravity. The same horses that can

haul a load against heavy resistance over miles of level road can, with a moderate increase of effort, haul it up a fairly steep hill; but the small team which can haul a heavy load against the small resistance of a good road is incapable of exerting two or three times the extra effort which the bad roads team found sufficient to haul their small load uphill. It may also be pointed out that on a steep piece of bad road the surface is often harder than on the level, and the friction resistance is correspondingly less. As noted in the pamphlet before us, steep grades are also slippery, and this is especially the case on a hard road.

* * *

The National Health Week.

The success which attended the efforts of the National Health Week Committee last year will no doubt still be within the recollection of many of our readers. The movement was taken up with alacrity and even enthusiasm in many centres, and the good work which was undoubtedly accomplished has encouraged the organisers to undertake the work this year, when "National Health Week" will again be celebrated, and will begin on April 6th. The general object of the scheme is to bring home to the minds of the masses the vital importance of both public and personal hygiene. The Central Committee has been formed merely for the purpose of guiding the representative local committees which are being appointed, the idea being that each locality shall be free to adapt the scheme to its own special conditions and needs. The general methods will no doubt be similar to those which were adopted last year, when special lessons were given in schools, appropriate sermons were preached in churches of all denominations, and many public meetings were held at which addresses were delivered by recognised experts in subjects appertaining to health science in all its phases. It is a commonplace among those who are experienced in public health administration that one of the greatest obstacles to success is the appalling ignorance of the vast masses of the population upon even the most elementary matters of health and hygiene. There can be no doubt that such an institution as that of "National Health Week" must by its educational work do much to dispel this ignorance and thus render a real service to public health administrators. It is satisfactory, therefore, to observe that in many places local authorities have taken the matter up officially and are cordially co-operating with voluntary workers to secure the success of the undertaking.

* * *

The Provision of Sanatoria.

A very useful and interesting memorandum, dealing with the construction and arrangement of inexpensive buildings for the treatment of tuberculosis, has just been issued by the Local Government Board to county councils and county borough councils. The memorandum has been prepared jointly by the architect and medical officer to the board (Mr. Brook Kitchin and Dr. Newsholme), and is designed to show how such buildings may be constructed with due regard to both efficiency and economy. The board adhere to the view which they have already expressed that a minimum of 100 beds should be provided if a sanatorium is to be administered economically. This minimum can usually be obtained by a combination of areas, if necessary. In cases where this is impossible, however, the board express their willingness to consider proposals for providing such institutions with fewer beds. In the course of the memorandum, which is reproduced *in extenso* in another column, it is pointed out that timber framing affords the cheapest method of construction, and that, under ordinary conditions, if this form of building be erected, the cost should not exceed £50 per bed, exclusive of the administration department. As regards the type of building to be adopted, the memorandum contains two alternative diagrams and descriptions. Other matters which receive consideration are heating, disposal of sputum, sleeping shelters, and sewage disposal. The memorandum will no doubt be welcomed by those authorities who are anxious concerning the financial aspect of their schemes for the provision of adequate sanatorium accommodation.

* * *

Economy in Reinforced Concrete.

A masterly paper on economy in reinforced-concrete design was read at the last meeting of the Concrete Institute by Mr. John A. Davenport, M.Sc. We give some extracts from the paper on another page, but it is unfortunately impossible for us to reproduce the exhaustive and elaborate series of tables which formed such a valuable feature of Mr. Davenport's communication. It was necessary at the beginning to distinguish clearly between economy as applied to the engineering structure and the same principle as applied to architectural design. Mr. Davenport was only concerned with the former aspect of the subject, and in considering it he dealt with the three fundamental questions of beam section, percentage steel, and arrangement. The paper was divided into four parts, the first being of an introductory character, and the others dealt with the economical beam section, the economical column section, and economy in slab, beam and column construction. The conclusions drawn by the author from the tables appended to the paper are very important, and show the most economical sections to adopt, and the most economical reinforcement percentage in various circumstances. Those of our readers who are specially interested in reinforced-concrete design would do well to obtain a copy of Mr. Davenport's excellent paper for future reference.

* * *

A New Phase.

The opinion which is entertained by certain members of local authorities as to the professional status of the staff of a borough surveyor's department finds expression in a variety of ways. The most usual indication is, perhaps, to be found in the advertisements which appear from time to time inviting applications for such appointments at salaries which a navvy would contemptuously reject. The matter appeared in a new guise, however, at a recent meeting of the Cambridge Corporation. Two members of the staff of the borough surveyor's department having resigned, the corporation had under consideration a recommendation from a committee that the vacancies be filled by the appointment of two assistants at commencing salaries of £80 each per annum, rising by annual increments of £10 to £120 per annum. It was further recommended that advertisements be issued inviting applications for these appointments. A worthy councillor thereupon observed that there was a Labour Exchange in the town, and that he thought they ought to take advantage of it! It is satisfactory to notice that the report of the committee was adopted, the mayor tactfully observing that he did not think an amendment was necessary as the committee would no doubt bear the suggestion in mind.

* * *

The Consistency of Bituminous Materials.

A paper presented at a recent meeting of an American society by Major W. W. Crosby, chief engineer of the Geological Survey and Roads Commission of the State of Maryland, forms a valuable summary of the present position as regards tests of the consistency of bitumens. Mr. Crosby does not confine his attention to American practice, and his practical suggestions are of general application. The paper—an instalment of which is given in another part of this issue – is one which should be read now and not merely marked for reference, and we thank Mr. Crosby for giving our own highway authorities and surveyors this opportunity of keeping abreast of the progress of these studies, to which he contributes valuable and timely material.

The Consistency of Bituminous Materials: Its Determinations and Value in Specifications.*

By W. W. CROSBY, D.Sc., Chief Engineer of the State Geological and Economic Survey and of the State Roads Commission, Maryland, U.S.A.

The consistency of a bituminous material or pitch may be defined as its degree of firmness, and is determined by measuring its internal friction. Consistency in fluids is generally referred to as viscosity. Lewkowitsch says: "Viscosity is internal friction, and has no relation to density."

Differing consistencies are colloquially expressed by such terms as liquid, fluid, semi-fluid, semi-solid, hard or soft, cheesy or sticky. Consideration of consistency will not be extended here beyond those pitches known to be capable of flowing perceptibly from their own mass at temperatures of 100 deg. Cent. and below if given reasonably sufficient time to do so.

The consistency is, of course, affected by physical conditions of temperature, atmospheric pressure, &c., and may be materially affected by the chemical composition of a pitch compound. For instance, two equal portions of a hard asphaltic pitch, when fluxed separately with equal portions of two oils, the one having a paraffin base, the other an asphaltic base, will produce compounds quite different in consistency. Hubbard has shown some effects of naphthalene in pitch compounds, and some effects of the presence of free carbon are already known.

The consistency does not concord with the specific gravity of pitches or pitch compounds generally, though it may frequently seem to be a fairly definite relation to the specific gravities in a group of materials of the same general origin. This concordance in a group may not always exist. For instance, pitch compounds of the same specific gravity may be made from coal-tar in three ways, supposing the tar to be divided into three fractions of light oils (to 170 deg.), middle oils (170 deg. to 270 deg.) and hard pitch (270 deg.). If now a certain specific gravity is reached by a combination of the first and third fractions, the same may be had by combining proper proportions of the first and second, or of the second and third. Yet it will be found that the consistencies of the three compounds so secured are visibly, or when measured by any of the methods usually followed, quite different from each other.

The measurement of the internal friction of a pitch can perhaps be made by finding its rapidity of flow, or its resistance to penetration or to displacement inside its own body. In making this determination it is important that the results be not vitiated by the effects of surface tension, of adhesion, or of specific gravity. For instance, with the penetrometer (referred to more fully later) it frequently happens that the readings are materially affected by the "cratering" of the pitch under the needle, and by the adhesion of the pitch to the sides of the needle penetrating it from without. With a viscosimeter, such as the Engler, the specific gravity of the material must affect the determination, and this is also the case with the ordinary plunger instruments, even if the adhesiveness of the pitch be avoided in the use of the latter.

The characteristics of a pitch as to its specific gravity, its adhesiveness, its cohesiveness, and on many other points expressed intelligibly and simply, are generally desirable, but for the greatest value they should be as far as possible determined and stated separately, as otherwise confusion or worse may result.

The measurement of the internal friction in a pitch, or of its resistance to displacement inside its own body, when separately made and not vitiated by other factors is the true determination of its consistency.

A NECESSITY IN HIGHWAY ENGINEERING.

The determination of the consistency or viscosity of pitches and the intelligible expression of such determination are necessary in highway engineering, as will be more fully indicated later in the portion of the paper referring to their values in specifications. Perhaps it might be said here that, naturally, before the specifications for the methods of use of the material are drawn, an idea must be held of the physical structure of the pitch to be used—*i.e.*, whether it is to be fluid or semi-solid, for instance—as many of the details of method depend entirely on the approximate consistency of the pitch. Certain methods, such as cold sprinkling, would be impossible with a too viscous pitch compound, and hot mixing would be impracticable with a pitch too fluid at normal temperatures. Further, a pitch with a moderate amount of internal friction is less likely to yield to displacement under stress than one with lower cohesiveness, while a pitch showing too high a resistance to internal displacement will probably prove to be brittle under shocks. Excess in adhesive qualities will not wholly make up for lack of cohesiveness or of resistance to internal displacement; hence the importance, again, of determining these qualities separately.

The determination of consistency is now usually made by various instruments based on different principles, and among the more generally used of these instruments are the following:—

The Engler viscosimeter is one of the oldest, and is perhaps the most generally used instrument for oils. It is the standard in Germany. Its principle is that of measuring the relation between the flow of the oil through an orifice or small tube and that of water under the same conditions. Its use is limited to those pitch compounds fluid at normal temperatures, or sufficiently so at temperatures up to about 110 deg. Cent., as to permit their passing in proper quantity through the orifice in a reasonable time. Another objection to the use of this instrument in determinations on pitch compounds is its apparent lack of concordance in repeated determinations. An average variation of the results seems to be about 5 per cent. While it may give valuable information as to the probable behaviour of a pitch compound in a sprinkling machine, the Engler instrument does not seem to be a satisfactory one for laboratory determinations on such materials.

The Sayboldt and the Redwood viscosimeters are modifications of the Engler, and are open to the same objections.

The penetrometer as exemplified by the Dow and the Richardson machines was originally designed for measuring the relative softness or hardness of solid or semi-solid asphaltic pitches. As its name implies, the instrument measures the amount of penetration by a loaded needle within a fixed time into the pitch. Its use is limited to the harder varieties of pitch. Recently an attempt has been made to increase its range by fixing different loads and times so as to accommodate softer as well as harder pitches than could satisfactorily be tested under the original standards of 100 grammes on the needle for five seconds. Its use also seems, unfortunately, attended by a certain non-concordance of results, the average variation being about 20 per cent. Although very widely used on solid or semi-solid pitches, its limited range makes it unsatisfactory as a laboratory instrument, especially since the advent of the more fluid pitch compounds into road work.

It seems to the writer that the concordance of the penetrometer could be improved, and the determinations be made more accurate were a slight change made in the methods of use. That is, instead of placing the clean needle or wire (preferably the latter) with its end in contact with the surface of the material before releasing the plunger, thrust the wire once well into the pitch, withdraw it and reset it on another spot with the lower end through the surface of the pitch and then release the plunger. In this way the effects of adhesion and surface tension would be lessened.

Before passing to the third main class of instruments for determining the consistency of pitches one may perhaps be considered for a moment which is unique in that it seems to belong to none of the classes referred to. It is true it does not actually determine the consistency itself of a material used in it, but rather the rate of change of its consistency.

* Paper read lately before an American Society.

The float test (Richardson) determines the time required for a cool plug of pitch to melt out of an orifice sufficiently to permit the entrance of a considerable quantity of water The test is a handy one, but its range is limited to those materials which will solidify sufficiently at 4 deg. Cent., and flow under 100 deg. Cent. The assumption is made that the rate of softening measured is akin to the actual consistency of a material. This may be correct, but the limited range of the float offers a sufficient ground for objection to it as a reliable laboratory instrument for general use. The non-concordance of repeated results with it seems to average about 12 per cent.

The third class of instruments used in determining consistency may be said to comprise those measuring in one way or another the resistance of the material to internal displacement. In it are included the Lunge and the Hutchinson floats, the Doolittle torsion machine, the Stormer paddles, the Serra Carpi, and the Schutte plungers. All but the two latter are usable only on liquids. The Serra Carpi and the Schutte plungers cover also the semi-fluid materials to some extent, but do not permit of use on the harder varieties of pitch; hence an objection to them under present conditions.

With the above listed instruments for determining the consistency of pitch compounds, which comprises practically all in general use, there remain some gaps—*i.e.*, a considerable number of materials cannot be tested satisfactorily by any of them.

It is probably readily apparent that one instrument with a range over the entire field of pitches and pitch compounds is desirable, especially for laboratory work and in view of the investigations necessary and now being made in the matter of bituminous materials. The inconvenience, expense, delay and other disadvantages of a variety of instruments for determining this one attribute—consistency—of such materials need not be dwelt upon here.

Two independent attempts to provide such an instrument have been carried on almost simultaneously by Mr. H. W. Abraham and by the writer with more or less success. Both of these instruments readily cover, in similar ways, the entire field of bituminous materials performing the work of the needle in the penetrometers, of the paddles in the Stormer, and such instruments, and of the plungers in the Serra Carpi and Schutte machines, with apparently greater accuracy and co-ordination of repeated results in most cases. They do not measure directly orificial flow, as does the Engler, but this loss of a doubtful determination of consistency in pitch compounds for road work is of minor importance, and it seems quite probable that this characteristic may be safely deduced from the direct determinations of these instruments. Both these instruments use needles and various discs, pistons, or plungers, and for a full description of each* reference should be had to the "Proceedings" of the American Society for Testing Materials, vols. ix., x. and xi. As these instruments do cover in the range of their applicability the entire field of pitch compounds, as the concordance in their repeated results is, on the average, well within 5 per cent, and as their determination of consistency seems to be direct, it appears to the writer that they may be considered as satisfactory laboratory instruments. If generally used, they should prove of great value in determining and recording the consistency of bituminous materials now so widely used in road work, and such records should be of greater assistance to all in the investigations now being carried on concerning the use of such materials.

THE TIME FACTOR.

With most of the instruments above referred to the time factor is usually made a constant. As the writer has elsewhere stated previously, it frequently seems that the "time" or "time load" should be the variable to be actually determined. A blown oil and a reduced coal-tar may show almost identical "penetration," yet if the former be struck smartly with the edge of a hatchet the latter will rebound, leaving a clean gash. On the other hand, the rebound from the tar will be imperceptible while the material near the line of contact will be shattered irregularly, generally flying off in chips. Were the "penetration" made the constant, the difference in the resulting "time" or "time load" would better indicate the differing character of the material.

The writer realises that, in view of the already accumulated mass of records from the use of the older instruments and their customary methods of use, a change to a new instrument or to new methods presents its difficulties. But if such changes are now desirable because, for instance, of the greater variety and the wider applicability of the pitch compounds, then delay in changing will seriously increase such difficulties.

With penetrometers, as generally used, apparently insufficient consideration of the effect of surface tension on the determination has been had, at least until recently, in prescribing standards for their methods of use.

With such instruments as the Engler, and to some extent with the penetrometers, a certain factor affecting the character of the material, and apparently comprehended under the term consistency, is ignored. For example, three samples respectively of asphaltic oil, water-gas tar and coal-tar were shown by two Engler instruments to have practically the same viscosity (though the two instruments gave results on the same materials differing by 6 per cent). The consistency of the three materials was visibly different. That this was actually a fact was shown on the Crosby consistometer by the record of a plunger as follows:—

Net load (for 5 seconds) of 0·5 gr. cu

Asphaltic Oil	Water-gas Tar	Coal Tar
106	25	12

(Plunger 12 Special; temperature in all tests 25° C)

For complete satisfaction in the determination of the consistency of a pitch, one instrument able to cover the entire range of materials, at any temperatures—cold, normal, or hot—should give concordant results by various operators at different times with the use of small quantities of material in each test. The main criticisms of the Abraham's instrument seems to the writer its complexity and cost, if consideration of the plungers up to the present used by it, and which could, of course, be readily altered, is omitted. The objection to the Crosby instrument seems to be its delicacy. Otherwise either of these two instruments seems capable of filling the requirements.

In 1909 a rough test for "viscosity" of tars was suggested by J. Walker Smith, city engineer of Edinburgh, in his book, "Dustless Roads Tar-macadam" (p. 52), which test was made by placing copper discs of uniform weight on the surface of the tar and noting the time required for the disappearance of the disc in the tar. The writer at that time was engaged in developing his instrument, and in 1910 had the pleasure of discussing the matter with Mr. Smith. Later, in the Minutes of "Proceedings" of the Institution of Civil Engineers, vol. clxxxvi. (1911), paper No. 3,939, "The Improvement of Highways to Meet Modern Conditions of Traffic," "Appendix V.—Description of Laboratory Tests for Tar," under "Penetration or Viscosity," after describing such a test as above made with "new copper halfpenny coins," he said:—

"It would probably be better to have a penetration machine so arranged that a plunger, say, ¼ in. in diameter, could be used upon the same principle as the needle penetration machines; by this method, taking a standard weight and a standard depth of penetration, the quantity to be determined would be the time taken to effect that penetration."

As before stated, the writer believes the practice of fixing the time load and the measuring the penetration is wrong, and agrees with Mr. Smith that the load and penetration should be the fixtures with the time to be measured. The prevailing practice of measuring the penetration, however, is fairly firmly established from its general use developed with the asphalt paving industry. Possibly in this case of more limited variation in the pitches tested the objections are not so strong as they would be when the variations between the pitches such as are available for road work are great.

So far the writer has operated the Crosby instrument along the lines of other penetrometers in general use, mainly because the bulk of the records available have been so secured and for the purpose of comparison with such. He hopes, however, that an early modification, such as is suggested, of the penetration test may be generally adopted, as he believes the light thus thrown on the matter under investigation would be appreciable. With Smith's crude test, or his suggested refinement of it, consideration of the effects of surface tension and of specific gravity should not be neglected. They have been fully considered, and the writer thinks provided for by the Crosby instrument.

(To be concluded.)

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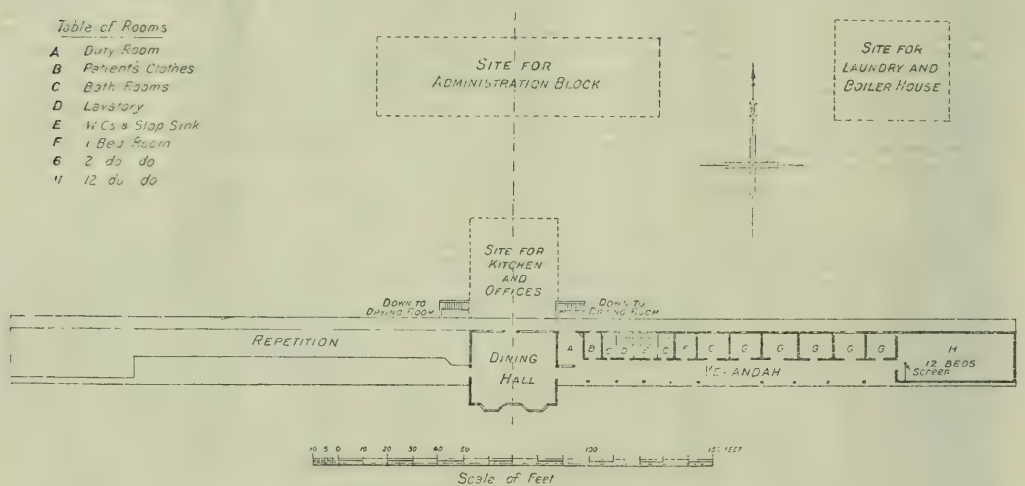
* For Crosby Consistometer see THE SURVEYOR (London), October 20, 1911, and May 3, 1912; also *Good Roads* (New York), September, 1911, and May, 1912.

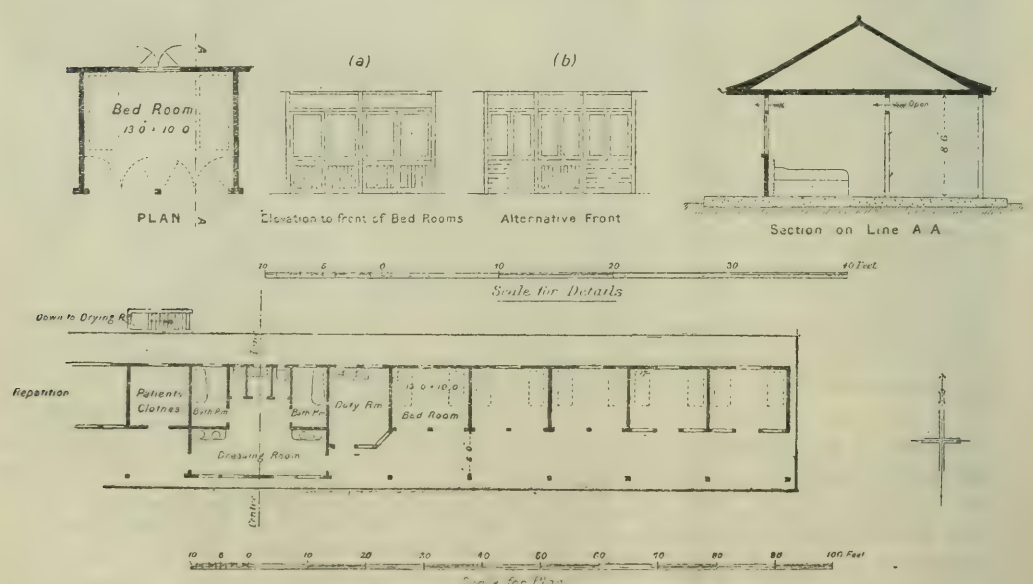
Provision of Institutions for the Treatment of Tuberculosis.

CONSTRUCTION AND ARRANGEMENT OF INEXPENSIVE BUILDINGS: LOCAL GOVERNMENT BOARD MEMORANDUM.

The Local Government Board have issued to county councils and county borough councils a Memorandum, which has been prepared by their architect and medical officer (Mr. Brook Kitchin and Dr. Arthur Newsholme), on the construction and arrangement of inexpensive buildings for the treatment of cases of tuberculosis. In an accompanying circular, Sir H. C. Monro, secretary to the board, states that his authority are impressed with the necessity for securing that in the provision of such institutions forms of construction are adopted which are as economical as is compatible with efficiency. He adds: "Although within the last twelve months a large number of beds have been made available for the treatment of tuberculosis, it is clear that in many areas further accommodation is urgently required. Complete institutions may be built in a comparatively short time, in accordance with the suggestions contained in the Memorandum, but additional accommodation may generally be more expeditiously provided at or in connection with existing hospitals and sanatoria, where provision for administration, &c., already exists. The board direct me to state that, while they adhere to the view expressed in their circular letter of December 6th last that a sanatorium for the treatment of early cases of tuberculosis should, where practicable, on grounds both of economy and efficiency, contain not less than 100 beds, they will be willing, in cases where the population of an area would not justify provision on this scale and it has



Suggested Pavilion for Fifty Patients, Twenty-five of Each Sex (Plan A).



Suggested Pavilion for Twenty Patients of One Sex (Plan B).

(If required for two sexes a modification of the sanitary arrangements will be necessary.)

not been found feasible to arrange for a combination of areas, to consider proposals for providing institutions with fewer beds."

THE MEMORANDUM.

The object of this Memorandum is to indicate in a general way the manner in which sanatorium accommodation of an inexpensive character may be erected within a comparatively short period in order to meet any pressing need of accommodation for tuberculous persons in a particular locality.

PROVISION OF ACCOMMODATION.

The manner in which such accommodation may be most easily and economically provided is by erecting such buildings as are hereafter described, either as a self-contained sanatorium on an independent site, or as an adjunct to an existing institution belonging to a local authority, whether for tuberculosis or for acute infectious diseases.

FORMS OF CONSTRUCTION.

Accommodation for patients may be rapidly built at a comparatively small cost of timber framing, weather boarded and creosoted, or covered with corrugated iron or other suitable material, such as tile hanging, asbestic sheeting, or covered with expanded metal and cemented, and covered internally with lath and plaster, asbestic sheeting, &c.; and a portion of this accommodation may be temporarily arranged and used for the accommodation of the additional staff until complete and permanent quarters have been provided.

In addition to the above method, the following forms of construction, which do not, however, lend themselves to such rapid and economical construction, but are of a more permanent character, may be employed: (*a*) Buildings constructed of steel framing filled in with terra cotta or concrete slabs, (*b*) hollow concrete blocks, (*c*) solid concrete. These forms of construction would, under favourable circumstances, be somewhat cheaper than brickwork, but their economy depends upon the ready access to suitable materials and upon the presence of labour skilled in such special forms of construction; further, it must be borne in mind that risks of settlement and fracture are incidental to buildings of concrete which have been hurriedly and perhaps carelessly constructed.

RELATIVE COST OF WALLS.

The relative initial cost of the walling constructed of these various forms in comparison with walls of 9-in. brickwork may, under ordinary conditions, be approximately reckoned as follows:—

Walls of timber framing covered with weather boarding or expanded metal lathing rendered in cement and plastered internally, from 25 to 30 per cent cheaper.

Walls constructed of concrete blocks or solid concrete, 20 per cent cheaper.

Walls constructed with terra cotta or concrete slabs, 15 to 20 per cent cheaper.

TIMBER-FRAMED BUILDINGS.

Under ordinary conditions the cost of patients' accommodation constructed of timber framing should not exceed £50 per bed, exclusive of administrative department, &c.

Timber-framed buildings, though less permanent and requiring greater cost in upkeep, have the advantage of requiring little or no foundations. They may be erected on a concrete platform, which may also form the flooring of the wards and verandahs. The actual amount of brickwork required will be almost negligible.

Where sufficient labour for the construction of such buildings cannot readily be obtained, it may be necessary to have recourse to firms who make a speciality of the rapid erection of such buildings, and who keep in stock the materials ready for emergencies.

TYPES OF BUILDINGS.

The type of building which is most suitable for the purpose will vary according to the particular needs and circumstances of the locality in which it is to be erected and for which it is required. The accompanying diagram plans are intended merely to illustrate two types which would generally be suitable:—

Plan A is a pavilion for fifty beds (twenty-five of each sex), which might form an adjunct to an existing hospital or form the basis of an independent sanatorium with an administrative department which is shown approximately by dotted lines on the plan. It is suggested that such a building might be constructed of timber framing on a concrete platform, and that it should comprise a series of two-bed wards, each 13 ft. by 10 ft., and one ward for twelve beds, with a central dining hall large enough to accommodate, besides the patients in the pavilion itself, any patients that might, at a future date, be accommodated in other pavilions or châlets. The room shown on the plan would be capable of dining 100 persons.

Plan B is a design for a pavilion of similar construction to contain twenty beds of one sex, intended to supplement existing accommodation. If a still smaller number of additional beds will suffice, the block can be reduced according to requirements.

DETAILS OF BEDROOMS.

The divisions between the bedrooms may be formed of timber framing covered with expanded metal or wood lathing and plastered, or of coke breeze or cement slabs 2 in. to 3 in. thick. The front wall of the patients' bedrooms should be framed in timber and fitted with two pairs of French casement doors, each door being hung in two sections, on the "stable door" pattern, or, as an alternative, with one pair of doors having window openings on each side, which may be left open and fitted with roller blinds or may be fitted with casement windows opening the full extent of the window frame (see detail B). The space above the door and window frame, and a corresponding space on the back wall should be left completely open for ventilation (see section). If the local circumstances are suitable the front of each bedroom or of some of the bedrooms may be left entirely open.

FLOORS.

The floors of the wards may be finished in cement and covered with linoleum, or covered with narrow floor boards laid in pitch. The verandah floors should be of granolithic finish, with a slight fall to the outside.

ACCOMMODATION FOR NURSES.

In the event of temporary accommodation for the nurses being required pending the completion or erection of administrative buildings—some of the bedrooms might be specially arranged for their use in such a way that they can readily be adapted later for the use of patients.

HOT WATER AND HEATING.

Hot water can be supplied from a boiler in a basement under one of the duty rooms, while in a corresponding basement on the other side a boiler for heating the dining hall, &c., could be installed. These rooms may also be used as drying rooms for patients' clothes, bedding, &c.

DISPOSAL OF SPUTUM.

Provision should be made for the satisfactory disinfection and disposal of sputum, and for the cleansing of sputum cups after disinfection, preferably by steam.

DUTY ROOMS.

The nurses' duty rooms should be fitted with sink, and with a gas range or small cottage coal range, which may be of the "portable" type, and a small ventilated food store.

SLEEPING SHELTERS AND CHALETS.

These, if provided, should form only a small proportion of the total accommodation, in view of administrative difficulties. Where the special circumstances of the case justify this form of accommodation on a limited scale, they should be erected on concrete foundations, and provision made for adequate supervision, and for convenient access of the patients to sanitary conveniences, &c.

SEWAGE DISPOSAL.

Where a drainage system is not already in existence some arrangements will be necessary for purifying the sewage before it is discharged into a stream or watercourse. Where suitable and sufficient land is available, purification by land treatment will be the most satisfactory. Earth closets are only permissible under exceptional circumstances or as a temporary arrangement. If the use of earth closets should be necessary they should be isolated from the building containing the patients' accommodation.

Hardship of Housing Act.—The Isle of Wight Rural District Council have decided by a majority against sanctioning the demolition of a poor man's cottage which he was unable to put into habitable repair. It was urged that it was a shame that the Housing Act imposed such hard conditions that the council could not allow the building to be used even for a shed.

Street Lighting Experiments in Manchester.

TESTS OF HIGH-PRESSURE GAS AND ELECTRIC ARC INSTALLATIONS.

At the Institution of Electrical Engineers, last night, the relative values of gas and electricity in connection with street lighting were discussed in a paper by Messrs. S. L. Pearce and H. A. Rateliff, the contribution having special reference to the comparative results of high-pressure gas lamps installed in Princess-street, and high candle-power arcs in Portland-street, Manchester.

GAS INSTALLATION IN PRINCESS-STREET.

Four high-pressure lamps were suspended in Princess-street at the same height above the roadway as the arc lamps—namely, 27 ft. 6 in. The distance between the lamps varied from 95 ft. 6 in. to 118 ft. 9 in., but 106 ft. 6 in. might be taken as approximately the average.

Each lamp contained three inverted burners, and clear globes were used. At normal pressure each burner was rated at 1,500-candle power, or a total of 4,500-candle power for the complete lamp; but the maximum candle power obtained was only about half this figure.

As originally installed the lamps were fitted with traversing and lowering gears; but these were apparently not successful, as the lamps were at a later date fixed permanently in position. The flexible gas supply tubing was also replaced by rigid galvanised gas barrel.

Princess-street is 60 ft. wide, and as the lamps were, on an average, only 106 ft. 6 in. apart, the resulting illumination was very good, and far superior to any previous example of high-pressure gas lighting in Manchester.

Presumably in order to improve still further the maximum illuminating effect, but certainly not the uniform distribution of the light, the lamps have been lowered about 1 ft.

ARC LAMPS IN PORTLAND-STREET.

The central suspension system was chosen for the lighting of Portland-street, and certain predetermined "units" of light were erected at such calculated distances apart as to give the maximum illumination for the least capital expenditure.

The paper points out that in addition to low initial costs the central lighting system has the following advantages, which appear to outweigh certain known disadvantages: —

(*a*) The distributing mains can all be kept to one side of the street.

(*b*) No separate lighting standards are required on the street pavements, with consequent advantage to pedestrian traffic.

(*c*) A more even illumination is obtained; in other words, the ratio of maximum to minimum illumination is less than with side lighting for a given amount of electrical power employed.

The traffic in Portland-street is of a very dense character all day long, and more especially between the hours of 4 p.m. and 6.30, and it was therefore deemed advisable to aim for a high standard of minimum illumination—viz., something of the order of 0·5 foot-candle. The minimum illumination at any point on a horizontal plane at ground level was expected to be not less than 0·44 foot-candle. This figure was not obtained with the lamps as at first installed, but has since been exceeded.

The length of Portland-street is 1,751 ft., and its width 66 ft. Sixteen 550-watt lamps, working four in series on the 200-volt mains, have been erected. Owing to the positions at which certain important side streets intersect the main street, the distance between lamps varies from 114 ft. to 124 ft.

Eight of the sixteen lamps are run on an all-night circuit, and the remaining eight are switched off at 11 p.m. The lamps are so arranged that, when all sixteen are burning, the lighting is balanced across the three-wire distributing mains; but after 11 p.m. the remaining eight lamps are connected to one side of the system only. The lamps are fixtures, in so far as no provision has been made for lowering or drawing them to the side of the street. All trimming has therefore to be done from a tower wagon. This decision was come to after carefully considering the extra expense and complication involved in arranging for lowering gear, and also with due regard to the type of lamp selected, the hours of burning, and the local conditions.

The first results obtained were not considered altogether satisfactory; the shadows under the lamps, thrown by the ash-trays, were most pronounced, as was also the series of concentric rings on the surface of the roadway. As fitted with clear inner and opalescent outer globes, the lamps gave a maximum candle-power on the 20-degree ray of 2,250. This was substantially lower than the result anticipated.

Photometric tests showed that the polar curve of the lamps with the particular inner and outer globes used did not meet the necessary requirements, and the resulting distribution of the light was very unequal. The shadows and concentric rings were practically eliminated by the use of slightly opalescent outer globes, but the efficiency of the lamps was impaired to a very appreciable extent, and the distribution of light was rather worse than before, the change from the dark zone midway between lamps to the bright zone adjacent to the lamps being very pronounced.

The paper mentioned that all the testing was done in the streets at night with the lamps burning under normal conditions, and consequently the results obtained are directly applicable to the requirements of practical work.

GENERAL COMPARISONS.

The authors proceeded to observe that any comparison of the Portland-street and Princess-street lighting other than on an "equal basis of cost and illumination" required to be very unbiassed, since there was much to be said in favour of both systems.

"The gas lamps give a much steadier light than the arc lamps, although the difference is not very noticeable to a casual observer, or even to a keen observer; but it is very noticeable when making measurements with a flicker photometer. . . . Unfortunately, although the gas lamps give a steadier light, their candle-power varies very considerably from day to day. The candle-power of a particular lamp may fall at least 50 per cent before the mantles are renewed, unless it is arranged to change only one mantle at a time, thus spreading the complete change over a fairly long period.

"The candle-power of the arc lamps may vary quite appreciably within a few minutes; but provided that the same make of carbons is used, the average candle-power at any particular angle will not change to any extent from day to day if the line voltage is reasonably constant.

"A very important feature directly affecting the comfort of the general public is the absence or otherwise of glare. . . . Obviously, the larger the surface of the light source in proportion to the total amount of light emitted the lower the intrinsic brilliancy and the less the effect of glare. In this respect the three-burner high-pressure gas lamps have an advantage over the flame arc lamps with clear inner and outer globes. The use of clear outer globes with flame arc lamps is, in fact, hardly advisable from the point of view of scientific lighting, since any form of lighting which is productive of eyestrain is essentially unscientific, and is certainly unsatisfactory.

"Two noticeable features in Princess-street are the comparative softness of the shadows of objects cast on the ground and the absence of a pronounced dark horizontal zone in line with the reflectors. The first result is, undoubtedly, due in a great measure to the fairly large triple light source, which has the effect of shading off the edges of shadows; and the absence of a dark zone in line with the reflectors is, no doubt, due partly to the fact that the source of light is well below the reflector, and partly to the reflection from the inner surface of the large globes. The shadows cast by the flame arc lamps when burning with clear inner and outer globes are very intense, and there is no appreciable shading of the edges; consequently it is possible to confuse shadows with actual objects. The smallness of the light source, or, in other words, the high intrinsic brilliancy, and the fact that the arc is well up under the reflector, is no doubt the cause of the objectionable horizontal dark zone noticeable in cases where reflectors are used."

The Portland-street light is considered by the authors to have a much warmer and more cheerful effect than

the comparatively cold light in Princess-street. The actual relative values of the two schemes of lighting is clearly shown by various tables and curves in the paper, giving the results of photometric tests and the contour curves showing the portions of the street area within which the illumination on a horizontal plane is equal to or greater than 0·5 foot-candle.

"Purely from the point of view of illuminating effect," the paper adds, "there is much to be said in favour of both systems; but the electric lighting system possesses all the practical advantages, a few of the more important of which are: (*a*) Lower cost; (*b*) simplicity of switching operations, and possibility of dispensing with lamplighters; (*c*) flexibility and ease of erection; (*d*) lamps not affected by vibration when suspended from traction poles; (*e*) possibility of reliable check on running costs (*i.e.*, current consumption and carbons); (*f*) negligible leakage; (*g*) absence of globe breakages due to heating, &c.

"All the above advantages are absent in the case of the high-pressure gas system, and in contrast may be mentioned the disadvantages incidental to its use (*a*) Extensive and highly dangerous leakage of high-pressure gas; (*b*) The detrimental effect of a foggy or heavily smoke-laden atmosphere on the mantles, resulting in a serious diminution of candle-power just at a time when it is most required; (*c*) partial and occasionally complete failure in frosty weather."

CONCLUSIONS FROM THE TESTS.

Messrs. Pearce and Ratcliff expressed the view that the tests referred to in their paper had at least vindicated the lighting of city streets by means of flame arc lamps, not only on the dual basis of equal cost and illumination, but also on the ground of light distribution.

"Unfortunately," they remarked, "owing to many unavoidable difficulties, the experiments with various forms of frosted globes have not yet been quite completed; nevertheless, the results so far have been very satisfactory, and further slight modifications will no doubt enable any reasonable alteration in the light distribution to be obtained."

As there was a substantial difference between the cost of the flame arcs and the high-pressure gas lamps for the same minimum illumination, it would be possible to improve the arc lighting, if considered desirable, by reducing the distances between lamps in the case of future extensions. If fixed at the present height, and 100 ft. apart, the minimum illumination would be not less than 0·75 foot-candle. No attempt had been made to obtain perfectly uniform illumination, since it was very doubtful whether such a scheme would be desirable, even if possible. A variation factor of 3·75 was not excessive if the change was fairly gradual; and in this respect partially frosted globes gave results quite as favourable as dioptric ones. A well-known authority on street lighting had expressed the opinion that perfectly uniform lighting was flat and uninteresting. From a purely psychological point of view that was no doubt quite correct; but there was also probably a more definite psychological explanation. The visual conception of illumination was largely a matter of contrast, in connection with which fatigue of the eye played a very important part. It was therefore quite probable that the hollows in the illumination provided the rest necessary to enable the eye to appreciate the peaks, with the result that the average impression produced was superior to the corresponding effect due to a perfectly uniform system of lighting of equal average intensity.

Sheffield Town Planning.—The prospects for the realisation of that co-operation between landowners and the corporation in the matter of the Sheffield town-planning schemes did not appear to be very reassuring at the meeting of owners of the land comprised in the Abbeydale, Woodseats and Ecclesall area, which was held (we learn from the *Sheffield Daily Telegraph*) lately. Mr. C. F. Wike, city engineer, described the area, which contains 1,700 acres, and which, he said, was very suitable for a town-planning scheme. The representatives of the landowners raised a number of objections to the proposal, and asked for details of the scheme. The town clerk sought to assure them that these could be discussed subsequently, and that the meeting was simply called to say whether or not the area was a suitable one. Nothing definite was elicited by the meeting, and it was suggested that the objectors could make their representations at the Local Government Board inquiry.

WIMBLEDON MUNICIPAL WORK.

BOROUGH ENGINEER'S REPORT.

Mr. C. H. Cooper, M.INST.C.E., F.R.S.I., borough engineer and surveyor of Wimbledon, has issued his report for the year ended March 31st last.

The district in which Mr. Cooper is engaged has an approximate length from east to west of 3 miles, and a width of 2 miles, and contains 3,220 acres. The population at the time of the last census was 54,876, and the number of houses is 11,600, of which a percentage of 4·41 are unoccupied. The rateable value of the district is given in the report as £433,872.

HIGHWAYS.

The number of streets repairable by the council at the end of the year was 243, these having an aggregate length of 46·90 miles, including 2⅝ miles of main roads. During the year ·12 miles of private streets were added.

The total cost of repairs of carriage and foot ways was £4,145, a figure which compares very favourably with that of previous years. The reason why the cost of repairs has not increased with the increase in traffic carried is considered to be mainly due to the more substantial making up of private streets and the keeping in better repair of streets maintained by the corporation, while the adoption of tar dressings on carriageways has tended to form a compact surface which prevents grinding, thus adding to the life of the roads.

Mr. Cooper mentions that considerable damage is done by the substitution of sliding for the rotating action of a wheel when braking vehicles in descending declines. The police have, however, rendered the corporation every assistance in enforcing the existing provisions as to skid pans, and during the year issued thirteen summonses, in each case obtaining a conviction.

A table in the report shows that the cost of the maintenance of carriageways during the twelve months under review amounted to £113,326, or £177·93 per mile, 1,286 tons of granite and 2,470 tons of flints being used in the work. Repairs to footways necessitated an expenditure of £1,580.

HOUSE REFUSE.

The quantity of house refuse collected during the year was 13,750 tons, the outlay in this connection amounting to £3,834. Collections were made once a week, except from May 10th to August 31st, when the work was done twice weekly, at an extra cost of £70.

SEWAGE FARM AND WORKS.

The Wimbledon sewage works consist of the following: (*a*) Pumping station, at which the sewage from the middle and low level sewers is raised an average height of 24 ft. by means of electrically-driven centrifugal pumps. (*b*) Settling tanks, consisting of six old tanks, having a capacity of 500,000 gallons; four new tanks, having a capacity of 800,000 gallons; making a total tank capacity of 1,300,000 gallons. In addition, there is a detritus tank for storm water. (*c*) Sludge pressing works, containing six presses, having a cake capacity of 3·65 tons. (*d*) The filters and land available for sewage treatment: Storm-water filters, 1·90 acres; filters, 1st run, 3·22 acres; filters, 2nd run, 3·54 acres; irrigation land, 1st run, 32·04 acres; irrigation land, 2nd and final run, 14·12 acres; total, 54·82 acres.

The total volume of sewage estimated to be treated at the works during the year was about 1,257,407,000 gallons. The average rainfall of the borough during the year was 27·38 in.

The total cost of sewage treatment was £3,119, equivalent to a rate of 1·70d. in the £. The amount of sludge cake produced during the year was 6,278 tons, incurring a cost of £852. Almost all the cake was disposed of, the contractor being allowed 3d. per ton for each ton so disposed of.

The length of sewers in the district is over 56 miles, and that of surface-water sewers slightly over 46 miles, a total of some 102½ miles.

NEW BUILDINGS.

Mr. Cooper states that 152 new buildings were erected during the year (as compared with 271 in the previous year), and additions and alterations were carried out to 33 buildings.

The "Surveyor" Circulation.—We have just received payment for a subscription from Mombasa, British East Africa.

Highway Administration in the United States.

STATE DEPARTMENTS : COMMISSIONERS : STATE ENGINEERS : COUNTY COURTS.

(*Conclusion.*)

It will be seen that in most of the States already referred to the State highway department or commission has considerable powers, but in some States the duties of the department are mainly of an advisory character. The duties and powers of the central department cannot be gauged by its constitution, for some of the chief powers and duties are those entrusted to a single commissioner. In a few of the States the functions of the central department seem to be, at present, of no great importance. In others they are mainly advisory and connected with the collection and publication of data and information useful to highway engineers. In most cases, however, the department exercises a greater or less degree of control over State-aided roads, while in some States the executive and administrative powers of the commissioner are very great, this condition of affairs being usually accompanied by provision for liberal State contributions to the construction and, sometimes, the maintenance of roads.

In the above instances no attempt has been made to go into the matter of the local control of roads, attention being confined to the manner in which State control and supervision are exercised and State aid rendered. It is desirable, however, to note briefly what are the authorities exercising control in those States in which central departments have not been constituted; and it will be understood that in the other States central control is more or less superimposed on similar systems, and more or less substituted for such system, as can be judged by reference to the notes already given.

STATES IN WHICH THE COUNTY COURT IS A HIGHWAY AUTHORITY.

Arkansas.—In this State the County Courts divide each county into road districts, appointing an overseer for each district. The Court may declare a township to be a road district. Where a road tax is levied, or county prisoners are employed on the roads, a county road commissioner may be appointed, and the work may be let by contract.

Kentucky.—The "fiscal court" of each county has control of roads and bridges. The county judge divides his county into "precincts," with an overseer in each. In counties in which funds are raised by taxation for road purposes the Court may appoint a supervisor, and the work may be let by contract.

Missouri.—In this State the County Court of each county divides it into districts, with an overseer in each, but is required to appoint, in addition, a county overseer. In counties under township organisation the county engineer has supervision over all the public roads and over the road overseer of the civil townships.

Oregon.—The County Courts appoint a road supervisor for each district, and may appoint a county road master, or more than one, in any county, the work being done either by contract or by hired labour.

STATES IN WHICH COUNTY COMMISSIONERS ARE THE HIGHWAY AUTHORITIES.

Florida.—The control of roads and bridges is vested in the Board of County Commissioners, each commissioner's district being considered a road district. The county board appoints three persons in each district as commissioners of roads and bridges, and may appoint a county road superintendent to exercise general supervision.

Georgia.—There are two systems in this State, one being similar to that of Florida. The road commissioners in Georgia are, however, required to appoint road overseers. An alternative arrangement may be adopted by any county on the recommendation of the Grand Jury, this consisting in the appointment of a county superintendent of public roads with overseers and guards. The Statute labour tax of ten days a year may be commuted at the rate of 2s. 1d. a day.

Montana.—The county boards divide the counties into road districts and appoint a supervisor for each district. The county commissioners may let by contract any work costing more than £40. The Board of County Commissioners is authorised to issue bonds for road and bridge construction.

Nebraska.—Where township organisation does not exist the system in this State is similar to that of Montana. In counties under township organisation the township board has control of the roads in its area. In addition to powers such as those exercised in Montana the county board may, as in Florida and Georgia, appoint a person, in this case called a commissioner, to supervise district overseers, and to "have all main-travelled roads dragged regularly, at a cost of not more than $1 per mile for each dragging."

South Carolina.—The control of the roads is exercised by the Board of County Commissioners and the county supervisors in each of the counties not under township organisation, each township constituting a county road district having its own overseer. Recently some counties have obtained powers to adopt the contract system, to employ superintendents and engineers, and to develop a systematic plan of road construction. In the remaining eight counties, which are under township organisation, the township board, with the approval of the county commissioners or supervisors, divides the township into districts, with an overseer for each.

South Dakota.—The two methods just described are also in operation in South Dakota, but it seems that the township authorities can act without obtaining the sanction of the county commissioner.

Texas.—The system is similar to that of Florida and Georgia, the counties being divided into "precincts," with overseers, and the commissioners being empowered to appoint a county road superintendent to exercise general supervision of the roads in the county and of convict labour.

Mississippi.—The typical county system is also in force in this State, including provision for the appointment of a general supervisor for the county, and for carrying out work by contract.

Indiana.—The control of highways is exercised by the Board of County Commissioners and by the township trustees. A road supervisor is elected annually for each of the four or six districts of a township.

Wyoming.—The county commissioners may divide the county into road districts in the usual way, with a supervisor for each. If a county is not so divided, a county supervisor is elected by the people.

UNUSUAL FEATURES IN FOUR STATES.

Delaware.—This small State is divided into three counties. The Governor appoints a State highway commissioner for each of two of these counties (salary £200), and the Levy Court of the remaining county (New Castle) appoints a county commissioner at a salary of £500. In all three counties general jurisdiction over the highways is vested in the Levy Courts, which appoint one road supervisor for each "hundred," described as a unit, "which in a measure resembles the civil township." It is interesting to find a transatlantic representative of our "hundred."

Kansas.—Highway administration in this State has several features in common with other systems, but the arrangements are made in a different way. There is a central department in fact, if not in name, since the State engineer at the Agricultural College gives advice and prepares plans and specifications for road and bridges. This is probably done to a less extent than in other States, since the local units, the counties, are each provided with an engineer. The work done in individual counties resembles that done by the central authority in other States, for when 60 per cent of the abutting owners file a petition the Board of County Commissioners may authorise the improvement of the highways under the direction of a superintendent. In such cases the landowners pay three-quarters of the cost and the townships one-quarter, unless the county also contributes. Subject to the authority of the county engineer, all roads are under the control of the townships. Both the county and township authorities have powers to levy taxes for highway purposes. A road-poll tax of 12s. 6d. may be paid either in money or in labour. The administrative arrangements in

this State seem favourable to the gradual development of a very efficient system, in which due shares of responsibility would be borne by the State, the counties, and the townships.

Nevada.—The county boards in Nevada have, it seems, the usual powers, and the counties are divided into districts with an "inspector" for each. In any county polling 3,000 or more votes at the preceding general election the commissioners have to divide the county into districts with one "supervisor" in each, serving during the pleasure of the board.

There is a State engineer for highways. A poll tax of 12s. 6d. is levied, and convict labour is employed.

North Carolina.—The functions of a central information department for roads are performed by the State Geological Board, which makes experiments and investigations, issues bulletins, and gives lectures, the provision for these purposes being £1,000 a year. The system of township and county control of roads in this State presents some unusual features, though in practical effect the system seems to be much like that of some other States. The justices of the peace in each township constitute the township board of supervisors of public roads, and they divide the township into road districts and appoint overseers. The exercise of these powers is, however, subject to the direction of the Board of County Commissioners. The Statute labour tax is six days in one part of the State and ten days in another part, and convict labour is employed.

LOCAL AUTHORITIES IN STATES WHICH HAVE CENTRAL DEPARTMENTS.

The functions of local authorities seem to be substantially the same in States in which central departments have been created as they are in those States which have no such departments, except in so far as they are affected by financial and, in some cases, administrative control by the State department. It seems that in a few cases the State department has been given some powers of direct control apart from those associated with State aid; but, looking at the matter as a whole, it may be said that the State highway departments are additions to the existing system rather than organic developments of it. The manner in which the local authorities carry out their part of the highway administration of those States may be judged by referring to the brief descriptions of the arrangements relating to the central departments, and noting what is, in each case, the share of the work falling to this department. Usually the work done directly by the State is such as could not, or would not, have been undertaken without State aid, and often constitutes an important advance as regards both economy and traffic facilities.

Some mention must, however, be made of certain notable developments.

In Michigan the county road system may be adopted by a vote of the people, in which case not more than three commissioners are elected in a council. These officials have large powers. They decide which roads are county highways, and they may improve any of these roads, fix the taxes for road purposes, disapprove of the expenditure proposed by the board of supervisors, and take up the responsibility for road maintenance. Further, two or more townships may combine to form a "good road district," and one township or more may join with adjacent cities or villages for the same purpose. And all this in Michigan, which has a State department. Clearly the administrative arrangements in this State are specially worthy of study.

In Massachusetts each town may annually elect a road commissioner or surveyor of highways, who controls the maintenance of roads and bridges without being subject to the authority of the select men.

In New Hampshire the highway law provides that 65 per cent of the fees and fines collected under the motor-vehicle law shall be used for the maintenance of trunk line roads, and 35 per cent for the maintenance of the other roads.

In some States a local authority may issue bonds for highway purposes. In New York the fiscal authority of a town board has large powers of taxation, and the "money system" allows of the raising of a tax equal to at least half the value of commuted Statute labour, while every able-bodied male pays a poll tax of 4s. 2d.

Ohio is another State in which "good roads districts" may be formed, and engineers appointed to manage the roads in these areas.

In Utah there is no definite limit to the taxation for road purposes. Bonds may be issued with the approval of the majority of the inhabitants.

In Vermont the town is the unit of local administration as regards highways, the county having no jurisdiction over roads.

In Washington the counties are divided into districts, with supervisors, but there is also a surveyor for each county. He must be a civil engineer, and he has substantial authority. Since township organisation is permitted by a law passed in 1911, the normal county district system is modified in both directions, tending to the typical threefold control found in many countries, but seldom fully developed.

CONVICT LABOUR.

Convict labour is employed both in "rock crushing" and in road making in the following States: California, Massachusetts, Michigan, and Virginia; in rock crushing only: Colorado, Illinois, Maryland, and Minnesota; in road making only: in Georgia, Louisiana, and Wyoming. In New Mexico "territorial convicts" are worked on the roads. In New Jersey convict labour is used in rock crushing at three prisons. In Florida the law allows the use of convict labour on the roads, but so far it has not been so employed.

In some States only a few convicts are employed—25 in Minnesota, 80 in Colorado, for instance. Three hundred are employed in Illinois. The State in which convict labour has been most prominent is Georgia, about half the total number (4,600) being State convicts and the other half county convicts.

"THE SURVEYOR" EXHIBITION.

NOTICE TO INTENDING EXHIBITORS.

The Building Trades Exhibition at Olympia will be opened on Saturday, April 12th, by the Lord Mayor of London.

The Surveyor Section, in the gallery, will, as usual, have a special attraction for municipal engineers and surveyors, the arrangement of this part of the exhibition being in the hands of Mr. C. S. Mason, 24 Bride-lane, Fleet-street, E.C.

Only a very limited number of spaces are now to let, and intending exhibitors are advised to make early application for particulars.

Crittleton and District Water Supply.—Mr. T. J. Moss-Flower, of Westminster and Bristol, has been instructed to prepare a scheme of water supply for this district. The work involves a deep well and boring, elevated reservoir, and several miles of cast-iron water mains.

London Water Supply: Chingford Reservoir.—His Majesty the King, who will be accompanied by Her Majesty the Queen, will on Saturday, the 15th inst., at 3.30 p.m., perform the inaugural ceremony in connection with the new reservoir of the Metropolitan Water Board at Chingford.

Institution of Electrical Engineers: Paris Meeting.—The council of the Institution of Electrical Engineers have accepted an invitation from the Société Internationale des Electriciens to hold a joint meeting in Paris during the last week in May. It is proposed that the visit shall last three days, the time being given partly to the reading and discussion of papers and partly to visits to works and places of interest, and a banquet. As soon as sufficient details are available a circular on the subject will be sent to the members.

The British Fire Prevention Committee's Testing Staton.—Owing to the greater demands made upon the British Fire Prevention Committee for testing facilities, it has been decided to enlarge their testing station and to add to their plant. The main building is also being rearranged in such a form that the principal rooms will be available for the committee's interesting technical and historical collections. It is anticipated that the alterations will be completed early in April, when the testing operations for the new session will commence with several tests of fire-resisting doors, various forms of glazing, some new extinguishers, and certain further tests with concrete floors, &c., and with partitioning materials. Apart from the usual applications for fire tests emanating from Great Britain and the Colonies, there is a marked increase of requests for tests from Germany and from the United States, where the committee's reports also enjoy the recognition of the public authorities

The City of Karachi.

By J. FORREST BRUNTON, M.INST.C.E., Formerly Chief Officer and Chief Engineer to the Municipality.

An exceedingly interesting and able paper dealing with the rise, progress and future of Karachi was yesterday afternoon read before the Royal Society of Arts by Mr. Forrest Brunton. How rapid has been the growth of the city—the population of which at the census of 1911 was 159,270, including municipal and cantonment limits—is indicated by the fact that when the place was first occupied by the British in 1839 it was a small, mud-built town of some 12,000 to 14,000 inhabitants. The site was, and is, low-lying, the old town, and many parts of the modern town, being only 3 ft. and 4 ft. above subsoil water-level; consequently it was not in those days an altogether healthy spot. The only water available was obtained from wells. These wells were of little depth, and the water was more or less brackish, that from some wells being worse than that from others. There was, of course, no drainage and no sanitation, and what must have been the condition of the town can, as Mr. Brunton observed in his paper, some extracts from which follow, only be imagined by those who are conversant with India and with the habits of the Indian in relation to domestic sanitation.

WATER SUPPLY.

Karachi now has an excellent water supply, though in years of scanty rainfall it is somewhat deficient in quantity. The first scheme to give the town a water supply was prepared, under the auspices of Sir Charles Napier, by Lieutenant Baker in 1845. The proposed source of supply was the Malir river, and the scheme was a purely military one, intended to supply water to the troops only. Between 1845 and 1878 eleven schemes were proposed, seven of which were to obtain water by means of wells, or galleries, from the bed of the Malir river. This stream only has water in it about five days a year, but when rain falls it often comes down in heavy flood, and water can at all times be obtained by excavating in the river bed. The last scheme was that of Mr. James Strachan, C.I.E., late secretary and engineer to the Karachi Municipality. His scheme, first put forward in 1874 and modified in 1878, was approved by Government and carried out between February, 1880, and April, 1884, when the works were formally opened. They consisted of two wells on the banks of the Malir river, some 18 miles from Karachi, a masonry conduit from the wells to the distributing reservoir at Karachi, the distributing reservoir itself, and a system of cast-iron distributing mains. The cost of these works was some Rs.11,50,000.

Since 1884 the source of supply has been extended, first by tapping the Malir five miles above the original wells, at a place called Dumlotte, and carrying the water there obtained by a masonry conduit to the wells, and there connecting it with the main conduit to Karachi, and later by sinking two more wells, in a heavily water-bearing strata, and pumping water from those wells into the masonry conduit. Pumping is only necessary when, on account of drought, the water level in the bed of the river sinks too low to give a sufficient supply at the gallery level.

The daily supply of water averages 3,750,000 gallons for all purposes, equivalent to 23·5 gallons per head of population. This is not found sufficient, and, in accordance with recommendations made by me in 1908, works are now in hand to augment the supply and to improve the distribution.

DRAINAGE.

Karachi is one of the few towns in India that is provided with a thoroughly up-to-date and efficient drainage system. The town is so flat that a gravitation system was not practicable, and Mr. James Strachan, C.I.E., therefore recommended the installation of the Shone hydro-pneumatic system. Between 1892 and 1895 the most thickly-populated portion of the native town, containing some 28,000 inhabitants, was provided with this system at a cost of some Rs.6,00,000. This installation proved a complete success, though after plague broke out in 1896, many of the residents within the area sewered believed that the drainage system was responsible for the epidemic. For some years this view was very strongly held, and, curiously enough, most strongly by some who had had an "English education," and among these I do not think it is yet dead.

Between 1905 and 1907, under my advice, the system was extended to other quarters of the town, at a cost of Rs.11,20,000, and it is now, I understand, again to be extended to the Civil Lines and Frere Town quarters. The system is in every way satisfactory, the inclusive cost of working it being 1·25d. per 1,000 gallons of sewage discharged at the outfall. Connected with the installation is a sewage farm, which has proved very successful, and it is, I believe, the only such farm in India that has been successful.

ROADS.

When Karachi came into our possession in 1842 it had not a single metalled road. Outside the walls of the native town there were no roads whatever, and within the roads and lanes were crooked, narrow, uneven and neither drained nor metalled. To-day there are 6 miles of paved roads and lanes, chiefly in the old town, 55 miles of metalled roads, and 35 miles of unmetalled roads.

Generally, the roads are well aligned, satisfactorily drained, and of ample width, but it must be admitted they are very dusty, and are difficult to keep in repair where the traffic is at all heavy. This is due to the fact that the local stone available for metal is a somewhat soft limestone, not at all suitable for dustless roads or for heavy traffic. For light traffic the stone makes a very good road, easy for horses' feet, and if well watered, not too dusty; but undoubtedly, sooner or later, Karachi will be compelled to import a harder and more durable metal for its main roads.

Few of the roads are provided with footpaths, though of late years these—from the English point of view—very necessary adjuncts have been added to some of the more important roads. The Indian, at any rate the Karachi Indian, has not yet learnt the use of footpaths, and does not appreciate them, at least for walking on. He uses them chiefly to tether cows and horses on, to deposit goods and furniture on, to sit on during the day and sleep on during the night, but not to walk on. Perhaps time, and the advent of the motor car, will teach the true use of footpaths, and will convince the pedestrian that it is not only cleaner, but safer, to walk on them than in the centre of the carriageway.

Karachi has so far not been able to indulge in either gas or electricity for lighting its roads. Until some ten years ago they were lit by ordinary kerosene oil lamps, with not very satisfactory results. To-day the principal roads are lit with 1,000-candle power Kitson lamps, and many of the narrow, crooked lanes of the native town, where powerful lamps would be unsuitable, with 100-candle power petrol lamps, the old oil lamps being reserved for the less important roads.

The Surveyors' Institution.—The next ordinary general meeting will be held at the Institution on Monday next, when the adjourned discussion on the papers read by Mr. William Woodward on "Building By-laws and Regulations as Affecting the Housing of the Working Classes," and by Mr. M. Price Holmes on "Some Urban Housing Problems," at the meeting of Monday, February 10th, will be resumed by Mr. Wm. Menzies. The chair will be taken at eight o'clock.

Bonecourt Boilers for Steam Raising.—Bonecourt Surface Combustion, Limited, Parliament Mansions, Victoria-street, S.W., have issued a booklet dealing with the application of the Bonecourt surface combustion system to steam raising. Two types of boilers are illustrated in the catalogue, one a 110-tube, similar to that at present in use at the works of the Skinningrove Iron Company, and the other a 10-tube, the model shown at, and employed in supplying steam to, the Engineering Exhibition at Olympia in October last. The remarkable efficiency of the boilers is indicated by the results which are given of recent tests carried out with the 10-tube model, and as both brickwork setting and chimney are dispensed with in their installation, the economy attending their use will be appreciated by engineers.

Office Conversations.

MORE OR LESS IMAGINARY.

[*Contributed.*]

VII.—Security of Tenure.

How's our union going? Union? No savez, Mr Hemple; wasn't aware that we had one. Trying for superannuation and security of tenure? Oh, yes, certainly we are. Combining together for it? Of course, we are. We can't expect to get anything without combination, can we? Well, you have me there. I suppose it *is* unionism, after all; but it's not trades unionism. What is it then? Don't see the difference? Comes to the same thing, after all? Not quite, Mr. Hemple, not quite. Let me explain. You're a carpenter, and you have your trades union, by which you regulate your own trade customs, apprenticeships, wages, hours of labour, and so forth. If things don't please you, you down tools, and don't pick 'em up again until either you've got what you asked for or your funds are for the time exhausted. You pay certain contributions to your union, and the money accumulates merely to meet the eventuality of a strike. Now, we—— Not quite right? Still, I'm near enough for the purpose of argument, aren't I? You'll allow that? Right.

* * * *

Now, we belong to a professional society, and we should regard with horror anything like a strike. We meet together for the purpose of discussion and social intercourse, and we visit works, and—— Agitate for superannuation and security of tenure? Yes, we do that; but we do it in a quiet, gentlemanly way. Our mission is to bring the authorities round, by sound reasoning, to our way of thinking. We consider that the justice of our cause is bound in the long run to be recognised. Look at the Poor-law officials. They've obtained all we ask for, and—— By a fluke? I don't understand you. They agitated for years, and were ultimately successful, as we shall be. There was no question of a fluke—it was genuine hard work—you shake your head? Never in their natural? They'd never have got it but for the flukiest of flukes? Bills can't always be rushed through when the House is asleep? No, I suppose not; but really you surprise me. It's the first time I've heard how they succeeded, and if what you say is right we don't seem likely to score as soon as I expected. Weight and numbers must tell in the end, however, and we're going to present a solid front and make equal cause against the common enemy. I'll guarantee that—— Not make a rash statement? No, perhaps I won't on second thoughts; none the less, I don't agree with you, Mr. Hemple.

* * * *

What do we mean by security of tenure? Surely the expression speaks for itself. We want our position so assured that we shan't be at the mercy of every little local authority, we want to be able to do our work without fear or favour, and we want a central authority to which to appeal in cases of harsh or unfair treatment. Another side to the question? I'm surprised at you, as a trades unionist, seeing that. But perhaps you're speaking now as a councillor, and if so the boot's on the other foot, of course. Security of tenure can only mean that we shan't be dispossessed of our office? Well, and we oughtn't to be so long as we do our work well and to the best of our ability. Who shall be the judge of our ability? Shall each man judge himself? Now, you know you're talking nonsense just for the sake of prolonging the argument. If I'm appointed to carry out certain definite duties, and I can't do them—out I go. That's very clear, and no central authority, no court of appeal 'll uphold me. If, however, I'm asked to undertake work clearly beyond what I was appointed to do, just to save the expense of a consulting engineer, then I shall be upheld, and you'll have to keep me. An unfortunate phrase? Yes, I think a better one than security of tenure might be devised. Protection is not a bad word; but that raises the question, "Protection from what?" And such words as persecution spite and others are better left out. If you can suggest a better expression I'll bring it before my society.

Now, Mr. Hemple, as a worker yourself, as a unionist, as a progressive, as a Labour member, say that you'll give our cause your unqualified support! We're not averse to a minimum wage and decent hours and proper training, and all that sort of thing; but it's of no use our biting off more than we can chew. These are all matters to follow. In your line, if Jones doesn't suit you, you can express your opinion of him, in language as forcible as you please, and can then straightway go and work for Brown. If I quarrel with the council and deliver my opinion—as I might occasionally have good cause to do—where do I stand? I am done! You require no testimonials as to character your tools and your ability to use them are the only testimonies you need. I may be the cleverest engineer in the country, but I don't stand a chance—no, not even against the biggest duffer—unless every entry in my book contains a V.G. Give us security of tenure, and we shall be free to ask for the other things I mentioned, without fear of rancour and spite arising, and the making examples of the most advanced men among us.

* * * *

You still shake your head? Ah, well, it's just as I expected. So long as you've all you want you don't care a tinker's dam* for anyone else. We ought to start a union? Oh, hang your union! We intend to work out our salvation in our own way. Snobbery? Possibly. Only if it's snobbery to prefer a professional society to a trades union then I'm a snob, and I glory in it. We don't work by the hour or by the day; indeed, we work all hours and all days. We don't loaf and malinger at every possible opportunity, and we certainly don't scamp our work. If we had to buckle to and build a brick wall we'd build it. We wouldn't place just a dab of mortar on the edge of a brick, leaving the joint hollow inside; and if we had to drive a screw in we wouldn't hammer it in up to the head and then just give a couple of turns with the screwdriver. We wouldn't get filled up with bad beer from Saturday midday till closing time on Sunday, and then shirk Monday morning and lose half a day. No, Mr. Hemple, we're professional, and the name of trades union stinks in our nostrils. Done good? The unions done good? That's a point that's quite beside the present argument; but I know one thing, and that is that the worker has got on horseback too quickly, and if he doesn't ride quite to the devil it's only a nasty fall on the way that 'll stop him.

* * * *

We don't want anything of that sort. We're out for our rights, and we'll get them—never you fear—but meanwhile we're going to keep on hammering at the necessity for education and training. No intelligent body of men need fear making the mess of it that so many trades unions have done. Going? Well, I'm sorry if I've appeared to hit you hard; but you know that I'm not one to indulge in personalities, and you must confess that the working man is not quite without flaw or blemish, apotheosised as he is by modern Governments. It licks me hollow why a lime-plastered, greasy-coated son of toil should go seven miles for a penny, and spoil the clothes of workers who have to pay fourpence for their ride, especially, too, when the horny-handed one is earning in all probability the bigger wage of the two. A benefit of unionism? It may be; but we surveyors don't ask for preferential treatment of that kind, and we're not going to become unionists to get it. Sorry for us? Well, that's very good of you, Mr. Hemple, but I'd be much more grateful if you'd back our cause. Why, even Colonel Jubber confessed the justice of it the other day! Doesn't that move you? No? Then I almost renounce all hope. Good-bye; we'll have another chat on it some day. You're bound to come round before I've done with you. Good-bye!

* The sensitive are reminded that a "tinker's dam" is technically a wad of clay used to stop the flow of hot lead. In its Pickwickian sense it means literally "something very worthless—just a lump of dirt."

F.*

Comparative Reports of General Practice.—LXXX.

DUST COLLECTION IN AND AROUND THE METROPOLIS.—(3.)

The present comparative report of general practice- the first portion of which appeared in our issue of February 21st deals with dust collection in and around the Metropolis, and is reproduced by the courtesy of Mr. Reginald Brown, M.INST.C.E., F.S.I., engineer and surveyor to the Southall-Norwood Urban District Council. Mr. Brown has collected information on the subject from no fewer than sixty-one districts.

District	Population.	Area in acres.	Storage		Collection.						Disposal How is your Refuse disposed of (in cubic yards) per annum						Remarks
			Do you insist upon the provision of galvanised iron sanitary dustbins	Do the owners or council provide same?	(a) How often is the refuse collected?	(b) Do you collect by contract or by your own staff?	(c) Is there a "house-to-house" collection, or is the "D" Card System adopted?	(d) What is the average number of men and carts employed daily?	(e) No. of cubic yards collected daily.	(f) Have you made any regulations as to assistance to be given by occupiers: If so, what?	Tip.	Brickfields	Barging	Destructor	Other means	Cost.	
Hampton Wick	2,600	1,314	See remarks	Owners	Weekly	Contract £156 per annum	House-to-house in specified days	2 men and 1 cart	10 cubic yards	No	3,000	—	—	—	—	12·48 pence	(a) In nearly all cases. There are a few brick ashpits, but these are generally being done away with.
Hammersmith	121,000	2,282	Yes	Owners	Weekly (see remarks)	Own staff paid at the rate of 2 6 per ton per gang of 4 men	House-to house	15 horses and carts, 30 men	100 tons per day	—	—	—	36,848 tons	—	—	2 10½ per ton	(a) Except in the case of flats and similar buildings, which are collected twice per week.
Hayes	5,000	3,311	No. Hope to do so in the future	—	Weekly	Horses & carts supplied by contract, but actual collection done by staff	House-to house	2 horses, carts and drivers and 1 labourer for 3 days in each week	—	No	1,300	—	—	—	—	See remarks	*Cost.*—Cannot give you this, as no definite record is kept of the number of loads. The collection of refuse is difficult in this district owing to its scattered nature.
Hackney...	222,587	3,299	Yes	Owners	Weekly	By contract (see remarks)	House-to house	78 men, 40 vans	170 tons	—	—	—	—	(1911) 57,068 tons	—	*See remarks	(b) By contract at per ton delivered at the council's destructor, the contractor providing his own shoot (when required) at per cubic yard. **Cost.*—36·25d. per ton estimated. Estimated cost of disposal (1911-12, April to March), £6,010 17s. 3d. Re-estimated result, £6,293. Total cost of removal and disposal (destruction), January to December, 1911, £14,752 12s. 2d.

Heston and Isleworth ...	43,316	6,893	Yes	Owners	Weekly	Council's own staff	House-to house	10 drivers, horses and carts and 7 fillers	23 tons	No	—	—	—	7,030 tons	—	4/4 per ton, including all new baskets, ladders, forage, &c., and repairs to carts, harness and plant.	
Hendon (Urban) ...	35,000	5,583	See remarks	Owners	Weekly	Own staff in 2 wards, contract in 1 ward	House-to house	See remarks	25 cubic yards. Council's collection	See remarks	—	—	—	—	Sent away by rail	Cost per cubic yard varies 2/- to 2/6	(*a*) The by-laws provide for both brick and portable ashbins. As a matter of fact, they are nearly all portable ashbins in this district. (*d*) Council's staff—8 dust carts with driver and filler to each, and 3 dust vans with driver and filler. Total, 11 carts, 22 men. Number of men and carts employed by contractor unknown. (*f*) Occupiers of flats are required to bring the dustbins down to the ground level, as it is impossible for the men to go up spiral staircases outside.
Hampton	10,000	2,044	Yes	Owners	Weekly	Council's staff	House-to house	3 carts, 6 men for 4 days a week	9 tons	No	—	—	—	1,872 tons (actual weight 1911)	—	4·6 per ton, or 1d. per house per week	
Holborn	49,000	405	Yes	Owners	Twice weekly (see remarks)	See remarks	House-to house	—	—	—	—	—	—	—	—	—	(*a*) In main thoroughfares daily before 10 a.m. In streets containing boarding-houses, every other day. (*b*) The council contracts for the collection, removal and disposal of house refuse, the contractor providing all horses, vans and drivers as necessary for a lump sum of £9,050 per annum.
Ilford	80,000	8,503	Yes	Owners	Weekly	Own staff	House-to house	16·66	43·16	See remarks	All	—	—	—	—	*See remarks	(*f*) The council some years ago requested the occupiers to place their dustbins outside the front door, but this was strongly resented, and the practice is not carried out except in a few cases. *Sixpence per load of 3 cubic yards. We also level the refuse at the shoot, and the labour costs for 3 men about £4 10s. per week in addition.
Kingsbury	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	Nothing done in the way of collecting house refuse.
Kensington	172,402	2,290	No	Owners	Not less than once a week	Own staff	House-to house	54 carts and men and 40 dustmen	56,582 tons	No	—	—	—	—	—	—	Figures of cost, &c., only kept for departmental use.

(*To be continued.*)

Law Notes.

Edited by J. B. REIGNIER CONDER, 11 Old Jewry Chambers, E.C., Solicitor of the Supreme Court.

The Editor will be pleased to answer any questions affecting the practice of engineers and surveyors to local authorities. Queries which should be written legibly on foolscap paper, one side only, should be addressed to "The Law Editor," at the office of The Surveyor, *accompanied by the writer's name and address, but correspondents who do not wish their names to be published should also furnish a "nom de plume." Where necessary, copies of local Acts or documents referred to should be enclosed.* **All explanatory diagrams must be drawn and lettered in BLACK ink only, and in such style as to be fit for direct reproduction** — *i.e.*, **without re-drawing or amendment.** *Unless these conditions are complied with we cannot undertake to reply to queries.*

Highway: Dedication: Cul-de-Sac.—An important decision, which, if it stands, will modify the generally accepted doctrine as to the informal dedication of highways, is that of Mr. Justice Neville in *Kirby* v. *Paignton Urban District Council* (Chancery Division, January 23rd). The facts were as follows: There was a building estate at Paignton, bounded on the north by private land and on the south by an old road. In 1906 the owner prepared plans (which were approved by the council) for developing the estate, and in accordance therewith he constructed a new road leading out of the old road, and extending to the northern boundary of the estate. This new road was thus a *cul-de-sac*. It was made up with proper sewers, footpath and kerbing for its whole length. Seventeen building plots were pegged out on the east side of the new road, and of these the first fifteen, reckoning from the old road, were sold between 1907 and 1910, and houses were erected on them. The conveyances of these plots gave the purchasers the right of way over the new road in common with all other persons who might have a like right. In September, 1910, the two remaining plots—being those at the northern extremity of the estate, and of the new road—were sold to the plaintiff, together also with so much of the new road as abutted on the plots—*i.e.*, about 90 ft. of the northern end of the road. The conveyance, however, expressly excepted and reserved the rights of all persons (if any) having a right of way over that part of the road. In 1911 the plaintiff built a house on his plots in accordance with plans approved by the council. The following year he began to build a 4-ft. 6-in. wall, with gates in the middle, across the south end of the plot of road conveyed to him. The council having threatened to pull down the wall, the plaintiff claimed an injunction to restrain them from carrying out their threat. The council relied partly upon sec. 50 of the Paignton Improvement Act, 1898, which provides that no person shall in any new street commence to erect any new building until the whole length of the street has been defined. The evidence showed that no steps whatever had ever been taken to exclude the public from or to prevent them from using the new road (prior to the plaintiff's attempt to do so). Gas and water mains had been laid in the road for its entire length, and it was policed by the council. Mr. Justice Neville granted the injunction asked for. He said in his opinion this was still a private road. The owner of the property had done nothing whatever to dedicate it to the public. The fact that no precautions were taken to prevent the public walking to the original end of the road was not of much importance. He could not find anything in the statutes or in the Paignton Improvement Act, 1898, or in the by-laws made thereunder, which would take away the owner's absolute right at common law to resume his ordinary ownership of this little piece of land at the end of his own private road.

QUERIES AND REPLIES.

In order to avoid confusion queriists are requested to use distinctive words as **noms de plume**. *The letter* **X.** *combinations such as* **X.Y.Z.**, *and words such as "engineer" and "surveyor," should never be used.*

Explosives Act, 1875 (38 Vict., c. 17): The Question of Having Premises Registered for the Keeping of Mixed Explosives. "Ynys" writes: Having received a certificate from the chief officer of police that a certain firm in the town are fit persons to keep at their premises the following explosives—viz., blasting gelatine and gelatinite, maximum quantity to be stored, 20 lb., I subsequently called upon the firm with a form of notice to local authorities to register premises for gunpowder or mixed explosives, which they declined to fill in for reasons stated in a letter addressed to the council, a copy of which is enclosed herewith. Will you kindly advise—(*a*) Whether the firm referred to can be compelled to fill in the form of notice, and to pay the usual fee—viz. 2s. 6d.? (*b*) If not, what quantity of gunpowder, &c., can a person or firm keep without a licence? And (*c*) under what Act or order can he do so?

[copy of the letter referred to.]

Explosives (*mixed samples*).—About 15 years ago, on taking up an explosives agency, we read up the Act to see how it affected us, and while finding therein various clauses *re* gunpowder (which we do not sell), *re* magazines or stores (which we do not keep), *re* retailing or selling over counter or from premises (which we do not do), we failed to find that the keeping of a few cartridges of various kinds as samples in the office came under the Act at all. We only proposed to sell in bulk, by correspondence or personal solicitation at the mines, and have nothing to do with storage or delivery. As far as our recollection goes, this view was confirmed by the clerk to the county council, and by the superintendent of police, but in order to put us safe in the event of there being any ambiguity, the latter sent us annually a free permit, saying that as it was not the same as a store licence there was no authority to make a charge, adding that nobody else asked for it, and that gentlemen with gun and game licences required no permit to keep a small stock of sporting cartridges in their houses. If now any subsequent regulations have been passed whereby either (1) the keeping of a few cartridges of mixed samples is prohibited by Act, or (2) the renewal of this permit is made compulsory and transferred from the police to yourselves, or (3) a charge is authorised and has been levied for the same, then we shall be glad if you will kindly show us a copy of the said regulations, as we receive all literature affecting our trade and have seen nothing to this effect. In the meantime please consider our application as in abeyance.

Sec. 5 of the Explosives Act, 1875, prohibits the keeping of gunpowder except at (1) a factory in which it is made, (2) a magazine or store lawfully existing or licensed under the Act for keeping it, or (3) premises registered under the Act. But this section does not apply to a person keeping for private use and not for sale any quantity not exceeding 30 lb. Sec. 30 applies sec. 5 to explosives other than gunpowder (subject to certain provisions not material to the question under consideration). The samples kept by the firm are, I understand, "not for sale." If, therefore, they are kept "for private use" the exemption would apply, and the premises would not require to be registered under the Act. I am not aware of any judicial decision as to whether samples are kept for "private use" within the meaning of the Act, and the point must be considered a doubtful one.

Bills of Quantities and Certificates.—"J. J." writes: My father, X.Y., died in 1912. My brother is an executor together with my mother and myself for my father's will. He was with my father in business, which was known as "X.Y. & Son," building and engineering surveyors, and received a fixed weekly salary. My father had in hand for the P.Q. Corporation at the time of his death a considerable amount of work in the course of completion in the nature of bills of quantities for sewers, known as the P.Q. main drainage, and the subsequent measuring and drawing up of monthly certificates as the work was proceeded with by the contractors so that the contractor could have payment on account. For these contracts bills of quantities were prepared by my father, but he died before the first certificates were started. My brother says it is recognised that ¾ per cent is allowed for preparing the quantities and ¾ per cent for measuring up for certificates. My brother is continuing my father's business, and the P.Q. Corporation have agreed to let the work remain with him, and he is claiming for himself the ¾ per cent for the certificates. No mention is made in the will concerning my brother and his continuing the business, and his claim seems excessive.

Inasmuch as there is no specific devise of the business or the goodwill to "J. J.'s" brother, he must be taken to be carrying on the business on behalf of and as agent for the executors. He is bound on the one hand to account to his co-executors for the monies received by him in the business from the corporation or otherwise; and on the other hand he is entitled to a fair remuneration from the executors for his services. But he cannot appropriate to his own use the amount paid by the corporation for the work for which his father was retained.

We have to draw the attention of querists to the directions laid down for their guidance in regard to the preparation of diagrams. Rough sketches obviously cannot be made use of, and we should be obliged if correspondents would therefore send only carefully-prepared drawings, preferably about 6 in. in width, and without colouring or wash of any description. Failure to observe these rules will involve the risk of queries remaining unanswered.

SUBSIDENCES OF SEA BANKS.

SCHEME TO PROTECT TYNEMOUTH HIGHWAYS.

The borough surveyor of Tynemouth, Mr. J. F. Smillie, pursuant to instructions, has submitted to the town council a report on the recent subsidence of the sea banks. Upon a cartoon accompanying the report is shown the character of the work which he is of opinion should be undertaken to remedy the damage done to the public highway, and to prevent a recurrence of such an incident at any part of the sea banks which is supporting the highway. The proposals thus illustrated are virtually the same as those which the council had before them in September, 1900. In addition, however, Mr. Smillie shows a section for an alternative wall for the protection of the toe of the bank. The first proposal was to construct a sloping wall, similar in detail to that which, about a couple of years ago, was provided at the Cullercoats end of the Long Sands, to protect the bank which supports the road above from being destroyed by the action of the sea.

The alternative section shows a vertical wall which could be constructed in cement and faced with machine-made cement concrete blocks, or with stone blockers. In each case at and behind the summit of the wall there would be a terrace walk, and the wall would be coped in such a way that in time of high seas the waters running up the face of the wall would be thrown off by the coping, and thus kept off the terrace wall. The coping would be surmounted by a parapet railing similar to that fixed on the wall at Cullercoats. Whichever type of wall might be adopted it would be broken in places by staircases, to afford access between the terrace walk and the foreshore. One advantage of constructing a wall at the toe of the bank, as he said in his report of 1900, and dressing down the banks to a comparatively flat slope, which would be self-supporting, was that it admitted of the banks being laid out, and adapted as a place of resort. It could not be doubted by those familiar with Tynemouth that the banks there, if so treated, would be frequented, as the situation was sheltered from the north wind. If retaining walls, with precipitous faces, were provided upon the seaward boundary of the highway, for the sole purpose of supporting the highway, and the banks below left as they now are, the public were practically cut off from them, and if no wall were erected at the foot of the bank, then sooner or later the retaining wall at the top must collapse, as the banks, under the influences which are at work upon them, fell away.

Mr. Smillie says that on the part of the sea banks now under consideration it suggests itself to him that there can be no sufficient objection to the toe-wall being carried out so far to the seaward as to permit of the slopes of the banks being formed in the manner suggested. The proposal was to found the toe-wall upon the rock or shale, and to carry it to a height of 12 ft. above high-water mark, ordinary spring tides. To carry out the scheme now submitted in its entirety would probably involve an outlay of about £12,500. Without accurate and numerous sections of the cliffs, knowledge of the materials, and their quantities, of which they are composed, and of the quantities of the filling or embanking that may have to be executed, Mr. Smillie says it is impossible to commit oneself to a figure, and that information he had not got. The costliest part of the undertaking would be the wall at the toe of the bank, and he was satisfied that he had not underestimated its cost. The cost of the section of the work which the Improvement Committee recommend should be proceeded with as soon as possible was £3,500. So far as regarded the cost of the two alternative schemes, he was of opinion that there was little to choose between them.

It would probably be more satisfactory to the committee, and certainly he should be better satisfied, if upon the problem which the circumstances have presented the advice be sought of an engineer who has specialised in dealing with such problems. In 1902 the late Mr. Jas. Walker, who was then the engineer to the Tyne Commission, was called in, and in his report he endorsed the opinions and proposals which he (Mr. Smillie) had then submitted. The recent incidents, however, have revealed more than at that time was apparent, and it might be that a specialist now would have other views as to the works which should be undertaken. It occurred to him, seeing how the stone which overlies the shale is being moved outwards by the water which is forcing its way between the stone and shale, that works additional to those involved in forming a sloping bank in front of the cliff, and thoroughly draining it, might be required to prevent the stone coming forward on the top of the shale, and upon that, if not upon the scheme generally, Mr. Smillie thinks it would be well to call in the services of a consultant.

INSTITUTION OF MUNICIPAL AND COUNTY ENGINEERS.

NORTH-WESTERN DISTRICT MEETING AT STRETFORD.

At a North-Western District meeting of the Institution of Municipal and County Engineers held at Stretford on Saturday last the following were present—viz.: Messrs. T. H. Bell (Ramsbottom), A. W. Bradley (St. Helens), J. S. Brodie (Blackpool), H. E. Brown (Altrincham), R. Burslam (Congleton), T. A. Clare (Leigh), W. Clough (Audenshaw), A. E. Coupe (Fulwood), D. I. Diver (Marple), J. Heath (Urmston), F. H. Holden (Lytham), W. Holt (Sale), H. T. Hughes (Chapel-en-le-Frith), T. Kenyon (Tottington), A. H. Mountain (Barton-on-Irwell), J. B. Nuttall (Heywood), A. J. Price (Lytham), J. Rowbottom (Ashton-under-Lyne), J. A. Settle (Bury), R. W. Smith-Saville (Darwen), W. Stubbs (Blackburn), J. Swarbrick (Manchester), G. H. Wild (Littleborough), M. H. Wilkinson (Leyland), R. H. Winterbottom (Irlam), E. Worrall (Stretford), H. Yarwood (Rochdale), Y. Yelland (Bury) members; Messrs. J. Cunliffe (Withington), D. Furness (Manchester), E. Parker (Stretford), E. Pilling (Swinton), A. J. Price (Eccles), A. P. Statham (Salford) associate members; Messrs. G. Kershaw (Stretford), E. Prescott (Leigh) students; Messrs. G. H. Abrahams (Stretford), R. H. Bateson (Stretford), F. A. W. Campbell (Stretford), J. H. Cooper (Stretford), J. W. Gould (Stretford), C. E. Grimshaw (Withington), H. Robinson (Stretford), A. Vernon (Stretford), E. Walker (Stretford), F. West (Stretford), and E. Woodhouse (Sale), visitors.

The chairman of the district council (Mr. Councillor J. Robinson, J.P.) welcomed the members on behalf of the district council.

Mr. J. S. Brodie (Blackpool) was voted to the chair.

Some discussion took place in reference to the appointment of four new members on the District Executive Committee, and ultimately Messrs. Worrall, Settle, Smith-Saville, and Price, junr., were elected.

The hon. district secretary (Mr. A. W. Bradley) was requested to ascertain the views of the members entitled to vote in regard to the nominations for the offices of district chairman, district representatives, and hon. district secretary.

Mr. Ernest Worrall, surveyor to the Urban District Council of Stretford, read a short paper on "Asphalt Street Pavements," some extracts from which will appear in a future issue.

A very interesting discussion, in which Messrs. Brodie, Stubbs, Smith-Saville, Swarbrick, Price, Mountain, Statham, Robinson, Cunliffe and Winterbottom took part, followed the presentation of the paper.

Visits were afterwards paid to various streets paved with rock asphalt, to the Old Trafford baths, Seymour Park schools, and the technical institute.

Ottawa Water Supply: Strong Condemnation.—A report strongly condemning the Ottawa water supply was recently submitted by Sir Alexander Binnie and Dr. Houston, who were called in to settle the long-standing dispute over the water supply of the Canadian capital. This came as the result of two serious typhoid epidemics, which at one time led to talk of changing the location of the Parliamentary session until conditions were improved. Both experts advise the abandonment of the Ottawa River as the source of supply, and securing a new supply from the lakes in the Laurentian Mountains, north of the capital. As this move (says the *Daily Telegraph*) formed the basis of the last municipal campaign, when the advocates of a new water supply, no matter what the cost, secured a large majority, it is altogether likely that the advice of the English engineers will be acted upon.

Assistants' and Students' Section.

Conducted by SYDNEY G. TURNER, Assoc.M.Inst.C.E.

All communications in regard to this page must be addressed to The Editor, St. Bride's House, 24 Bride-lane, Fleet-street, E.C. *Envelopes must be marked "Assistants' Section" in the top left-hand corner. Correspondents are invited to submit questions for consideration and answers to the questions which appear. For the contributions considered to be the most meritorious, one or more premiums in books will be awarded monthly. Diagrams must be drawn to scale on separate sheets, ready for reproduction.*

THE MONTHLY PREMIUM.

The premium for February is awarded to

Mr. A. V. Cole,
Borough Engineer's Office,
Town Hall, Nelson,

whose contribution has, in the opinion of the adjudicators, been the best received during the month.

QUESTIONS.

This week answers are invited to the following questions:—

311. Surveying.—How would you draw a "give and take" line to an irregular boundary to facilitate taking out an area? (C. F. H., *Lincoln.*)

312. Design of Structures.—How can the weights of bridge members be allowed for when designing the structure? (H. V. O., *West Bromwich.*)

313. Mechanical Haulage.—What is the most suitable plant for hauling road metal over weak country roads by mechanical traction? How does the cost compare with horse haulage? ("Ehu.")

314. Concrete Roof.—It is desired to construct a semi-circular barrel roof in concrete of 50-ft. span, reinforced with expanded metal. Show the dimensions of the supporting walls, which are to be 15 ft. high from the top of the footings. The roof is to be ribbed with an extra thickness of concrete over the piers. (H. V. A., *Clapton.*)

315. Surveying: Theodolite.—If the graduated plate of a theodolite is not correctly centred, how may the error arising therefrom be eliminated? Prove that the method adopted does eliminate the error referred to. (T. W. P., *Bexhill-on-Sea.*)

[The Editor is at all times glad to hear from readers who desire to submit questions regarding matters of general interest, points of daily practice, &c., for insertion in the "Assistants' and Students' Section." Questions which are published are taken into consideration, as well as other matter, in awarding the Monthly Premium.]

REPLIES TO QUESTIONS.

308. Moment of Inertia.—Show how to find the moment of inertia of a tee section. What use is made of the moment of inertia in finding the strength?

In considering T sections, the flanges are usually taken as being parallel and having square corners; the result, therefore, is only approximately correct

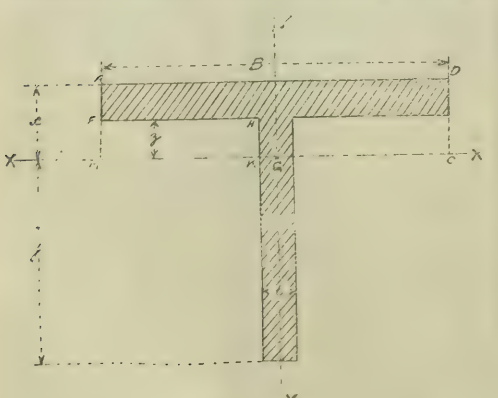


Fig. 1.

for practical sections, which have tapered flanges and rounded corners; but for all practical purposes the results obtained are sufficiently accurate.

Referring to Fig. 1, let G be the centre of gravity of the T section shown, at a distance x from the outside of the flange, and at a distance z from the inside of the flange.

Then, in one position, depending on the mode of loading, the neutral axis XX will pass through G parallel to the flange AD; and, in the other position, the neutral axis YY will pass through G at right angles to XX.

Let us denote the moment of inertia of the section by I.

We wish to find I_{XX} and I_{YY}, that is, the moment of inertia about each of the axes just mentioned.

(1) *To find I about the axis XX.*

First suppose the space between the under side of the flange and the neutral axis XX to be filled in solid to form the rectangle AMCD. Then, to find the I of that part of the T section above XX we find the I of the rectangle AMCD about XX, and from this subtract the I of the two rectangles which do not form part of the T section.

Symbolically—

I_{XX} of Section above XX = I_{XX} of Rect. AMCD − 2 (I_{XX} of Rect. MFHK).

To obtain the moment of inertia of the whole T section about XX we must add on the I_{XX} of the lower rectangle forming the remainder of the section.

$\therefore$ I_{XX} of T section = I_{XX} of Rect. AMCD − 2 (I_{XX} of Rect. MFHK) + I_{XX} of Rect. $y\,t$. . . . . (1)

Now, the moment of inertia of a rectangle about one edge is obtained from the formula

$$I = \frac{b\,d^3}{3} \quad . \quad . \quad . \quad (2)$$

where b = Breadth of Rectangle
and d = Depth ,, ,,

Now, referring to Equation (1), it is clear from Fig. (1) that:

$$2\ (I_{XX} \text{ of Rect. MFHK}) = 2\ (I_{XX} \text{ of Rect. } \frac{(B-t)}{2} \times z$$

$$I_{XX} \text{ of Rect. } (B-t).z$$

Equation (1) thus becomes:—

$$I_{XX} \text{ of T section} = I_{XX} \text{ of Rect. } B.x - I_{XX} \text{ of Rect. } (B-t).z + I_{XX} \text{ of Rect. } y\,t$$

Substituting values from Equation (2) we get that:—

$$I_{XX} \text{ of T section} = \frac{B\,x^3}{3} - \frac{(B-t)\,z^3}{3} + \frac{y^3\,t}{3}$$

$$= \frac{B\,x^3 - B\,z^3 + t z^3 + t y^3}{3}$$

$$= \frac{B\,(x^3 - z^3) + t\,(y^3 + z^3)}{3}$$

(2) *To find I about the axis YY.*

The moment of inertia of a rectangle of breadth b and depth d about its neutral axis is obtained from the formula

$$I = \frac{b d^3}{12}$$

$\therefore$ I_{YY} of T section = I_{YY} of Rect. $B.\ (x - z) + I_{YY}$ of Rect. $t.\ (y + z)$.

$$= \frac{(x-z)\,B^3}{12} + \frac{(y+z)\,t^3}{12}$$

$$= \frac{B^3\,(x-z) + t^3\,(y+z)}{12}$$

If a beam be subjected to a bending action, the upper layers of the material are compressed and the lower layers are stretched. A stress is thus produced in the beam.

Then it can be proved that

$$\frac{M}{I} = \frac{f}{y}$$

$$\therefore M = \frac{f\,I}{y}$$

where M = bending moment
I = moment of inertia of the beam section
f = stress produced in the beam
y = distance of any layer under consideration from the neutral axis.

The Surveyor
And Municipal and County Engineer.

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Now, for a given case, f and y are constant,

$$\therefore M = KI$$

$$\therefore M \propto I,$$

i.e., bending moment is proportional to moment of inertia of the section.

Hence, in designing a beam section to resist a given bending moment, it is essential to obtain as great a moment of inertia as possible, in order to keep the stress within permissible limits. (T. W. P., *Bexhill-on-Sea.*)

Concrete Institute.—The next meeting of the Concrete Institute will take place on Thursday next, the 13th inst., when a paper on the subject of "The Strength of Cement" will be read by Mr. H. C. Johnson, Demonstrator in Engineering, University College, Cork.

Shorland's Ventilating Stoves.—The new isolation hospital, Colne, is being supplied with Shorland's warm air ventilating patent Manchester Stoves and patent exhaust roof ventilators by Messrs. E. H. Shorland & Brother, Limited, of Failsworth, Manchester.

More L.C.C. Workmen's Dwellings.—The Housing Committee of the London County Council have approved of a scheme for the erection of 721 cottages and two shops on the Old Oak estate, Hammersmith, at a cost of £180,746. A further outlay for roads, sewers, and other development works will bring the total up to £216,846, which will be spread over the next seven years.

Road Congress Delegates' Expenses.—The organising committee of the International Road Congress have issued a circular in which is reproduced a communication from the Local Government Board with regard to the suggestion that county and district councils should be empowered to contribute towards the expenses of the forthcoming congress in London, and of the expenses of delegates attending the congress. As noted in our issue of June 5th last, the board will be prepared to sanction the payment of the reasonable expenses of highway surveyors at the congress, and to consider favourably the payment of small subscriptions by county councils or other important road authorities.

THE ENGINEERING PROFESSION.

Mr. Arthur Valon, Assoc.M.Inst.C.E.,
President of the Society of Engineers.

Mr. Arthur Valon, Assoc.M.Inst.C.E., delivered his inaugural address as president of the Society of Engineers (Incorporated) on Monday, and made reference to a number of questions affecting the engineering profession. He pointed out that the inventive ingenuity and scientific knowledge brought to bear upon the smallest details of engineering work increased the number of practicable solutions to any given problem, and engineers were therefore obliged to specialise. So far as specialisation led to economy, due to division of labour, it was advantageous, but rigid specialisation was detrimental both to the engineer and the community. Whatever position an engineer occupied, he must know his work thoroughly, and the range of his studies must be restricted on that account, but should not be limited by want of organisation and co-ordination of existing knowledge.

Standardisation was one method of effecting co-ordination, but there was a danger that a standard might be regarded as a petrified convention instead of merely the best summary of existing knowledge. The advantages of standardisation, however, far outweighed its risks, by effecting economies and setting energy free to deal with newer problems. The work of the Engineering Standards Committee was referred to in this connection.

The development of engineering during the past twenty years had wrought a great change in the *personnel* of the profession. When engineering was almost entirely a matter of practical experience, professional qualification was independent of general education, but now that rational methods of calculation and design had superseded those of empiricism, a complete knowledge of these principles was necessary to every engineer, so that the system of apprenticeship no longer completely met educational requirements. The requirements for modern engineering training were contrasted with those of twenty years ago, and it was shown that a great increase had taken place in the number of engineers occupying more or less subordinate positions, for which technical competence was a greater recommendation than personal initiative.

Speaking of the organisation of the profession, Mr. Valon said that the numerous engineering societies had confined their work almost exclusively to educational matters, and but little attempt had been made to use the corporate strength of the profession to improve the status of engineers. The material interests of a professional man might be classified under employment, its remuneration and its conditions. The difficulties of readily obtaining suitable employment (and conversely of easily securing competent assistants) was mentioned, and it was urged that a central organisation for dealing with appointments would be not only a great convenience, but a source of strength to the profession, as it would then be possible to issue warnings against appointments carrying unsatisfactory conditions.

With regard to statutory registration, it was only right that those who had spent time, energy and money in qualifying as engineers should be in a better position than those who had not done so, but before registration could be enforced there were many obstacles to be surmounted which could be overcome only if the profession were united in desiring statutory recognition, and took steps to present their views in the proper quarter through a suitable organisation. The British Medical Association supplied an example of an organisation effectively presenting the views of the rank-and-file of their profession, who would otherwise have been obliged to submit to legislation that they believed to be inimical to their best interests. It was essential, however, that such an organisation should be merely protective, and not aggressive.

Engineering had an æsthetic side of hardly less importance than its utilitarian aspect. Many of the structures for which they were responsible were prominent and conspicuous objects, in which beauty was a desideratum, but differences arose when they came to define what was or was not beautiful. They must adapt available means to the practical end in view, and in so doing they should endeavour to obtain beauty of line, of form and of colour, but the ultimate verdict on their efforts would be given by

posterity. The destruction of a countryside and the development of unbeautiful urban centres, as the effect of radical operations, would meet with an unfavourable verdict, but if this was a crime, it was one in which all had shared, and the responsibility did not lie entirely, or even chiefly, with engineers.

One other matter which they could not contemplate with entire satisfaction was the growth of some occupations that were a disgrace to a civilised community, and had arisen out of the development of the country's economic resources. In some instances improvements had been made because of an accompanying economy in production, but such improvements ought to be made in any case. Hitherto engineering science had been directed almost exclusively to economic ends, but it was not unlikely that in the future it would be applied more directly for ameliorating social conditions and ensuring a proper standard of civilised life to every member of the community.

CORRESPONDENCE.

For every ill beneath the sun
There is some remedy or none;
If there be one, resolve to find it;
If not, submit, and never mind it.
— Anon., *circa* 1695.

LAND VALUATION BOARD APPOINTMENTS.

To the Editor of The Surveyor.

Sir,—I beg that you will allow me space in your valuable journal to reply to the letter, appearing in the issue of the 28th ult., of "A Disgusted Parent," referring to appointments under the Land Valuation Board.

As one who has had two years in the department I agree with him in several points, but I must entirely disagree with him when he states that no professional knowledge is necessary.

The whole of the property in the country has to be valued, and this includes collieries, public houses, railways, canals underground cables, pipes and sewers, waterworks, gasworks, picture palaces, factories, &c. &c.; and it is hardly necessary for me to add that only those with the best of experience can successfully ascertain the value of such works—and this the Valuation Department is at present or at least will soon be doing.

"Disgusted Parent" must remember that this is a valuation, not a surveying department, the surveying being merely one of the many duties to be performed. The fact that the son in question has had no surveying work to do does not imply that there is none to be done. He must be patient.

Let me quote my own case: I left a municipal office two years ago to take up the position of draughtsman under the board. Like the son, I was interviewed, put through a small test, and later informed of my appointment. I perceived no trap in which to ensnare me to accept the appointment; in fact, my interviewer pointed out the difference between this and my former appointment.

During the first few weeks I was engaged on surveying work to be precise, bringing the ordnance maps up to date in connection with Undeveloped Land Duty. After six months I was "promoted" to be a valuation assistant (the promotion being increase of hours but not salary). Here opportunities were afforded me of learning the art of valuing, of which I soon availed myself. Six months afterwards the valuer whom I assisted was transferred to another part of the division, and I was given the chance of taking in hand the parish which he vacated. What is there wrong here?

When once you are valuing on your own account the work is both instructive and interesting. Ability and tact are certainly required, for if the valuations are assessed to be not correct by the owner he objects, and in many cases comes storming into the office cursing both the Chancellor of the Exchequer and the department generally, and unless you are thoroughly master of your figures you will have a very uncomfortable time indeed.

I would point out that while the salary of a surveyor to an urban district rarely exceeds £250 a year, the average salary of a permanent valuer is £500 a year, and he has not to acquiesce to a body of councillors.

Although the appointments of valuation assistants are stated a temporary it will be many years to come before the whole valuation is completed; and when we consider the influx of "Estate Duty" cases, "Occasion" valuations, "Reversion Duty" accounts, and the periodic valuation of statutory companies, we are unable to see how the work can be disposed of unless all who are at present employed are kept on permanently. This is the reason why ex-soldiers or ex-butlers are not placed in the vacant positions. Qualified men are wanted, and, as the supply is greater than the demand, they are easily obtained.

I apologise for the length of my reply, but I feel it my duty to uphold the workings of a department which has been a blessing to many an unemployed young surveyor, municipal and otherwise.—Yours, &c.,

Valuation Assistant.

March 3, 1913.

MODERN METHODS OF WATER PURIFICATION.

To the Editor of The Surveyor.

Sir,—In my paper on the above subject, which you were good enough to reproduce in your issue of February 14th, I gave a table showing the relative cost of sterilising water per 1,000 gallons by various processes.

Mr. Walker, waterworks engineer, Reading, has kindly furnished me with the cost of the Candy dechlorinating process as used at his waterworks. The details are as follow:—

	£	s.	d.
Chemicals	35	2	0
Carbon and renewals	18	0	0
Labour	nil		
Interest and repayment	200	0	0
Total	£253	0	0

This works out at ·17d. per 1,000 gallons of water treated. This is the actual cost after three years' working. Referring to labour, Mr. Walker says: "As to labour, there is, I find, to all intents and purposes, none—that is, I have engaged no additional hands, as those employed in pumping can easily do the work."

It is obvious, therefore, that the Dechlor process is cheaper than the ultra-violet ray process.

I may also add that when tank accommodation already exists, chlorination can be effected at even less than ·17d. per 1,000 gallons. I am now treating an enormous daily volume of water without any apparatus, and at a cost of less than ·05d. per 1,000 gallons; but the conditions are exceptional.

It would appear, therefore, that basing my original estimate on a somewhat small plant, I overestimated the actual cost of the Dechlor process when applied on a fairly large scale.—Yours, &c.,

John C. Thresh.

London Hospital, E.
March 3, 1913.

THE DRAINING OF MOOR ROADS.

To the Editor of The Surveyor.

Sir,—In reference to your notes on the draining of moor roads, and as to whether or not "grips," or "grups" as we call them locally, are in general practice, let me say that instructions were given to roadmen quite ten years ago, by the surveyors of the Norfolk main roads, to do away with grups wherever possible, and substitute a number of small perforations in the road margin. We have a custom here of keeping all material on one side of the road only, except in the case of a narrow part of the road, or in the vicinity of buildings and gateways, leaving at least sufficient room for a pedestrian between the inside of the heaps of material and the metalled road. The other side is therefore clear for horse riding, and the water grups are so flat as not to be dangerous to horses or cyclists.—Yours, &c.,

W. Adley,
Roadman.

Tottington, Thetford, Norfolk.
March 1, 1913.

To the Editor of The Surveyor.

Sir,—As solicitors for Mr. B. I. Cussons in his action against the Northallerton Rural District Council we beg to point out an error in your columns at p. 389 in the issue of The Surveyor on the 24th ultimo, wherein it is stated that the defendant council had erected a notice at the top of the hill to warn the public of the existence of the ditch. No such notice was erected or stated to have been erected by the defendant council.—Yours, &c.,

Hewitson & Harker.

Kirkby Stephen.
March 3, 1913.

[The statement with respect to the notice appeared definately in the report upon which our comments were based. Ed. Surveyor.]

LOCAL GOVERNMENT BOARD INQUIRIES.

The Editor invites the co-operation of Surveyor readers with a view to making the information given under this head as complete and accurate as possible.

INQUIRIES HELD.

Abergele and Pensarn U.D.C. (February 26th. Mr. P. M. Crosthwaite). £2,000 for the purposes of improvement on the promenade at Pensarn. Mr. E. A. Crabbe, town clerk, explained that the council had decided to construct a shelter on the sea front, to erect lavatories, to provide tanks for street watering, to construct a jetty on the foreshore, and to lay a very large storm-water pipe to deal with the flood water from the hills. The surveyor, Mr. M. R. Jones, explained the plans and estimates, and showed how by utilising a very fine spring of water the council would save money and labour in street watering.

Bedlington (Northumberland) U.D.C. (February 27th. Mr. F. O. Stanford). £2,467 for sewerage purposes.—Mr. Lester, deputy clerk, stated that the only opposition was from the North-Eastern Railway Company, with regard to crossing the company's line. The sewer was intended to serve an area of 40 acres, and varied from 9 in. at the head to 18 in. at the outfall. The surveyor, Mr. J. E. Johnson, explained the estimates and specifications, and the inquiry closed.

Blackpool T.C. (February 19th. Mr. F. H. Tulloch). —£2,933 for works of private street improvement, and £31,751 for gasworks extension.—When the application in regard to the gasworks came on, Mr. Taylor, of Carleton, which township is supplied with gas from Blackpool, complained that the charges for gas in the Bispham area were 33 per cent more than at Blackpool. He objected to Bispham finding money for the relief of the Blackpool rates. The town clerk replied that that matter would not be gone into. There were differential charges sanctioned by Act of Parliament. Bispham was charged 3s. per 1,000 ft., and from April 1st there would be a reduction. At Blackpool it was 2s. 2d. per 1,000 ft. Mr. Taylor retorted that when the reduction was made Bispham would be still paying 7d. more than Blackpool. After further argument the inspector told Mr. Taylor that he had a remedy in his own hands, and that if he did not like the gas he could cut it off.

Cannock U.D.C. (February 20th. Mr. F. O. Stanford). £10,442 for extensions at the sewage farm.—The surveyor, Mr. R. Blanchard, stated that owing to the water-logged state of the land at the farm there had been many complaints from the inhabitants of Bridgtown of the bad smells arising from the land in summer. The new scheme would obviate this nuisance considerably.

Hastings T.C. (February 27th. Mr. R. H. Hooper).—£8,134 for the purpose of electric lighting.—The sum required was made up by the following amounts: £4,000 for extensions, £500 for meters, £1,500 for house services, £700 for transformers, £1,600 for alterations and extensions of plant at the works. The electrical engineer (Mr. R. F. Ferguson) said it might be found necessary to take a high tension main to the northern boundary at a later date. Respecting the item of £1,600, the inspector thought it would be desirable to reduce the period from ten to seven years. He considered it would be better to have one short loan to pay off, and would meet the requirements better. This was agreed to.

Hinckley U.D.C. (March 4th. Major J. Stewart). —£1,100 for laying out a recreation ground and construction of a new road.—The clerk to the council explained that the recreation ground had been bought out of the profits of the gasworks, which belonged to the council, and that the loan required was for levelling and fencing purposes, and the formation of a new road through the ground. The engineer and surveyor, Mr. E. H. Crump, explained the necessary plans and estimates, and gave all details in connection with the scheme.—There was no opposition.

St. Helens (Isle of Wight) U.D.C. (February 18th. Major J. Stewart).—£1,600 for the erection of a reservoir to hold about 300,000 gallons of water.—It was explained that the water supply was obtained from the Ryde Corporation at the rate of 1s. 3d. per 1,000 gallons, and that the proposal for a reservoir at St. Helens was intended to meet any emergency, such as a breakdown.

Weymouth T.C. (February 19th. Major J. Stewart).—£3,720 for paving St. Thomas-street and King-street with wood blocks.—The borough surveyor, Mr. K. J. S. Harris, gave the necessary particulars. The roads in question being under the jurisdiction of the Dorset County Council, it was stated that this authority had agreed to pay £250 for fifteen years, which was £50 in excess of what they had been paying, and that at the end of the period named their liability for further payment would cease entirely.

APPLICATIONS FOR LOANS.

Cheltenham T.C.—£9,500 for municipal offices.

Chesham U.D.C.—£2,038 for a housing scheme.

Epsom U.D.C. £6,603 for wood paving and tarmacadam works.

Huddersfield T.C. £1,500 for the provision of workmen's dwellings.

Maidstone T.C. £3,500 for improvements at the sewage works.

Southampton T.C. £8,200 for additional plant at the electricity works, and £1,650 for asphalting.

Woolwich B.C. £5,230 for gas supply extensions.

LOANS SANCTIONED.

Bromley T.C. £3,320 for kerbing and channelling.

Buxton U.D.C. £1,000 for electricity extensions.

Chorley T.C. £2,212 for laying out a recreation ground.

Colne T.C.—£14,873 for paving works.

Dublin T.C.—£2,500 for an art gallery.

Oswaldtwistle U.D.C. £3,300 for the provision of a park, and £250 for a bowling green.

Plympton St. Mary R.D.C. £103 for works of sewerage.

Porthcawl U.D.C. £1,800 for surface-water drainage.

Preston T.C. £3,500 for the purposes of Haslam Park.

Ystradgynlais R.D.C. £4,000 for the extension of the water supply, and £2,321 for the erection of council offices.

FORTHCOMING INQUIRIES.

	MARCH.	£
10.	**Carshalton.** For authority to prepare a town planning scheme (Mr. Thomas Adams)	–
10.	**Erith.** For sewage disposal purposes (Mr. R. H. Bicknell)	1,875
11.	**Bungay.** For housing purposes (Mr. H. A. Chapman)	3,500
11.	**Leeds.** For authority to prepare a town planning scheme (Mr. Thomas Adams)	
11.	**Ludlow.** For water supply purposes (Mr. W. O. E. Meade-King)	1,300
11.	**Neath.** For a housing scheme (Mr. E. Leonard)	15,700
11.	**Salford.** For the purposes of the town hall (Mr. W. H. Collins)	15,614
12.	**Barrow-in-Furness.** For authority to prepare a town planning scheme (Mr. Thomas Adams)	–
12.	**Dursley.** For sewage disposal works (Mr. R. G. Hetherington)	10,000
12.	**Hereford.** For the installation of electrical pumping machinery (Mr. W. O. E. Meade-King)	1,600
12.	**Louth.** For the construction of a bridge (Mr. P. M. Crosthwaite)	128
13.	**Carlisle.** For water supply purposes (Mr. H. R. Hooper)	8,380
13.	**Cuckfield.** For the provision of stabling (Mr. C. H. Eyles)	1,615
13.	**Whitstable.** For sewage disposal works (Mr. P. M. Crosthwaite)	33,500
13.—**Widnes.**	For private street works (Mr. F. H. Tulloch)	4,700
15.—**Leicester.**	For the provision of fire brigade appliances (Mr. F. H. Tulloch)	4,295

Public Baths and Bathing Places.—A useful booklet by Mr. E. Harding Payne, A.R.I.B.A., containing suggestions on the general arrangements, structure and equipment of public swimming baths and bathing places, has been published by the Southern Counties Amateur Swimming Association. The publication, which is illustrated by a number of photographic views and plans, is obtainable at the price of 6d.

Municipal Work in Progress and Projected.

The Editor invites the co-operation of Surveyor readers with a view to making information given under this head as complete and accurate as possible.

The following are among the more important projected works of which particulars appear below: Buildings—Bourne £6,000, Canterbury £25,000, Hebden Bridge, Leeds £22,000; housing and town planning—Chelmsford £24,000, Meltham £6,000, Stafford £12,200; refuse collection and disposal—East Grinstead; roads and materials—Battersea £30,000, Kent, Middlesbrough £3,920; sewerage and sewage disposal—Dunfermline £90,000, Eastbourne £9,000, Plymouth £14,000; water, gas and electricity—Marylebone £42,000.—Particulars of other works projected will be found on our "Local Government Board Inquiries" page.

BUILDINGS.

Bingley U.D.C. The surveyor, Mr. H. Bottomley, has received instructions to prepare plans for a shelter in Myrtle Park.

Bourne R.D.C.—The council are recommended to enlarge the isolation hospital, at an estimated cost of £6,000.

Bristol T.C.—The river bank is to be improved by the erection of a new wall at the bend of the river under the Clifton Suspension Bridge, at an estimated cost of £4,735. The top of the embankment is to be laid out as a public walk, with rockeries, shrubs and seats.

Canterbury T.C.—The borough asylum is to be enlarged at an estimated cost of £25,000.

Cardiganshire C.C.—Sea defence works are to be carried out at Borth, at an estimated cost of £332, provided the adjoining owners contribute one half of the cost.

Coatbridge T.C.—It has been decided by the council to erect a sanatorium of their own, instead of, as suggested, joining with other Lanarkshire burghs for this purpose.

Edinburgh T.C.—The Public Health Committee recommend the corporation to provide buildings for consumptive patients at Colinton Mains, at an estimated cost of £2,000.

Egham U.D.C.—Sanction has been given to the erection of a bungalow at the Rider Park estate, to be built of concrete and timber. A letter had been received from the builders asking general sanction to the erection of bungalows of this kind, but the council considered that all sets of plans should be considered on their merits, especially with regard to contiguity to the river and distance from other buildings.

Great Ouseburn (Yorks) R.D.C.—A scheme is to be carried out for the widening and improvement of Pool Bridge, Nun Monkton, at a cost of £461, towards which the county council have promised a grant of £50.

Hebden Bridge U.D.C.—The question of building public baths is being considered by a special committee.

Kirkcaldy T.C.—It is proposed to provide several shelters in the public park.

Leeds T.C.—The plans of a tramway depot and offices in Sovereign-street, to be built at an estimated cost of £22,000, have been approved by the Tramways and Electricity Committee.

Rochdale T.C.—A new infants' school is to be built at a cost of £5,200.

Stoke-on-Trent T.C.—The borough surveyor, Mr. A. Burton, has been instructed to prepare plans for the alteration of a portion of the Burslem Town Hall for police purposes.—Plans have been approved for the erection of a new police station at Fenton.

Sunderland T.C.—The Education Committee have approved of a scheme for a day training college, at an estimated cost of £20,000, and a hostel at Bede Tower, at a cost of £1,200.

HOUSING AND TOWN PLANNING.

Cambridge T.C.—In addition to one block of six cottages with two or more bedrooms, and one block of twelve tenements to be erected in Stanley-road under Part III. of the Housing of the Working Classes Act, 1890, it has been decided to erect two more blocks of six cottages, each with two or more bedrooms. The borough surveyor, Mr. J. Julian, estimates the cost of the work at £1,900.

Chelmsford T.C.—The borough surveyor, Mr. P. T. Harrison, has prepared plans for a housing scheme at Rainsford End, consisting of 106 houses, estimated to cost £24,000.

Doncaster R.D.C.—The Askern district is the first portion of the council's area to be dealt with under the provisions of the Housing and Town Planning Act. The area has Askern as its centre, and extends over some 5,170 acres. It includes the whole of the parish of Askern, and the villages of Norton, Campsall, Sutton, and Haywood, and some of the parishes of Burghwallis, Owston Moss, and Fenwick.

Evesham R.D.C.—It has been agreed to consider the question of sites at Offenham for housing purposes.

Fifeshire C.C.—The Local Government Board have sanctioned the application of the Dunfermline District Committee to prepare a town-planning scheme for Limekilns and Brucehaven.

Glasgow T.C.—A special meeting was held last week to discuss the housing question, particularly with reference to the prevalence of tuberculosis. After a prolonged sitting, the resolution submitted by the Lord Provost was carried by a large majority, to the effect that the powers available under the Public Health, Town Planning and other Acts be taken advantage of, and the closing and removal of dwellings dangerous and injurious to health, the opening up of congested areas, and the provision of suitable houses for poorest classes be proceeded with at once.

Halifax T.C.—The Improvement Committee have decided to recommend the council to make application to the Local Government Board for authority to prepare a town-planning scheme for the "Bradshaw district" No. 3—lands which contain an area of about 655 acres.

Honiton R.D.C.—The proposed housing and town planning scheme for the parishes of Salcombe Regis and Sidbury was, at the recent meeting, dealt with at some length by the sanitary surveyor, Mr. A. J. Redfern. The objects of the scheme, he said, were development and sewage, and the protection of developed property in respect of the houses built. The site, one of the beauty spots of the district, would not be bought at a great cost, but with the consent and co-operation of the owners would be permanently saved from disfigurement. It was hoped to widen and straighten the main road, and the cross roads would be constructed in light and narrow carriageways—an economy impossible under the present by-laws. Blocks of two or four cottages, ten to fourteen to the acre, each with a garden and a yard, would be constructed. The first steps necessary under the Act had been taken, and up to the present no material opposition had been received.

Meltham U.D.C.—Twenty-two houses are to be erected at Broadlands, at an estimated cost of £6,000.

Pebworth R.D.C.—An offer of £110 per acre has been made by the council for land for housing purposes.

Stafford T.C.—At a meeting of the council on Tuesday the committee appointed to deal with the question of the housing of the working classes presented a report in which they recommended that twenty houses should be erected in Backwalls South, twenty in Coton Field, and twenty on the Lammascote estate, at rents ranging from 3s. 9d. to 7s. a week inclusive. The estimated expenditure was £12,200, and it was recommended that application should be made to the Local Government Board for their sanction to the appropriation of the land, and for the raising of the £12,200 for part purchase of the land and the erection of the houses. It was reported that the total annual expenditure, including repayment of capital and interest, would be £920, and that the estimated annual income from rents would be £875, leaving an annual deficiency of £45, which would be the annual charge on the rates. There was no opposition to the scheme, and the recommendations of the committee were agreed to.

Uckfield R.D.C.—The Housing and Town Planning Committee have recommended and the council have confirmed a resolution passed at the joint meeting of

the Uckfield and Hailsham councils to promote a town planning scheme.

Wellington (Salop) U.D.C.—With regard to the competition for designs for workmen's houses, the assessor, Mr. George Meek, architect, Manchester, has awarded the prize of £10 10s. for the best design to Mr. E. Hill, of Norwich. The assessor stated that he did not think any of the designs could be built from the estimates sent in. From 10 per cent to 15 per cent might be added to them, unless labour and materials were much cheaper in Wellington than in Lancashire.

PARKS AND OPEN SPACES.

East Ham T.C.—The estimate of the borough surveyor, Mr. J. E. W. Birch, at £673, for laying out the recreation ground has been approved.

Liverpool T.C.—The Parks and Garden Committee have approved of a report from the surveyor as to the cost of acquiring a site for a recreation ground for North Scotland Ward, and also as to the possibility and cost of acquiring land for recreative purposes in Edge-hill, Brunswick, Vauxhall and Great George Wards.

Manchester T.C.—Last year some land adjoining the waterworks reservoir at Gorton, let at an annual rental to tenants, was taken over by the Parks Committee at the same rental. The Parks Committee have since taken over from one of the tenants a field of 5 acres, and propose to take a further area and to lay it out as playing fields.

Wallasey T.C.—The Parks, Pleasure Grounds and Allotments Committee recommend that an application be made to the Local Government Board for sanction to borrow £6,470 for the purchase of 64,000 sq. yds. of land between Beaufort-drive and the Wirral Railway for recreation purposes.

REFUSE COLLECTION AND DISPOSAL.

East Grinstead U.D.C.—The surveyor, Mr. W. E. Woollam, has received instructions to prepare plans and specifications for the erection of a refuse destructor, and he has also been authorised to visit other towns for the purpose of viewing other refuse destructors.

Hampstead B.C.—It has been resolved to undertake the disposal of a portion of the house refuse of the borough by rail instead of, as in previous years, entering into an arrangement with a contractor. It is stated that the new arrangement will result in a saving of £400 a year.

Lambeth B.C.—The following recommendations of the Wharf and Cleansing Committee have been adopted: (1) That on the expiration of the present contracts the council revert to its former practice of collecting the house refuse from the Marsh, Bishop's, Prince's and Vauxhall Wards by its own men and plant; (2) that the tender of Mr. Chas. Murrell, to provide a shoot and barge away therefrom the house refuse from the wards in question, at 1s 11d. per ton, for a period of two years, be accepted; (3) that the tender of Mr. John Cronk, for the collection and disposal of house refuse from the Stockwell and Brixton Wards, for a period of two years, for the sum of £9,000, be accepted, and (4) that the tender of Messrs. Walter Clarkson & Sons, for the collection and disposal of house refuse from Herne Hill, Tulse Hill and Norwood Wards for one year, for £6,375, be accepted.

ROADS AND MATERIALS.

Aberdeenshire C.C.—At a recent meeting of the County Road Board a report was submitted with regard to the applications which had been made for grants from the Road Board towards proposed schemes of road improvement in the county. In connection with the reconstruction of the Ballater to Braemar road, the board had intimated a grant of £2,036 towards the nett estimated cost of £2,715, being the usual three-fourths of the cost. With regard to the revised scheme for the improvement of Cairnwell-road, from the bridge of Auchallater towards the county boundary with Perthshire, the board had stated that towards the gross expenditure involved by the scheme, amounting to £2,350, they were prepared to make a grant of £1,600, and to lend the balance of £750 free of interest, repayable by five equal annual instalments. The board had also made a grant of £255 towards the expenditure incurred by the Aberdeen District Committee in connection with road improvements carried out at Bucksburn, Bieldside, and Peterculter. This is in addition to the original grant of £277 towards the same works.

Aberdeen T.C.—It has been agreed to lay a section of a street with wood paving instead of granite, the frontagers agreeing to pay the difference in cost between wood and granite. A strong plea was put in for the use of the new silent flat setts which are in demand for street paving, and it was urged that Aberdeen as the centre of the granite industry should not take any action which would injuriously affect the trade.

Antrim C.C.—At the quarterly meeting last week the county surveyor, Mr. John H. Brett, reported that road works projects amounting to £57,325 appeared on the schedule of formulated proposals, but of these sufficiently advanced to be dealt with at present the amount was £46,200, which sum is made up of £4,543 for new roads and hill cuttings, £615 for a bridge, footpaths, and minor special works, £8,885 for ordinary road maintenance, £27,955 for direct labour road maintenance, and £4,200 for steam rolling. Applications for a year's steam rolling had been made and granted in all the rural districts; they amounted in all (including direct labour contingents) to £7,813, which should be sufficient to roll in about 160,000 tons of road metal. The expenditure on steam rolling for the year ended December 31st last was £7,314, and the quantity rolled in was approximately 150,500 tons. The condition of works and performance of contracts during the past quarter were generally fair, though there were many exceptions; the weather conditions bad. The direct labour undertakings continue satisfactory, and the county steam-rolling plant has been kept fully employed.

Battersea B.C.—It has been agreed to incur an expenditure of over £30,000 for the purpose of remaking the roads throughout the borough. The Road Board have agreed to make a grant of £7,000 towards the cost of the scheme.

Blackrock (co. Dublin) U.D.C.—It has been agreed to widen the corner of the main road between Dublin and Bray at "Artmore," at an estimated cost of £600.

Bridlington T.C.—Land is to be purchased along the full length of Cardigan-road for the purpose of widening the road to 50 ft., at a cost of £600, the estimated cost of road making to be £3,965.

Brighouse T.C.—It has been decided to repave Mill-lane with granite setts at an estimated cost of £1 540.

Coventry T.C.—Property valued at £3,000 is to be purchased for the widening of High-street, and the estimate of £3,500 for the Leicester-street improvement has been approved.

Derby T.C.—Two alternative schemes for dealing with Queen-street, one for widening the thoroughfare and the other for making a new street, have been drawn up by the Improvement Committee.

Dudley T.C.—The Improvement Sub-Committee recommend the purchase of property at the corner of Hull-street and King-street, for the sum of £1,000, for the purpose of street improvement.

Edinburgh T.C.—The War Office have agreed to allow the corporation to take certain lands off Piershill Barracks for the widening of Restalrig-road on the understanding that the War Department retain the ownership of the soil and that the corporation erect a new wall to the satisfaction of the engineer of the Scottish Command. The Streets and Buildings Committee have referred to the burgh engineer a proposal to provide a footbridge over the railway from the north end of Tay-street to Dundee-street.

Falkirk T.C.—£1,500 has been expended upon the purchase of property for several street improvements.

Gainsborough R.D.C.—At Tuesday's meeting of the council the General Purposes Committee recommended the acceptance of tenders for tar-macadam, which showed an increase of 9d. and 10d. a ton. It was pointed out that there was a saving of 50 per cent by the use of tar-macadam, and the surveyor, Mr. R. Maxwell, remarked that though it cost 25 per cent more to lay, the life of the road was from ten to fifteen years longer in rural districts. A number of members opposed the use of tar-macadam on the ground that it was bad for horses in frosty weather. A motion was brought forward that no more tar-macadam be used, and this was carried by sixteen votes to ten. It was asked what was to be done with the surfaces —some miles in length—already covered with tar-macadam. The surveyor replied that he did not know. The council had, in five minutes, upset the scheme he had had in mind for years of tar-macadamising the whole of the rural district.

Hampton Wick U.D.C.—The surveyor, Mr. P. Taylor,

has been authorised to obtain, when required, 2000 wood blocks for the paving of Upper-road.

Kent C.C.—It was reported at the council meeting recently that for the supply of hard material thirty-two tenders were received from thirty contractors. The average price per ton of the 60,349 tons recommended for acceptance is 10s. 11·34d., as against 10s. 3·12d. last year. The county surveyor, Mr. H. P. Maybury, again reported favourably upon the Kentish rag tarred macadam already laid. Tenders were therefore invited for a further supply, and sixteen contractors responded. A quantity of 31,444 tons is to be accepted, the average cost (including carriage to nearest place of user) being 11s. 10·08d. per ton, an increase of 2·48d. over last year. The tenders for the supply of other local material (untreated Kentish rag, Sevenoaks rock and flints) also showed an increase of 4·09d. per cubic yard over last year's prices, the average price being 4s. 11·36d. per cubic yard. The quantities accepted amount to 8,470 cub. yds. The total amount of material recommended for purchase was 109,263 tons or yards. Application is to be made to the Road Board for contributions amounting to £17,644 towards the cost to be incurred this year for the tar-painting of main roads, for pitch-grouting and foundation work, and for tar-macadam, and schemes are to be submitted for the improvement of a number of roads in the county.

Lambeth B.C.—The borough engineer and surveyor, Mr. H. C. J. Edwards, recently approached the Road Board, and it is reported that the latter are disposed to make the council a grant of £10,000, and, in addition, are prepared to sanction a loan of £17,000 at 4 per cent repayable in five years. The amount which it is proposed to expend this year upon the roads is £20,000 in excess of the amount expended last year.

Largs T.C.—The question of street paving was discussed at some length at a special meeting of the council, and it was agreed that steps should be taken to get all footpaths at present unpaved or unsuitably paved within the centre of the town properly laid down in concrete, with the view of the council taking over the maintenance of these in future. In regard to the streets outside the central district of the town, it was resolved to make the owners of property put all their footpaths in repair.

Leicester T.C.—A sum of £1,500 is to be paid for land for the purpose of improving London-road.

Middlesbrough T.C.—Subject to the Local Government Board sanctioning a loan, it has been decided to pave Commercial-road with whinstone setts at an estimated cost of £3,920.

Midlothian C.C.—The council last week discussed the question whether a county road surveyor should be appointed in succession to the late Mr. Robb, or whether each of the district surveyors should be made directly responsible, in the meantime, at all events, to his district committee. A letter from Sir George Gibb, chairman of the Road Board, to Colonel Trotter, was read recommending the appointment of a county surveyor, and after discussion a motion to that effect was adopted.

Norfolk C.C.—At the meeting of the West Norfolk Highways Committee it was reported that the Bills Committee had considered tenders for materials, team labour, tools, etc., for the year ending March, 1914. There were twenty-three tenders for granite as against forty-two, 140 for team labour as against 126, and seventy-three for gravel, sand and chalk as against sixty. The price of granite was about 1s. a ton higher than last year, and this would mean an increase of £800 on the cost of granite purchased by this committee. There would be a small increase in the cost of transport by rail when the railway rates were increased. The sea-borne granite would be brought from Northumberland. The Guernsey granite had gone up so much in price on account of the increase in freights that the committee could not get it. Tenders for the various articles had been accepted.

Northamptonshire C.C.—An application has been made to the Road Board for a grant of £4,125 towards the cost of carring the main roads.

Nottingham T.C.—The question of carrying out a road improvement scheme between Mount-street and Friar-lane has been referred to the Improvement Committee.

Oldham T.C.—Upon the suggestion of Mr. Jessop, superintendent of the sanitary department, it has been agreed to shut down the flag-making plant for a short time. They had, he stated, twelve months' stock of flags on hand. Last year he sent out 21,000 yards of flags and they had a stock of over 21,000 yards.

Plymouth T.C.—Several private street improvement schemes are to be carried out at a cost of £1,169, and Sutton-road is to be repaved at a cost of £2,000.

Stirlingshire C.C.—An intimation has been received that the Road Board grant for this year will not be less than £4,000.

Stoke Newington B.C.—It has been agreed to widen part of Church-street at an estimated cost of £2,050.

Taunton R.D.C.—With reference to a recommendation by the Finance Committee that no tar-spraying be carried out, the chairman, Mr. R. Bruford, stated that the council were using harder material for the road making, and with the weather they had experienced for the last two seasons tar-spraying was money more or less thrown away. The council decided not to ask the county council for any tar-spraying in that council's district.

SEWERAGE AND SEWAGE DISPOSAL.

Chipping Norton T.C.—The corporation have accepted the scheme of Messrs. Berrington, Son & Watney, of Wolverhampton and Westminster, for new sewerage and sewage disposal works, and have instructed them to prepare the necessary plans and estimates for the Local Government Board as soon as possible.

Dunfermline T.C.—The council have approved a proposal to borrow a sum of £90,000 for the payment of the construction of the new main sewer to the Forth The sewer is to provide drainage for the Admiralty, for the new town of Rosyth, and for a population estimated at 6,000 resident in the territory under the jurisdiction of the Dunfermline District Committee. It is estimated by the engineer, Mr. C. R. Hogg, Glasgow, that the cost of the sewer, subsidiary mains, and claims for wayleave will not cost more than £100,000, and of that sum the Admiralty contribute £10,000.

Eastbourne T.C.—Sewerage works are to be carried out at Hampden Park, at an estimated cost of £9,000.

Eccles T.C.—It is proposed to instal additional pumping machinery at the sewage farm, at a cost of £2,600.

Glasgow T.C.—The new ejector chamber at Prince's Dock was formally inaugurated last week. Its object is to lift the sewage of the low-lying portions of Govan into the main sewer in the Old Govan-road, along which it flows westward to Shieldhall. Messrs. Crouch, Hogg & Easton were the consulting engineers, and Mr. F. G. Holmes, formerly burgh surveyor of Govan, the engineer. Messrs. Kinnear, Moodie & Co. were the contractors for the sewers and ejector chamber, the compressor chamber was built by Mr. Elphinstone Forrest, and the plant was supplied and installed by Messrs. Daniel Adamson & Co., Dukinfield. The cost of this portion of the scheme is fully £7,000. It completes not only the south-side drainage scheme, but that for the whole of Glasgow, the total cost of which has been about £2,300,000.

Gosport U.D.C.—The tender of Messrs. Tom Wilson & Co., of Bournemouth, at £3,623, has been accepted for the extension of the outfall at Stokes Bay, the plans for which were prepared by the surveyor, Mr. H. Frost.

Meltham U.D.C.—Sewerage extensions are to be carried out at a cost of £600.

Plymouth T.C.—The Works Committee have decided to carry out the scheme for the surface-water drainage of the eastern high-level drainage area of the borough, at an estimated cost of £14,000.

Wigtownshire C.C.—A comprehensive drainage scheme for Portwilliam has been prepared by Mr. John D. Parker, of Glasgow, and it has been agreed to accept the tender of Messrs. Brown and Kincaid, Glasgow, at £1,585, for the work.

WATER, GAS, AND ELECTRICITY.

Bungay U.D.C.—A committee has been appointed to consider the question of a public water supply.

Leeds T.C.—The corporation are about to enter into an agreement with the Wharfedale Rural District Council for the supply of water in bulk to the villages of Askwith, Weston, Leathley and Clifton-with-Norwood, for 9d. per 1,000 gallons.

Marylebone B.C.—It has been decided to extend the electric lighting area at an estimated cost of £42,000.

Riccall R.D.C.—The Local Government Board having suggested to the council that a water supply scheme for the Barlby is of more importance to the district than the proposed sewer extension, the council have decided to abandon the drainage scheme for the present, and to consider the best means of securing an adequate and wholesome supply of water. The present water supply is from wells.

Rochdale T.C.—Electricity extensions, to cost £20,000, are to be carried out.

Ruthin T.C.—A committee has been appointed to go into the question of an electric installation for the town.

Scarborough T.C.—It has been decided to spend nearly £8,000 upon improving the supply of water from the Irton station.

MISCELLANEOUS.

Birmingham T.C.—The Tramways Committee have agreed to increase the wages of the conductors and motormen roughly by 2s. per week per man.

Edinburgh T.C.—A new motor fire engine has been purchased by the corporation. The motor is petrol-driven, and is of the four-cylinder vertical type, capable of developing 70 b.h.p. A speed of 35 miles per hour can be attained on the level, and hills with steep gradients can easily be ascended under a full load. The brakes are in duplicate, and very powerful. The pump can deliver 150 gallons to 500 gallons of water per minute.

PERSONAL.

Mr. W. T. Lancashire, city engineer of Leeds, has been granted an increase of salary from £700 to £800 a year.

Mr. C. Pursey, surveyor to the St. Helens (Isle of Wight) Urban District Council, has been appointed city surveyor of Wells, Somerset.

Mr. G. W. Cross, of Tunbridge Wells, has been appointed assistant borough surveyor of Richmond, Surrey, at a salary of £250 a year.

Mr. Oswald Hilton, a member of the Poole borough surveyor's staff, has been appointed engineering assistant to the Watford Urban District Council.

Mr. William H. Tillotson, highway surveyor to the Burnley Rural District Council, has been appointed district surveyor of the Watton district under the Norfolk County Council.

Mr. F. W. Cable, ASSOC.M.INST.C.E., deputy engineer, Coventry, has been appointed assistant surveyor to the Westminster City Council. The General Purposes Committee interviewed eight out of 160 applicants, and, in addition to Mr. Cable, submitted for the consideration of the council the names of Mr. Harold B. Hayes, ASSOC.M.INST.C.E., engineering assistant, Wimbledon, and Mr. C. J. Yorath, ASSOC.M.INST.C.E., deputy engineer and surveyor, Acton. Mr. Hayes obtained second place in the voting.

Mr. J. W. Newton having completed twenty-five years' service as borough engineer and surveyor of Accrington, was, at the conclusion of last Monday's meeting of the Town Council, presented with a gold cigarette case as a memento of the event. In making the presentation on behalf of the members Alderman Duckworth remarked that Mr. Newton had given them the best of his time, thought, ability and energy, and had not spared himself in the interests of the borough. His work bore testimony to the efficient manner in which it had been done.

FOR OTHER ADVERTISEMENTS

See End of Paper.

SUPERINTENDING SANITARY ENGINEER required by the Gold Coast Government. Age 36 to 45. Salary £500—£20—£600, and a duty allowance of £100 per annum. Free quarters, and first-class passages. Four months' leave in England on full pay after twelve months' service, if returning to Colony. Only candidates who are Corporate Members of the Institute of Civil Engineers, with experience of drainage work in tropical countries, will be considered, and should apply at once to the Crown Agents for the Colonies, 4 Whitehall-gardens, London, S.W. (259)

HINCKLEY URBAN DISTRICT COUNCIL.

The Hinckley Urban District Council invite applications for the appointment of a Temporary Clerk of Works in connection with the construction of a new Main Outfall Sewer.

It is anticipated that the work will take about 5 months.

Applicants must be good practical men, and be between the age of 35 and 45 years of age, and must have had good experience in this class of work, including the laying of large iron pipes and concrete tubes, &c., in running sand, timbering work, &c., and dealing with water in excavations, and should also be quite capable of setting out work, taking levels, and measuring up.

The person appointed will be required to work at night time or on Sundays when necessary without extra payment.

The salary will be at the rate of £3 3s. per week.

Applications, stating age, qualifications and experience, and accompanied by not more than two recent testimonials, to be sent to the undersigned on or before March 22, 1913.

The work will be commenced about the middle of April next.

E. H. CRUMP, ASSOC.M.INST.C.E.,
Engineer and Surveyor.

Council Offices,
Hinckley.
March 4, 1913. (253)

BOROUGH OF ROYAL TUNBRIDGE WELLS.

BOROUGH AND WATERWORKS ENGINEER'S DEPARTMENT.

SECOND ASSISTANT.

The Council are prepared to consider applications from persons between the ages of 23 and 30 years, for the post of Second Assistant in the Borough and Waterworks Engineer's Department. The person to be appointed must be a good Draughtsman and possess practical knowledge of the work of a Borough Surveyor's Office. He must also have had experience in the preparation of Plans, Quantities and Estimates, and in the use of the Theodolite and Level. Other things being equal, preference will be given to Candidates holding the Diploma of the Institution of Municipal and County Engineers.

Any further information may be obtained on application to Mr. W. H. Maxwell, ASSOC.M.INST.C.E., Borough and Waterworks Engineer.

Salary commencing at £110 per annum, rising by annual increments of £20 to a maximum of £140.

Application to be in Candidate's own handwriting, and to state age, past experience and date when duties can be commenced, to be accompanied by copies of not more than three testimonials, to be sent to the undersigned not later than 10 a.m. on Wednesday, the 19th day of March, 1913.

W. C. CRIPPS.
Town Clerk.

Tunbridge Wells.
March 5, 1913. (249)

CITY OF BIRMINGHAM.

APPOINTMENT OF CLERK (SHORTHAND-TYPIST).

The Public Works Committee are prepared to receive applications for the appointment of a Clerk (Male) in the City Surveyor's Secretary's Office. Applicants (whose age should be about 25) must be good Shorthand Writers and Typists, and have had experience in Correspondence and general office work.

Salary will be according to a scale, commencing at £90 at 20 years of age and rising to £110 at 25. The Candidate appointed will be required to devote the whole of his time to the service of the Corporation, and to contribute to the Superannuation Scheme. Applications, in Candidate's own handwriting, stating age, experience, present employment and salary, and accompanied by copies of not more than three recent testimonials, to be sent to the undersigned not later than Saturday, the 15th instant. Canvassing, either directly or indirectly, will be a disqualification.

HENRY E. STILGOE,
City Engineer and Surveyor.

Council House,
Birmingham.
March 5, 1913. (257)

COUNTY BOROUGH OF BURNLEY.

The Corporation of Burnley invite applications for the appointment of Engineering Assistant in their Borough Engineer and Surveyor's Department, at a wage of £2 10s. per week. Candidates must have a knowledge of sewerage and sewage disposal works, and general municipal engineering works.

Applications, in Candidate's own handwriting, stating age and experience, and accompanied by copies of not more than three recent testimonials, must reach me on or before Saturday, the 22nd instant, the applications to be endorsed "Engineering Assistant."

PEREGRINE THOMAS,
Town Clerk.

Town Hall, Burnley.
March 5, 1913. (254)

TRING URBAN DISTRICT COUNCIL.

TENDERS FOR MATERIALS.

The Council invites Tenders for the Supply and Delivery of Broken Granite and Flints as and when required for the year ending 31st March, 1914.

Full particulars and Forms of Tender may be obtained on application to the undersigned.

Sealed Tenders, accompanied by samples, endorsed "Tender for Materials," must be delivered to me not later than noon on Tuesday, the 18th March, 1913.

The lowest or any Tender will not necessarily be accepted.

S. S. GETTINGS, Assoc.M.Inst.C.E.,
Surveyor.

Surveyor's Office,
Tring.
March 5, 1913. (251)

KIDDERMINSTER RURAL DISTRICT COUNCIL.

HIGHWAYS DEPARTMENT.

TENDERS FOR ROAD MATERIALS FOR THE YEAR ENDING 31st MARCH, 1914.

The above Council invite Tenders for the Supply of Broken Granite, Granite Screenings, Broken Slag and Slag Screenings, delivered to the various stations and wharves in the district. Sealed Tenders, endorsed "Tender for Materials," to be sent to the undersigned not later than 10 a.m. on Tuesday, the 18th day of March, 1913, from whom Specifications, Schedules and Forms of Tender may be obtained.

G. J. SHEPHERD,
Surveyor.

85 Chester-road,
Kidderminster. (256)

EAST BARNET VALLEY URBAN DISTRICT COUNCIL.

The East Barnet Valley Urban District Council is prepared to receive Tenders for the supply of the undermentioned for one year, ending March 31st, 1914:

Broken Granite or Basalt for Roadways.
Gravel, Hoggin, &c., for Roadways.
Portland Cement.
Stoneware Pipes.
Tar-paving Materials.
Distilled Tar, or other Bituminous Substance, for Road Surfacing.
Brooms.
Forage.
Horse Hire and Cartage.

Specifications and Form of Tender can be obtained on application to Mr. Henry York, C.E., Surveyor to the Council.

Tenders must be on the Forms supplied, and delivered at the Council Offices, addressed to the Chairman of the Council, not later than 12 noon on Tuesday, the 18th March, 1913.

Samples of Materials must be deposited with the Tenders.

The Contractor or Contractors will be required to pay the local rate of wages prevailing in the district for the same class of work for which his Tender is accepted.

The Council do not bind themselves to accept the lowest or any Tender.

T. A. BUCKLEY,
Clerk.

Offices of the Council,
Station-road, New Barnet.
March 5, 1913. (258)

COLWYN BAY AND COLWYN URBAN DISTRICT COUNCIL.

PROMENADE WORKS.

TENDERS

are invited for the Promenade Extension Works at Rhos, Colwyn Bay, to include the provision of all Labour and Materials, the Erecting of Sea-wall, the Construction of Slipway, &c., and the carrying out of other Works connected therewith for the Urban District Council.

Plans, Sections and Drawings may be seen on application at the Office of Mr. William Jones, Assoc.M. Inst.C.E., Engineer and Surveyor to the Council, from whom a printed copy of the Specification, Bill of Quantities and form of Tender may be had upon the deposit of a £5 Bank of England Note, which will be returned after a Tender has been accepted to every person who has sent in a *bonâ-fide* Tender in accordance with the printed instructions.

Tenders to be sent in under seal, and endorsed with the words "Tender for Promenade Extension," and to be delivered to the undersigned by 12 noon on Tuesday, the 1st of April, 1913.

The Council do not bind themselves to accept the lowest or any Tender.

JAMES AMPHLETT,
Solicitor and Clerk to the Council.

Council Offices,
Colwyn Bay.
March 5, 1913. (250)

TILBURY URBAN DISTRICT COUNCIL.

GENERAL STORES.

The Urban District Council of Tilbury invite Tenders for the Supply of the following Articles for a period of one year from April 1, 1913:—

No. 1. Stoneware Pipes, Bends, Gullies, &c.
No. 2. Ballast, Sand, Hoggin.
No. 3. Bricks.
No. 4. Castings, Ironmongery, Tools, &c.
No. 5. Cement.
No. 6. Kentish Rag Stone.
No. 7. Guernsey Granite.
No. 8. Coal and Coke.
No. 9. Uniforms, Oilskins, &c.
No. 10. Sewermen's and Firemen's Boots and Repairs to same.
No. 11. Steam Rolling.
No. 12. Disinfectants.

Forms of Tender may be obtained upon application to Mr. S. A. Hill-Willis, Surveyor to the Council, Tilbury, on and after Friday, March 7, 1913.

Tenders, endorsed as stated on forms, to be delivered to my Office not later than 5 p.m. on Monday, 17th March, 1913.

The Council will not be bound to accept the lowest or any Tender.

(By order)

THOS. A. CAPRON,
Clerk to the Council.

Council Offices,
Dock-road,
Tilbury.
March 4, 1913. (252)

ACTON URBAN DISTRICT COUNCIL.

TAR-SPRAYING ROADS.

Tenders are invited for the Tar-spraying of about 100,000 square yards of Flint and Granite Carriageway within the district.

Particulars and form of Specification and Tender may be obtained on application to the Surveyor to the Council.

Tenders, endorsed "Tar-spraying," to be delivered to me, the undersigned, not later than 3 p.m. on Tuesday, the 18th instant.

The council do not bind themselves to accept the lowest or any Tender, and canvassing the Members or Officers of the Council either directly or indirectly will disqualify.

WM. HODSON,
Clerk to the Council.

Council Offices,
Winchester-street,
Acton, W.
March 4, 1913. (255)

ECONOMY IN REINFORCED CONCRETE DESIGN.

Mr. John A. Davenport, A.M.INST C.E., A.M.I.MECH.E., was the reader of a paper on the above-mentioned subject at a meeting of the Concrete Institute last week.

The question of economy in reinforced-concrete design might, said the author, be discussed with regard to: (1) The engineering structure, (2) the architectural structure, and the two sets of conclusions might or might not coincide. The completed engineering structure was a skeleton frame, without any architectural finishes, embellishments, fittings, &c.; while the completed architectural structure was the engineering structure made ready for use and presentable to the eye by the addition of finishes, fittings, embellishments, &c. There were, of course, certain structures such as retaining walls, bunkers, harbour works, &c., which are engineering structures purely and simply, and could not well be considered from an architectural point of view. But it was the object of the paper to deal chiefly with the structures composed of beams, columns, slabs, and walls, which came under the head of architectural structures. The most economical reinforced concrete engineering structure would have a certain arrangement of slabs, beams, columns, &c., with definite percentages of reinforcements, such arrangement and percentages having been determined with due regard to the loading, with a view of producing the cheapest possible skeleton structure. This result would probably be attained by keeping the slab thicknesses small by the introduction of beams, by keeping beams deep and narrow, and by having the size of columns (probably all different) just sufficient to carry the loads. The adoption of such a scheme would result, as already stated, in the most economical engineering structure; but if they considered the salient engineering points from an architectural point of view, they might find the nett results economical in some cases and very uneconomical in others. Generally speaking, it was economical to reduce the thickness of the slabs by introducing beams and keeping the spans small. Now, it often happens that beams running across ceilings required special finishes, cornices, &c., and the amount saved on the engineering structure might be much less than the extra cost of architectural finishing. The adoption of uniform column sizes might be more economical ultimately, for the same reason. Again, deep and narrow beams were, generally speaking, most economical from an engineering point of view; but they did not conduce to efficient lighting and ventilating, and it might cost more to get these necessary properties than the amount saved on the skeleton structure.

In order to design economical reinforced-concrete structures many factors had to be considered, some of which varied in all cases, but there were three fundamental points which influenced all structures in the same way, and these were: (1) The effect of beam section on economy; (2) the effect of percentage steel on economy; (3) the effect of lay-out or arrangement of beams, columns, &c., on economy.

In dealing with the first factor, the relative economies of singly reinforced T beams and singly and doubly reinforced plain beams, as regarded the ratio of breadth to depth, were discussed. The meaning of the second and third factors being self-explanatory were not further explained.

The total cost of any reinforced-concrete structure, whether a single slab, column, a whole floor, or a complete frame, would be the sum of the total costs of the three items—concrete, steel, and centering—and these, in their turn, would depend upon the unit costs. Now, these unit costs would vary for different parts of the one complex structure, but not for any single member; so that while a mathematical expression for a single member was possible, it would be impossible, owing to the very large number of variable quantities involved, to deduce a mathematical general expression for all classes of structure, simple and complex. Any attempt to deal with the subject of economy mathematically could only lead to ambiguity and vexation. It was, however, possible to deal with the subject by taking different arrangements, percentages, &c., and by calculating the cost of the various items, the required totals could be obtained by summation. That method appeared at first sight to be rather formidable, but by a suitable arrangement of the work it would be found that the difficulty is more apparent than real.

The conclusions from Tables I., II. and III. of the paper might, said the author, be summarised as follows: —

(*a*) Reinforced-concrete T beams, correctly designed, with the total depth three times the breadth of web, are more economical than any other section for all values of unit cost and loading.

(*b*) For plain beams, reinforced in any way whatever, the most economical ratio of depth to breadth is 3 for all values of unit cost and loading.

(*c*) For singly reinforced plain beams, the most economical reinforcement percentage runs from 1 to 1·2 for all values of unit cost and loading.

(*d*) For doubly reinforced plain beams the most economical reinforcement percentage is 1, with equal tension and compression steel, for all values of unit cost and loading.

(*e*) Plain beams doubly reinforced may be more economical than similar beams singly reinforced, the relative economies depending upon the values of unit cost and ratio of depth to breadth of section, but not to any appreciable extent upon the loading.

The foregoing conclusions were quite independent of any economies effected by adopting uniform sections throughout a design.

The results of Tables IV. and V. were summarised by the author as follows: —

(*f*) For ordinary values of unit cost square columns, helically reinforced, are most economical of cost when the diameter of lateral is small, the pitch of lateral is 0·2 the breadth of core, and the percentage longitudinal steel is high.

(*g*) Increased economy of cost will result from the use of longitudinal reinforcement having a lower yield point than ordinary mild steel, provided such material be cheaper than mild steel.

(*h*) The greatest economy of space is obtained by using large diameter laterals, pitched at 0·2 the breadth of core, and a high percentage of longitudinal reinforcement.

Summarising the conclusions drawn from the remaining tables the author said: —

(*i*) A rational arrangement of slabs and beams supported by columns is more economical than slabs supported by beams only.

(*j*) A low-percentage slab reinforcement is more economical than a high percentage.

(*k*) A thin slab is more economical than a thick slab.

RANSOME-VERMEHR MACHINERY.

The Ransome-verMehr Machinery Company, Limited, Brunswick House, Westminster, S.W., have issued a new illustrated catalogue in which are given particulars of their patented concrete mixers, steel sheet piling, pile extractors, aggregate conveyors, stone dryers, and tar-macadam mixers. The information has been brought very carefully up to date; at the same time an endeavour has been made by the division of the contents of the catalogue into sections to make it possible for those interested in concrete mixers—which are mainly dealt with—to ascertain readily the details and particulars with regard to any size and type of machine which may appeal to them. The figures given in the catalogue are likely to be of considerable value to all users of concrete, and the manner in which the various dimensions and weights have been tabulated allows of very easy reference. Among the users of the firm's mixers may be mentioned the Admiralty, the War Office, and several of the British Colonial Governments, the Associated Portland Cement Company, Limited, the Derwent Valley Water Board, and numerous large engineering and building firms, including Sir John Jackson, Limited, Messrs. S. Pearson & Son, Limited, Holloway Bros. (London), Limited, and Easton Gibb & Son, Limited. At Rosyth naval base Messrs. Easton Gibb & Son, Limited, have used over 500 tons of the company's steel piling, while 700 tons of the material are being employed in connection with the Port of London Authority dock extensions.

The Ransome pile extractor, which is among the appliances described in the catalogue, is an entirely new invention. The machine works by steam power on the lines of a steam hammer, but delivers an upward blow, which is transmitted through side links to the pile. These extractors—nine of which are being operated at Rosyth—are pulling daily 12-in. by 12-in. timber piles, with a penetration of 35 ft. into the ground, in an average time of two minutes.

"FLUXPHALTE" AS A ROAD DRESSING AND BINDER.

The ideal material for a road dressing and binder is claimed to be provided by a pure Mexican asphalt which is being offered to surveyors by the Anglo-Mexican Petroleum Products Company, Limited, under the trade name of "Fluxphalte." This is a native liquid asphalt of which there are vast supplies owned by the Mexican Eagle Oil Company, Limited, who have spent years of careful investigation in perfecting the methods of refining, with a view to marketing the product for road purposes.

"Fluxphalte," of which a constant and abundant supply is guaranteed—is stated to contain over 65 per cent of pure bitumen, and special attention is drawn by the supplying company to its high cementing value. To quote from a booklet lately issued by the firm, "Fluxphalte not only acts as a dressing, but possesses the qualities of an asphaltic binder, improving the wearing surface and durability of the road after its application." Costing practically no more than tar, the material is claimed to be just as easily applied, while being immensely superior in its results, and it has the further advantage that it contains no poisonous elements of a soluble character which can be washed off by rain into rivers and streams.

"Fluxphalte" is heated in the ordinary way, and applied either by spraying machines or with brushes, according to the length of the road being treated. Surveyors accustomed to the use of tar or similar products will require no elaborate instructions for its use, and the following remarks cover all that is required to be said on the subject. The first essential matter, the importance of which is strongly emphasised, is that the road should be absolutely dry, not merely on the surface, but to the depth of $\frac{3}{4}$ in. Before applying "Fluxphalte," the road to be treated should be thoroughly cleaned, all mud and dust being vigorously swept away so as to leave the surface metal visible. For this purpose a rotary horse-machine brush is most suitable.

"Fluxphalte," owing to its high cementing value, will grip the surface with great tenacity and penetrate the interstices if the road is cleaned in the above manner before it is applied. After the application of the material, which will be found to cover approximately about 5 yds. to every gallon used, the road should be well sprinkled with coarse grit or clean dry chippings, ½-in. to ¾-in. being the most suitable size. This should be spread evenly, and a ton of chippings should be made to cover between 200 sq. yds. and 300 sq. yds. of road surface. When this has been done traffic may be allowed at once over the section so covered, and surveyors will find it advantageous to treat the road half-widths at a time. After a few hours' traffic the "Fluxphalte" may show through in places, when a second application of chippings at such points is desirable.

When "Fluxphalte" is applied by hand it should be poured on to the road from cans or buckets and well brushed out, care being taken to spread the road dressing as evenly as possible. Better results are, however, stated to be secured when any of the usual tar-spreading machines are available for spraying.

Inquiries for samples and quotations are invited from surveyors and others interested in roads, and should be addressed to the Anglo-Mexican Petroleum Products Company, Limited, Asphalt Department, Finsbury Court, London, E.C.

The Development of Kingsway.—Kingsway has been "filling up" steadily for some time past, and its rapid development into one of the important business thoroughfares of London was further illustrated last week when Sir Herbert Marshall, J.P., of Leicester, and Regent House, formally opened the extensive new premises of the Dictaphone Company, formerly of Oxford-street. Many well-known London business men gathered on the invitation of the managing director, Mr. Thomas Dixon, and an interesting feature of the ceremony was the receipt by wireless of a message of congratulation from Mr. Marconi, who has at Marconi House, in the Strand, one of the largest Dictaphone installations in the country. The company's new offices are a model of modern business equipment, and the problems of light and air space have been carefully studied.

A GREAT BRIDGE BUILDER.

THE LATE SIR WILLIAM ARROL.

Sir William Arrol, whose death, following an operation, occurred on the 20th ult. at Glasgow, began life as a piecer in a cotton mill. At the age of fourteen he was apprenticed to a blacksmith and engineer at Paisley, and at the expiration of his indentures he obtained further experience in various places both north and south of the Border, and ultimately, at the age of twenty-four, became a foreman at Messrs. R. Laidlaw & Sons' boiler and bridge yard in Glasgow. Five years later he had saved £85 from his weekly wages. With this small capital he decided to start business on his own account in Glasgow as a contractor for the making of boilers and girders. It was a struggle at first, but his qualities of invention, perseverance and resource stood him in good stead, and in 1871 his business had so much expanded that it was necessary to remove to larger premises. Here he founded the business now carried on as Sir William Arrol & Co., engineers. He specialised in bridge work, and in the course of his career his firm erected the present Tay Bridge, the Forth Bridge, all the main aqueducts and many swing bridges over the Manchester Ship Canal and the steelwork of the Tower Bridge, one of their most recent undertakings of importance being the widening of Blackfriars Bridge, London.

Sir William Arrol ceased to take an active part in the management of his business after the opening of the Forth Bridge. He was elected Unionist M.P. for South Ayrshire in 1895, and sat until 1906. He was thrice married—in 1864, 1905 and 1910—on the last occasion, then aged seventy-two, to a London lady, Miss Robertson, who survives him.

THE DUBLIN VACANCY.

The Dublin Corporation in committee have reported as follows with reference to the filling-up of the borough surveyorship and applications for the vacancy by Mr. Buckley and Mr. Henry Allen: "Having carefully considered these matters, your committee recommend that the council direct the insertion of an advertisement for candidates to fill the position of borough surveyor, the salary and duties to be the same as those which governed the appointment to the said position of the late borough surveyor the salary to be £800, rising by increments of £50 per annum to £1,000."

The Housing Question in Wales.—At a recent sitting at Cardiff of the Welsh Housing Conference a discussion took place regarding the suggested amendment of the Housing and Town Planning Act so as to allow of the introduction of the Irish Labourers' Dwellings Acts into Wales. General agreement was expressed with the proposal, but no resolution was passed. A suggestion by Alderman Phillips, of Neath, for the formation of a Welsh National Advisory Committee on Housing was favourably received.

Mr. Henry Vivian and Insane By-laws.—Mr. Henry Vivian, in his address as chairman at the annual meeting of the Co-partnership Tenants last week, stated that the progress of the garden suburb movement was continually hampered by the insane by-laws which existed in some parts of the country. Many of these neither accorded with common sense, public interest, nor private profit. In one district, for example, there was a by-law against building hollow walls, which every competent authority regarded as one of the best preventatives of dampness in houses. Another city authority, under its statutory obligations, had involved the movement in devoting strips of land to 36-ft. roads which were not 100 yds. in length and led nowhere, not even to the front or back door of a single house. The roads were absolutely useless, and merely burdened the cost and deteriorated the estate plan. True, these provisions were defended by no one, and why they continued to be imposed on and by an intelligent community was a mystery to him. It was high time that the Local Government Board took some action in the matter and co-ordinated the by-laws of the country in accordance with common sense and modern needs and requirements.

ENAMELLED FIRECLAY SANITARY WARE AND FITTINGS.

Messrs. W. R. Pickup & Co., Limited, have prepared a sumptuous catalogue and price list of their enamelled fireclay sanitary ware and fittings, comprising the well-known productions of the old-established Pearl Brook Works, Horwich, the proprietorship of which has passed into their hands since the previous catalogue was issued by their predecessors, Messrs. C. & D. Musgrave, Limited. The publication, which is strongly bound in cloth covers, is most conveniently arranged for reference, a thumb-index rendering it possible to turn at once to any of its half-dozen sections—which deal respectively with baths, urinals, closets, sinks, lavatories, and hospital specialities. The information which is given with regard to the various articles is admirably complete, and presented in a manner which does credit to those responsible for the compilation of the catalogue—a copy of which should be in every municipal engineer's and contractor's office.

"Rocmac" in Scotland.—Peebles Town Council at their last meeting decided upon the use of Rocmac in completing the relaying of the Northgate and in the paving of the centre of the High-street of that town. Bailie Forrester, in moving the recommendation, said he thought that anyone who had made a careful study of Rocmac in the Northgate would agree that it had been from almost every point of view a success. That success would be complete, he considered, when the whole of the Northgate was laid with the material. The surface would be durable and clean in winter, and if it were afterwards decided to tar-spray it in summer it would be absolutely free from dust and noise. Moreover, Rocmac made crossings unnecessary, because there would be a clean street in the worst of weather. Bailie Dalling agreed that the paving had been an unqualified success, and another member, referring to the section already laid in the Northgate, asserted that the roadway was as good to-day as when it was constructed. Although it was dear to begin with, in the long run it would be one of the cheapest roads they could make.

INSTITUTION OF MUNICIPAL AND COUNTY ENGINEERS.

President—Mr. R. J. Thomas, M.Inst.C.E., County Surveyor, Buckinghamshire.

EASTERN DISTRICT.

District Chairman: Mr. Alfred Fidler, M.Inst.C.E., Northampton.

An Eastern District meeting is to be held at the new offices of the institution, 92 Victoria-street, Westminster, to-morrow (Saturday).

Programme.

3 p.m.—Meet at the offices of the institution, 92 Victoria-street, Westminster, to consider nominations of district representatives.

Discussion on points of interest or difficulties arising in the ordinary course of practice.

E. J. Elford, M.Inst.C.E., *Hon. District Secretary*, Borough Engineer, Southend-on-Sea.

A. Fidler, M.Inst.C.E., *District Chairman*, Borough Engineer, Northampton.

NORTH-EASTERN DISTRICT.

A meeting of the members of the North-Eastern District will be held in Leeds to-morrow (Saturday).

A meeting of the institution will be held in the North-Eastern District at Newcastle-on-Tyne on May 2nd and 3rd next.

ANNUAL MEETING: ALTERATION OF DATE.

The date of the annual meeting of the institution has been altered from July 23rd-26th to July 16th-19th.

SCOTTISH MEETING.

A meeting of the institution will be held in the Scottish District at Dundee on June 6th and 7th.

By order of the Council,

Thomas Cole, *Secretary.*

11 Victoria-street, S.W.

INSTITUTION OF MUNICIPAL ENGINEERS.

President—Mr. Frank Latham, M.Inst.C.E.I., F.S.E., Borough Engineer and Surveyor, Penzance.

COUNCIL MEETINGS.

The following council meetings have been arranged: March 26th, London; April 30th, London; May 31st, Manchester; June 28th, London; July 30th, London.

GENERAL MEETING.

A visit will be paid to the Building Exhibition at Olympia on April 12th, by kind permission of the promoters. Full particulars will be issued later.

NORTHERN DISTRICT.

A district meeting will be held at Wallsend on March 29th, when a round of visits will be made to the municipal works and shipyards of the town. Full programme will be issued later.

EXAMINATIONS.

The next examination will be held in London and other centres during the week ending May 17th next. Copies of syllabus and forms of application to sit may be obtained from the secretary. Intending entrants are requested to make early application.

B. Wyand, *Secretary.*

39 Victoria-street, S.W.

ROYAL SANITARY INSTITUTE.

PRELIMINARY ARRANGEMENTS FOR EXETER CONGRESS.

The twenty-eighth congress of the Royal Sanitary Institute will be held this year at Exeter, commencing on July 7th, under the presidency of Earl Fortescue, K.C.B., Lord Lieutenant of Devonshire.

The Engineering and Architecture Section of the congress will be presided over by Mr. H. Percy Boulnois, M.Inst.C.E., late deputy chief engineering inspector to the Local Government Board, and chairman of council of the institute. Mr. Samuel Hutton, surveyor and water engineer to the Exmouth Urban District Council, will act as local secretary, and Mr. A. Saxon Snell, F.R.I.B.A., as recording secretary of the section.

The usual conference of engineers and surveyors to county and other sanitary authorities will be presided over by Mr. Thos. Moulding, M.Inst.C.E., city engineer and surveyor of Exeter. The local secretaries of the conference will be Messrs. W. P. Robinson, Assoc.M. Inst.C.E., county surveyor (Northern Division), Exeter, and Robert H. Dymond, assistant city surveyor of Exeter, and the recording secretary Mr. John S. Brodie, M.Inst.C.E., borough engineer of Blackpool.

The Health Exhibition will be held in the Victoria Hall, from July 5th to 12th.

SESSIONAL MEETING.

On Friday, the 14th inst., at a sessional meeting of the institute to be held at the Guildhall, Plymouth, a discussion on "The Water Supply of Devonport" will be opened by Mr. F. W. Lillicrap, water engineer, Devonport. The chair will be taken at 7 p.m.

On the following day, at 10.30 a.m., visits will be made to the electricity works and the Burrator waterworks.

APPOINTMENTS VACANT.

Official and similar advertisements received up to 4.30 p.m. on Thursdays will be inserted in the following day's issue, *but those responsible for their despatch are recommended to arrange that they shall reach* The Surveyor *office by noon on* **Wednesdays** *to ensure their inclusion in the weekly list of summaries. Such advertisements may, in cases of emergency only, be telephoned (No. 1339 Holborn), subject to later confirmation by letter.*

INSPECTOR OF NUISANCES AND SURVEYOR.—March 8th.—Bicester Urban District Council. £130 per annum, with free house.—Mr. Edward Foster Tanner, clerk.

BOROUGH ENGINEER AND SURVEYOR.—March 8th.—Corporation of Wigan. £350—£500 per annum.—Mr. William Henry Tyrer, town clerk.

ARCHITECTURAL ASSISTANT.—March 10th.—Corporation of Halifax. £140 per annum.—Mr. J. Lord, borough engineer and surveyor.

SURVEYOR AND INSPECTOR.—March 10th.—Buckhaven Town Council. £175 per annum.—Mr. R. Leslie, town clerk.

SURVEYOR AND INSPECTOR.—March 11th.—St. Helens (Isle of Wight) Urban District Council. £135 per annum. Mr. Chas. G. Vincent, clerk.

ASSISTANT SURVEYOR.—March 12th.—Lytham Urban District Council. £65 per annum.—Mr. Arthur J. Price, surveyor.

INSPECTOR OF NUISANCES.—March 12th.—Horbury Urban District Council. £110 per annum.—Mr. T. Barker, clerk.

TOWN PLANNING ASSISTANT.—March 12th.—Corporation of Doncaster. £2 2s. per week.—Mr. F. Oscar Kirby, borough surveyor.

TEMPORARY ASSISTANT.—March 13th.—Nantyglo and Blaina Urban District Council. £2 5s. per week.—Mr. W. J. Davies, surveyor, Council Offices, Blaina, Mon.

SURVEYOR AND INSPECTOR OF NUISANCES.—March 14th.—Llandrindod Wells Urban District Council. £120 per annum.—Mr. D. C. Davies, clerk.

TEMPORARY ASSISTANT.—March 15th.—Chesham Urban District Council. £2 per week.—Mr. Percy C. Dormer, engineer and surveyor.

SURVEYOR'S ASSISTANT.—March 19th.—Seisdon Rural District Council. £1—£1 5s.—Mr. W. Cannan, Surveyor's Office, Wombourne, near Wolverhampton.

ASSISTANT ENGINEERS. — May 1st.—Indian Public Works and State Railway Departments.—Secretary, Public Works Department, India Office London, S.W.

PERMANENT WAY INSPECTOR (no date).—Federated Malay States. £200—£250, and allowances.—Messrs. Gregory, Eyles & Waring, 12 Dean's-yard, Westminster.

MUNICIPAL COMPETITIONS OPEN.

Official and similar advertisements received up to 4.30 p.m. on Thursdays will be inserted in the following day's issue, *but those responsible for their despatch are recommended to arrange that they shall reach* The Surveyor *office by noon on* **Wednesdays** *to ensure their inclusion in the weekly list of summaries. Such advertisements may, in cases of emergency only, be telephoned (No. 1359 Holborn), subject to later confirmation by letter.*

IPSWICH.—March 31st.—Designs for laying out 26 acres as a working-class suburb on the lines of a modified garden city. Premiums of 50 guineas, 30 guineas, and 20 guineas are offered.—Mr. W. Bantoft, town clerk

DEVONPORT.—June 14th.—Designs for municipal buildings and a guildhall, for the Corporation of Devonport. Premiums of £350, £150, and £100 are offered. The assessor is Mr. Ernest Newton, A.R.A., F.R.I.B.A.—Mr. R. J. Fittall, town clerk.

MUNICIPAL CONTRACTS OPEN.

Official and similar advertisements received up to 4.30 p.m. on Thursdays will be inserted in the following day's issue, *but those responsible for their despatch are recommended to arrange that they shall reach* The Surveyor *office by noon on* **Wednesdays** *to ensure their inclusion in the weekly list of summaries. Such advertisements may, in cases of emergency only, be telephoned (No. 1359 Holborn), subject to later confirmation by letter.*

Buildings.

BOURNE.—March 8th.—For the construction of two brick bridges, for the rural district council.—Mr. Cecil W. Bell, clerk.

EAST HAM.—March 8th—17th.—For the erection of a school, for the corporation. Applications for bills of quantities must be made to the architect, Mr. R. L. Curtis, 11 and 12 Finsbury-square, London, E.C., not later than March 8th.—Mr. F. R. Thompson, secretary, Education Office, Town Hall, East Ham.

SHREWSBURY.—March 8th.—For constructing a concrete retaining wall and fixing wrought-iron unclimbable fence on same, for the corporation.—Mr. W. Chapple Eddowes, borough surveyor.

SOMERSET.—March 10th.—For the erection of a school, for the county council.—Mr. C. H. Bothamley, county education secretary.

ABERAVON.—March 10th.—For the erection of arcade and municipal offices, and ferro-concrete construction, for the corporation. — Mr. M. Tennant, town clerk

DONCASTER.—March 10th.—For the erection of retort-house and coal store extensions, for the corporation.—Mr. R. Watson, engineer, Gasworks.

BERMONDSEY.—March 10th.—For alterations at Rotherhithe Town Hall, for the borough council.—Mr. R. J. Angel, borough surveyor.

OXFORD.—March 10th.—For the erection of a girls' and infants' school, for the Education Authority.—City Estates Surveyor.

CARRICKMACROSS.—March 10th.—For the erection of twenty-five houses in four blocks on one site, for the urban district council.—Mr. Thomas Nolan, clerk.

MARGAM.—March 10th.—For excavating foundations for gas-holder, for the urban district council.—Mr. D. E. Jones, clerk, Fort Talbot.

BARNES.—March 11th.—For building a thatched pavilion and a sanitary convenience (above ground), for the urban district council.—Mr. G. Bruce Tomes, surveyor.

MARGATE.—March 11th.—For the erection of cookery, laundry, and manual training centre, for the Education Committee.—Mr. E. A. Borg, borough surveyor.

CARDIFF.—March 12th.—For the erection of two single cottages, for the corporation.—Mr. J. L. Wheatley, town clerk.

RYE.—March 12th.—For enlargement of pumping station and buildings, for the corporation.—Town Clerk.

CLARE.—March 13th.—For the erection of four cottages, for the rural district council.—Mr. S. L. Bigmore, clerk, 2 Wrotting-road, Haverhill, Suffolk.

SOUTHEND.—March 13th.—For the erection of a swimming bath, for the corporation.—Mr. E. J. Elford, borough engineer.

MANCHESTER.—March 15th.—For the erection of a school and caretaker's house, for the Education Committee.—Accountant, Education Offices, Deansgate.

BARROW-IN-FURNESS.—March 19th.—For the erection of two pavilions and laundry at hospital, for the corporation.—Borough Engineer.

WEST RIDING.—March 21st.—For the erection of a new school at Castleford, for the county council.—The Clerk, County Hall, Wakefield.

SHEFFIELD.—March 25th.—For the erection of a light reinforced-concrete bridge, for the corporation.—Mr. S. E. Fedden, general manager and engineer, Electricity Department, Commercial-street.

FARNBOROUGH.—March 31st.—For the erection of a refuse destructor, with buildings and chimney stack, for the urban district council.—Mr. J. E. Hargreaves, surveyor.

EDMONTON.—March 31st.—For the erection of a public convenience, for the urban district council.—Mr. C. Brown, engineer.

CARNARVON.—April 16th.—For the erection of a police station and court room at Llandudno, for the Joint Committee.—Mr. A. Bodvel-Roberts, Clerk of the Peace, Carnarvon.

Iron and Steel.

HALIFAX.—March 8th.—For the supply of cast-iron pipes, lead piping, pig lead, and gun metal fittings, for the corporation.—Mr. Percy Saunders, town clerk.

SWANSEA.—March 10th.—For laying 3-in. cast-iron water mains, sluice valves, and valve covers, for the rural district council.—Mr. Edward Harris, clerk.

CARMARTHEN.—March 14th.—For the construction of a water tank, and providing and laying 3-in. cast-iron or steel water main, for the rural district council.—Mr. John Saer, clerk.

BASFORD.—March 17th.—For providing and laying about 6,000 yds. of 4-in. and 3-in. cast-iron water mains, with necessary special castings, valves, and service connections, for the rural district council.—Mr. Henry Stone, clerk.

BOMBAY.—March 25th.—For supplying and laying about 19 miles of 50-in. diameter steel main, for the municipality.—Mr. H. J. Trivess Smith, hydraulic engineer, Municipal Offices, Bombay.

HALSTEAD.—March 27th.—For laying and jointing about 7 miles of cast-iron water mains, from 5 in. to 3 in. in diameter, including the fixing of valves and hydrants, for the rural district council.—Mr. R. L. Hughes, clerk.

HALSTEAD. March 27th.—For the supply of about 300 tons of cast-iron pipes, specials, and the supply and erection of cast-iron water tank to hold 40,000 gallons, for the rural district council.—Mr. R. L. Hughes, clerk.

Roads.

KIVETON PARK.—March 8th.—For the supply of slag, broken granite, and tar-macadam, for the rural district council.—Mr. F. Hewitt, surveyor.

NEWARK.—March 8th.—For the supply of granite, slag and tar-macadam, for the rural district council.—Mr. R. Oakden, junr., 27 Winchelsea-avenue, Newark.

DRIFFIELD.—March 8th.—For the supply of 7,000 tons of whinstone, 2,500 tons of broken slag, 600 tons of sea cobbles, 300 tons of sea gravel, and 150 tons of tarred chippings, for the rural district council.—Mr. T. Casson Beaumont, surveyor.

CLOWNE.—March 8th.—For the supply of broken slag and granite, for the rural district council.—Mr. J. T. Pears, surveyor.

HUNSLET.—March 8th.—For the supply of granite, limestone, dross, tar-macadam, kerbs, setts, flags, and steam rolling, for the rural district council.—Mr. W. B. Pindar, clerk.

PANTEG.—March 8th.—For the supply of metalling and general haulage, for the urban district council.—Mr. H. R. Davies, Council Offices, Pontymoel.

STAFFS.—March 8th.—For the supply and cartage of road materials, tools, and road implements, for the county council.—Mr. J. Moncur, county surveyor, Stafford.

STOCKTON.—March 8th.—For the supply of whinstone and slag, for the rural district council.—Mr. W. Heslop, highway surveyor.

SELBY.—March 8th.—For the supply of road materials, for the rural district council.—Mr. J. Townend, clerk.

HOLBORN.—March 8th.—For paving work in compressed rock asphalt, granite setts, creosoted deal blocks and sectional hard-wood blocks, for the borough council.—Mr. L. Walford, town clerk.

HOVE.—March 8th.—For paving and other works, for the corporation.—Mr. H. Endacott, town clerk.

HOYLAND NETHER.—March 8th.—For the supply of broken slag, granite and tar-macadam, for the urban district council.—Mr. Fred. J. Thackray, engineer and surveyor.

LANCASHIRE.—March 8th.—For repaving about 40,000 sq. yds. with granite setts, and about 10,000 sq. yds. with granite cubes, for the county council.—Mr. Harcourt E. Clare, clerk, County Offices, Preston.

KING'S LYNN.—March 10th.—For the supply of road material, for the corporation.—Mr. Alfred J. Smith, borough surveyor.

WEST SUFFOLK.—March 10th.—For steam rolling in connection with the Newmarket-Bury-Stowmarket road reconstruction, for the county council.—Mr. W. Lionel Jenkins, county surveyor.

LEAMINGTON.—March 10th.—For the supply of 3,000 tons of road stone, for the corporation.—Road Surveyor.

OXENDON.—March 10th.—For the supply of broken granite, chippings and dust, broken slag, tar-macadam, and tar grouting and binding, for the rural district council.—Mr. W. J. Smith, surveyor, Rothwell House, Market Harborough.

TENTERDEN.—March 10th.—For the supply of granite or other approved macadam, picked flints, Kentish ragstone and beach, and carriage and steam rolling, for the rural district council.—Mr. W. L. C. Turner, district surveyor.

MOTTRAM-IN-LONGDENDALE.—March 10th.—For the supply of rock setts, for the urban district council.—Mr. S. Hudson, surveyor.

NORTON.—March 10th.—For the supply of materials and team labour, for the rural district council.—Mr. J. E. Moulding, clerk, The Edge, Sheffield.

CAISTOR.—March 10th.—For the supply of granite and slag, for the rural district council.—Mr. A. A. Padley, clerk.

WIMBORNE AND CRANBORNE.—March 10th.—For quarrying gravel and team work, for the rural district council.—Mr. R. T. S. Seymour, district surveyor, Wimborne Minster.

WING.—March 10th.—For the delivery of 1,500 tons of granite and 1,500 tons of slag, sand and gravel, for the rural district council.—Mr. C. W. B. Calcott, clerk.

BOLTON-UPON-DEARNE.—March 10th.—For the supply of road materials, for the urban district council.—Mr. J. L. Hawksworth, clerk.

LEEDS.—March 10th.—For kerbing, flagging, channelling and pitching, for the Highways Committee.—City Engineer.

CHEADLE AND GATLEY.—March 10th.—For the supply of tar-macadam, broken granite, artificial stone flags, setts, flags, kerbs, Portland cement, and tools, for the urban district council.—Mr. Arthur Briggs, clerk.

DARTON.—March 10th.—For making up certain streets, for the urban district council.—Mr. J. Gibson, clerk, Regent Chambers, 3 Regent-street, Barnsley.

BAILDON.—March 10th.—For the supply of limestone and tarred and untarred granite, for the urban district council.—Mr. J. Bentley, clerk.

BASFORD.—March 10th.—For the supply of granite, slag, gravel and tarred macadam, for the rural district council.—Mr. G. W. Hawley, highway surveyor, Burton Buildings, Parliament-street, Nottingham.

COVENTRY.—March 10th.—For the supply of broken road stone, granite kerbs, granite setts and workmen's tools, for the corporation.—Mr. J. E. Swindlehurst, city engineer.

LOFTUS.—March 11th.—For the supply of broken whinstone and slag, pipes and gullies, for the urban district council.—The Surveyor.

MOUNTAIN ASH.—March 11th.—For the supply of broken limestone and gravel, broken native stone, and hauling broken stone and gravel, for the urban district council.—Mr. H. P. Linton, clerk.

FAVERSHAM.—March 11th.—For the supply of granite, broken pit flints, shingle, and fine gravel, for the rural district council.—Mr. J. G. Chitttenden, district surveyor.

ELHAM (Kent).—March 11th.—For the supply of flint and Kentish rag, for the rural district council.—Highway Surveyor, Lyminge, Kent.

DOCKING.—March 11th.—For the supply on hire of a 10-ton steam road roller, for the rural district council.—Mr. J. A. Stoughton, clerk.

EPSOM.—March 11th.—For laying 7,300 sq. yds. of wood paving, and 13,000 sq. yds. of tar-macadam, for the urban district council.—Mr. E. G. Wilson, clerk.

MAIDSTONE.—March 11th.—For the supply of Guernsey granite, Cornish elvan or stone of a similar nature, Cherbourg quartzite, tarred ragstone concrete, Portland cement and ballast, for the urban district council.—Mr. S. Lance Monckton, town clerk.

BRIDGNORTH.—March 11th.—For the supply of road material and for haulage, for the rural district council.—Mr F. Richards, surveyor.

HAZELGROVE.—March 11th.—For the supply of broken stone, setts, kerbs, chippings, ashes, and pipes, for the urban district council.—Mr. F. Pidgeon, clerk.

GRIMSBY.—March 11th.—For the supply of whinstone, granite, slag, and screenings, for the rural district council.—Mr. J. F. Wintringham, clerk.

SCULCOATES.—March 11th.—For the supply of stone, gravel, and asphalt, for the rural district council.—Mr. J. F. Robinson, clerk.

UPPINGHAM.—March 11th.—For the supply of broken granite and screenings, for the rural district council.—Mr. F. Oakley, clerk.

CANTERBURY.—March 12th.—For making up pitch-grouted and water-bound granite macadam roads, for the corporation.—Mr. H. C. Turley, city surveyor.

CHADDERTON.—March 12th.—For the supply of road materials, for the urban district council.—The Surveyor.

HENDON.—March 12th.—For the supply of tar, for the rural district council.—Mr. J. A. Webb, Stanmore.

RYE.—March 12th.—For the supply of materials, for the rural district council.—Mr. L. Amon, highways clerk.

BIRKENHEAD.—March 12th.—For making up certain streets for the corporation.—Mr. C. Brownridge, borough engineer and surveyor.

BIRMINGHAM.—March 12th.—For reconstructing a road, for the Public Works Committee.—Mr. H. E. Stilgoe, city engineer and surveyor.

WEM.—March 12th.—For the supply of stone and cartage, for the rural district council.—Mr. A. G. Eccleston, 30 Noble-street, Wem, Salop.

HARTISMERE.—March 12th.—For the supply of 2,300 tons of 1¾-in. granite, and 2,000 tons of pit stones, for the rural district council.—Mr. Harold Warnes, clerk, Eye, Suffolk.

LANCASHIRE.—March 12th.—For the supply of granite macadam, limestone macadam, rubble, chippings, gravel for binding, and tarred slag or tarred granite macadam, for the county council.—Mr. Harcourt E. Clare, clerk, County Offices, Preston.

LANCHESTER.—March 12th.—For the supply of limestone, whinstone and slag, for the rural district council.—Mr. W. Cumming, highway surveyor.

PONTEFRACT.—March 12th.—For the supply of road materials, for the rural district council.—Mr. J. D. Smith, clerk.

LONG BENTON.—March 12th.—For the supply of hand-broken whinstone, for the urban district council.—Mr. Wemyss H. Blaxland, clerk, 89 Pilgrim-street, Newcastle-on-Tyne.

FLEETWOOD.—March 12th.—For the supply of Haslingden kerbs, channels and flags, limestone macadam, lonkey and grit stone setts, pitch, creosote oil, tar, and Welsh granite macadam, for the urban district council.—Mr. A. Cottam, clerk.

HAYES.—March 12th.—For horse hire, supply of local stone and haulage, for the urban district council.—Mr. C. D. Lewis, clerk, Hayes, Middlesex.

WEMBLEY.—March 12th.—For road improvement works and sewerage, for the urban district council.—Mr. F. W. Rodd, clerk.

WHEATENHURST.—March 12th. For the supply of stone and hauling, for the rural district council.—Mr. T. Daniels, road surveyor, Moreton Valence, Stonehouse, Glos.

LOFTUS.—March 13th.—For making up certain streets, for the urban district council.—The Surveyor.

OSWESTRY.—March 14th.—For keeping in repair the district roads, for the rural district council.—Mr. C. H. Bull, clerk.

STAINES.—March 14th.—For the supply of granite and granite chippings, for the urban district council—Mr. E. J. Barrett, engineer and surveyor.

BRIGHTON.—March 14th.—For laying wood pavement, for the corporation.—Mr. H. Talbot, town clerk.

CROMPTON.—March 14th.—For the supply of kerbs, edgings, grit setts, grit chippings, granite and limestone macadam, and pitch and creosote oil, for the urban district council.—Mr. F. F. Gartside, clerk.

EASTRY.—March 14th.—For the supply of surface and approved dug flints, and recarting stones, for the rural district council.—Mr. Fred. S. Cloke, clerk.

DARTFORD.—March 15th.—For the supply of broken hard stone of one of the following kinds: Rhenish basalt, Guernsey granite, Clee Hill basalt, Leicester granites, Cornish granites, Penmaenmawr or other North Wales granite, quartzite, or Quenast, for the rural district council.—Mr. E. J. Hobbs, clerk.

ALNWICK.—March 15th.—For providing and laying road materials, for the rural district council.—Mr. J. Short, 22 Duke-street, Alnwick.

WOKINGHAM.—March 15th.—For the haulage of gravel, and steam rolling, for the rural district council.—Mr. John F. Sargeant, clerk.

HUNTS.—March 15th.—For the supply of gravel and sand, for the county council.—Mr. H. Leete, county surveyor, Huntingdon.

WATH-UPON-DEARNE.—March 15th.—For the supply of macadam, tar-macadam, kerbs, flags, and setts, for the urban district council.—Mr. J. H. Drew, engineer and surveyor.

PONTARDAWE.—March 15th.—For the supply of road metal and haulage, for the rural district council.—Mr. J. Morgan, engineer.

CHORLEY.—March 17th. For the supply of broken granite and slag, rubble, chippings, setts, flags (natural), and concrete, kerbs, tools, implements, and pitch and oil, for the rural district council.—Mr. John Whitfield, clerk.

THURNSCOE.—March 17th.—For the supply of broken granite, granite chippings, broken slag, slag screenings, flags, kerbs, channelling, asphalt and pipes, for the urban district council.—Mr. T. Bull, surveyor.

NORTHWICH.—March 17th.—For work of making-up, for the urban district council.—Mr. J. Brooke, engineer and surveyor.

FINCHLEY.—March 17th. For making up twelve streets, for the urban district council.—Mr. E. H. Lester, clerk.

POCKLINGTON.—March 17th. For the supply of the best blue stone and slag, for the rural district council.—Mr. T. Robson, clerk.

CHISWICK.—March 17th.—For the construction of a new 60-ft. road, including the laying of sewers and construction of culvert and bridge, for the urban district council.—Mr. Ernest F. Collins, clerk.

LLANFRECHFA.—March 17th.—For road metalling and hauling, for the urban district council.—Mr. G. Jones, surveyor.

EAST ASHFORD.—March 17th.—For the supply of flint and haulage of gravel, rock, and granite, for the rural district council.—Mr. Julius Kingsford.

BEDWELLTY.—March 17th.—For the construction of an access road, for the urban district council.—Mr. T. J. Thomas, clerk.

HEBDEN BRIDGE.—March 17th.—For work of tar-spraying, for the urban district council.—Mr. T. Waddington, surveyor.

LONDON.—March 17th.—For the supply of Kentish ragstone and hassock, for the Commissioners of Sewers.—Mr. A. Hurtzig, 2 Queen-square-place, Queen Anne's-Mansions, Westminster, S.W.

BILLERICAY.—March 17th.—For the supply of materials and steam rolling for the ensuing year, for the rural district council.—Mr. C. Edgar Lewis, clerk.

BILSTON.—March 17th.—For the supply of broken stone, for the urban district council.—Mr. Vincent Turner, engineer and surveyor.

BRIDGE.—March 17th.—For the supply of surface-picked and other hard flints and gravel, for the rural district council.—Mr. T. Louis Collard, clerk.

HEAVITREE.—March 18th.—For making good several streets, for the urban district council.—Mr. J. W. W. Mathew, clerk.

TUTBURY.—March 19th.—For the supply of broken granite and limestone, for the rural district council.—Mr. H. S. Tebbitt, surveyor, Tatenhill, Burton-on-Trent.

WORTLEY.—March 20th.—For the supply of granite flag, limestone and tarred slag, for the rural district council.—Mr. F. Crawshaw, surveyor.

NUNEATON.—March 25th.—For the supply of broken granite and haulage, for the rural district council.—Mr. C. Blakeway, clerk.

SOUTHGATE.—March 25th.—For works of street improvement, for the urban district council.—Mr. W. M. Ellenor, clerk.

CHATHAM.—March 27th.—For the supply of broken granite, granite chippings, surface-picked flints, broken Kentish ragstone, granite channel and granite setts, for the corporation.—Borough Surveyor.

WANDSWORTH.—March 31st.—For making up and paving Genoa-avenue, Putney, for the borough council.—Mr. D. A. Nichol, town clerk.

TANGIER.—April 10th.—For the construction of a sewer and a road, for the Special Committee of Public Works.—Commercial Intelligence Branch of the Board of Trade, 73 Basinghall-street, E.C.

TANGIER.—April 12th.—For the construction of the second section of Casablanca-road, for the Special Committee of Public Works.—Commercial Intelligence Branch of the Board of Trade, 73 Basinghall-street, E.C.

THINGOE (no date).—For the supply of granite, for the rural district council.—Mr. A. R. Cameron, surveyor.

Sanitary.

WORSLEY.—March 8th. For the supply of materials required for sewering a portion of the district, for the urban district council.—Mr. J. Pethean Monks, clerk.

PONTYPRIDD.—March 10th.—For the construction of 9-in. and 12-in. stoneware surface-water drain, for the urban district council.—Mr. J. Colenso Jones, clerk.

DURBAN (Natal).—March 10th.—For the supply of stoneware sewerage pipes, for the corporation.—Messrs. Webster, Steel & Co., agents, 5 East India-avenue, Leadenhall-street, London, E.C.

PORTHCAWL.—March 10th.—For the construction of a granite concrete tube surface-water drain, for the urban district council.—Mr. Arthur Libley, engineer and surveyor.

BINGLEY.—March 10th.—For alterations and additions to the sewage disposal works, for the urban district council.—Mr. H. Bottomley, engineer and surveyor.

CLITHEROE.—March 10th.—For the construction of earthenware pipe sewers, with manholes, tanks,

filters, and sludge beds, for the rural district council. —Mr. Thos. Eastham, clerk.

WINDERMERE.—March 10th.—For the removal of refuse, for the urban district council.—Mr. C. E. Hines, surveyor.

CREWKERNE.—March 11th.—For the construction of storm overflows, screening chamber, detritus tanks, channels, and mixing race, precipitation and sedimentation tanks, circular bacterial filters, storm-water tank, and sludge lagoon, for the urban district council.—Mr. J. W. Munden, clerk.

WATFORD.—March 11th.—For scavenging and removal of house refuse, for the rural district council.—Mr. H. Morten Turner, clerk.

HANDSWORTH.—March 11th.—For emptying closets and removing house refuse, for the urban district council.—Mr. B. Powell, surveyor, Woodhouse.

BEDLINGTON.—March 11th.—For the removal of the contents of privies and ashpits, for the urban district council.—Mr. J. E. Johnston, surveyor.

DEPTFORD.—March 11th.—For the removal of refuse by barge, for the borough council.—Mr. V. Orchard, town clerk.

SHOEBURYNESS.—March 11th.—For the removal of refuse and earth-closet soil, for the urban district council.—Mr. W. Stafford, surveyor.

STALYBRIDGE.—March 12th.—For the supply of complete sludge-pressing plant, and mechanical screening plant in duplicate, for the Stalybridge and Dukinfield Joint Sewerage Board.—Mr. William Moss, clerk.

WATFORD.—March 12th.—For street watering, emptying of catchpits, and cultivation of sewage disposal sites, for the rural district council.—Mr. H. Morten Turner, clerk.

GREASBROUGH.—March 12th.—For the removal of nightsoil and refuse, for the urban district council. —Mr. J. H. Jackson, clerk.

STALYBRIDGE.—March 12th.—For the supply of sludge-pressing plant and mechanical screening plant, for the Joint Sewerage Board.—Mr. W. Moss, clerk, Bradley Hurst, Dukinfield.

HOWDEN.—March 13th.—For scavenging work, for the rural district council.—Mr. H. Green, clerk.

ROTHERHAM.—March 14th.—For the supply of disinfectants, for the rural district council.—Mr. B. Hey, surveyor.

LONDON.—March 14th.—For the construction of 488 lin. ft. of brick and concrete, egg-shaped sewer, for the county council.—Sir Laurence Gomme, clerk.

NOTTINGHAM.—March 14th.—For the construction of a sewer from the junction of North-gate and Radford-road to the junction of Marshall-street and Mansfield-street, Sherwood, for the corporation.—Mr. W. J. Board, town clerk.

YEARDSLEY-CUM-WHALEY.—March 15th.—For the construction of stoneware-pipe sewer, manholes, and other works, for the urban district council.—Mr. Sydney Taylor, clerk, 9 Terrace-road, Buxton.

ROYTON.—March 17th.—For work in connection with sewering Gravel Hole and district, for the urban district council.—Mr. Ellis Harrison, clerk.

BILLERICAY.—March 17th.—For the removal of house refuse, for the rural district council.—Mr. R. J. W. Layland, High-street.

KEIGHLEY.—March 17th.—For emptying privies and ashpits, for the rural district council.—Mr. T. Burton, inspector.

CHELTENHAM.—March 25th.—For the supply and delivery of 10,000 cub yds. of material suitable for media in connection with sewage filters, for the corporation.—Mr. J. S. Pickering, borough engineer.

HINCKLEY.—March 29th.—For laying a new main outfall sewer, consisting of about 416 lin. yds. of 36 in. diameter cast-iron pipes, and 1,102 lin. yds. of egg-shaped concrete tubes, varying from 42 in. by 28 in. to 30 in. by 20 in., together with necessary manholes, for the urban district council.—Mr. E. H. Crump, engineer and surveyor.

Stores.

SUTTON COLDFIELD.—March 8th.—For the supply of granite macadam and kerb, limestone macadam and setts, gravel and broken pebble stones, Yorkshire or pennant kerb, Rowley setts, earthenware pipes, cement, lime, iron castings, iron, steel, timber, hardware, oils, paints, and bass brooms, for the corporation.—Mr. W. A. H. Clarry, borough engineer and surveyor.

BINGLEY.—March 8th.—For the supply of road materials, ironmongery, brooms, oils, pitch, distilled tar, sanitary pipes, and castings, for the urban district council.—Mr. H. Bottomley, clerk.

BARNES.—March 10th.—For the supply of broken Guernsey or Alderney granite, broken pit flints and Thames ballast, hire of horses and carts, disinfectants, ironmongery, Portland cement, forage, litter, granite kerb, channel, paving slabs, oils, paints, and stoneware pipes, for the urban district council.—Mr. G. Bruce Tomes, engineer and surveyor.

NEWARK.—March 10th.—For the supply of 1,900 tons of slag and 150 tons of tar-macadam, for the rural district council.—Mr. A. J. Franks, clerk.

COVENTRY.—March 10th.—For the supply of broken road stone, granite kerbs, granite setts, stoneware pipes, castings, and workmen's tools, for the corporation.—Mr. J. E. Swindlehurst, city engineer and surveyor.

EASTBOURNE.—March 10th.—For the supply of Portland cement, cast-iron goods, wrought-iron goods, tools, ironmongery, oils, colours, timber, broken granite, granite kerb and setts, bricks, pipes (stoneware) brooms and brushes, for the corporation.—Mr. A. Ernest Prescott, borough surveyor.

COLNE.—March 10th.—For the supply of Lancashire and local setts, flags, kerbs, channels, Portland cement, granite macadam, limestone macadam, lime, ironwork (street grates, manholes and lamphole covers), pitch, creosote oil, earthenware pipes, and brushes, for the corporation.—Mr. Alf. Varley, town clerk.

EAST HAM.—March 10th.—For the supply of glazed stoneware pipes, glazed stoneware gulley fittings (London make), Portland cement, greystone, chalk, ground limes, lime for sewage precipitation, bricks, Thames ballast, engineers' sundries, broken granite, crushed granite, granite setts, Guernsey granite chippings, granite kerb and channelling, broken flints, cast iron work, shovels, brooms, picks, handles, disinfectants, and other sundries, for the corporation.—Mr. C. Eustace Wilson, town clerk.

PEMBROKE.—March 10th.—For the supply of road materials and general stores, for the urban district council.—Mr. J. C. Manly, clerk.

ESTON.—March 11th.—For the supply of slag, milk, provisions, butcher's meat, disinfectants, street brooms, brushes and team work, for the urban district council. —Mr. Thomas Belk, clerk, Council Offices, Grangetown.

TWICKENHAM.—March 12th.—For the supply of broken granite, ballast, shingle, flints, gravel, granite kerb, channel, quadrants, granite cubes, setts, Portland cement, fodder, forage, oils, iron castings, street gullies, drain pipes, tar slag macadam, and Kentish rag tar-paving, for the urban district council.—Mr. H. Jason Saunders, clerk.

EXETER.—March 12th.—For the supply of bricks, bass brooms, and refilling stocks of sweeping machines, Portland cement, building lime and slates, cast-iron pipes, granite channelling and kerb, Yorkshire flags, concrete flags, painting work, stoneware pipes, miscellaneous iron castings, stone, sand, timber, ironmongery, oils, plumbers' material and labour, asbestos goods, and maunds or baskets, for the corporation.—Mr. H. Lloyd Parry, town clerk.

STOKE-ON-TRENT.—March 12th.—For the supply of 440 tons of Portland cement, 6,200 yds. of stoneware pipes, 18 tons of cast-iron pipes, and timber, for the corporation.—Mr. E. B. Sharpley, town clerk.

LONDON.—March 12th.—For the supply of bricklayers', stonemasons', carpenters', ironmongers' and gasfitters' materials, iron bolts, nuts, rubber goods, oils, brushes and sundries, for the corporation of the city.—Bell, Guildhall, E.C.

CHESTER-LE-STREET.—March 12th.—For the supply of Northumberland whinstone, broken slag, tarred slag, brooms, shovels, sanitary pipes, broken limestone and disinfectants, for the urban district council.—Mr. F. J. Gray, clerk.

DARTFORD.—March 15th.—For the supply of broken hard stone of the best description, 6,790 cubic yards of unbroken flints, 1,020 cubic yards of broken Kentish ragstone or Sevenoaks rock, 500 yds. of gravel, labour, haulage, tar-painting and steam rolling, for the rural district council.—Mr. E. J. Hobbs, clerk.

SMETHWICK.—March 15th.—For the supply of road materials shovels, picks, sanitary ashbins, scavenging brushes, manhole and lamphole covers, cement and disinfectants, for the corporation.—Mr. Alex. Hosken, borough engineer and surveyor.

HEYWOOD.—March 17th.—For the supply of setts, earthenware pipes, bends, junctions, taper pipes, traps, gullies, pitch, creosote oil, limestone chippings, hand-broken granite, granite chippings, kerbs, flags, granite setts, Portland cement, and waste-water closets, for the corporation.—Mr. Geo. G. Bouchier, town clerk.

GAINSBOROUGH.—March 19th.—For the supply of broken granite or whinstone macadam, granite or whinstone setts, broken and block slag, slag chippings and dust, York setts, kerbs, channels, flags, concrete flags, stoneware and earthenware pipes, gullies, cast-iron pipes, tar-macadam, pitch, and creosote oil, and Portland cement, for the urban district council.—Mr. Sam. W. Parker, engineer and surveyor.

Miscellaneous.

BIRMINGHAM.—March 11th.—For the supply, delivery and erection of additional electric rolling stock, for the corporation.—Mr. Alfred Baker, general manager.

TENDERS FOR MUNICIPAL WORKS OR SUPPLIES.

The Editor invites the co-operation of Surveyor *readers with a view to making the information given under this head as complete and accurate as possible.*

* Accepted. † Recommended for acceptance.

BARKING.—For the erection of workmen's dwellings, for the urban district council:—

E. H. Glenny, Wanstead-park, £5,442.

BYFLEET AND PYRFORD.—For making up certain streets, for the Chertsey rural district council.—Mr. H. Beeney, surveyor:—

Ripley, Strong & Co., Farnborough	£1,966
S. Kavanagh & Co., Surbiton-hill	1,953
F. May & Sons, Ashtead	1,795
A. Hardy & Co., Woking	1,620

DENBIGH.—For the supply of roadstone and tar-macadam, for the county council.—Mr. E. W. Jones, county surveyor, Wrexham:—

Llangollen-road.—Blodwel Quarry, 6s. 3d. per ton; Ceiriog Granite, 6s. 9d. per ton.
Ruabon Station.—Blodwel Quarry, 6s. 6d. per ton; Ceiriog Granite, 6s. 11d. per ton.
Acrefair Station.—Arenig Granite, 6s. 10d. per ton; Ceiriog Granite, 7s. 3d. per ton.
Trefor Station.—Arenig Granite, 6s. 10d. per ton; Ceirog Granite, 7s. 3d. per ton.
Llangollen Station.—Arenig Granite, 6s. 8d. per ton; Ceiriog Granite, 7s. 3d. per ton.
Wrexham Station.—Bwlchgwyn Company, 6s. 9d. per ton; Arenig & Ceiriog, 7s. 6d. per ton.
Rossett Station.—Bwlchgwyn Company, 7s. per ton; Berwyn Granite, 8s. 1d. per ton.
Gwersyllt Station.—Bwlchgwyn Company, 7s. per ton; Berwyn Granite, 8s. 2d.
Ceffnbedd Station.—Bwlchgwyn Company, 7s. per ton; Arenig & Ceirog, 8s. 3d. per ton.
Marchwiel Station.—Bwlchgwyn Company, 7s. per ton; Llangynog & Berwyn, 7s. 11d. per ton
Bangor Station.—Bwlchgwyn Company, 7s. per ton; Llangynog & Berwyn, 7s. 9d. per ton.
Llansilin-road Station.—Blodwel Quarry, 5s. 6d. per ton; Mr. Makers, Llangynog, 5s. 7d per ton.
Llangedwyn Station.—Blodwel Quarry, 5s. 6d. per ton; Mr. Makers, Llangynog, 5s. 9d per ton.
Pentrefelin Station.—Mr. Makers, Llangynog. 5s. 5d. per ton; Berwyn Quarry, 5s. 5d. per ton.
Llanrhaiadr Station.—Mr. Makers, Llangynog, 5s. 4d. per ton; Berwyn Quarry, 5s. 5d. per ton.
Wharfs.—Llangollen, Trefor & Vron.—Ceiriog Granite, 6s. 11d. per ton.
Sidings.—Heber, Pandy & Pont Faen. Ceiriog Granite, 6s. 6d. per ton; Blodwel Quarry, 7s. 3d. per ton.

Tar Macadam.—Bwlchgwyn Roadstone Company's quotation for roadstone delivered on the various roads.

	Per ton in trucks. s. d.
Llangollen-road.—Ceiriog Granite	12 0
Llangollen Station. Arenig Granite	12 3
Wrexham Station.—Bwlchgwyn Company	12 6
Rossett Station. Bwlchgwyn Company	12 6
Gwersyllt Station.—Bwlchgwyn Company	12 6
Marchwiel Station.—Bwlchgwyn Company	12 6

The Bwlchgwyn Company stated that they were prepared to deliver tar-macadam for a radius of 5 miles from Wrexham on any road for 13s. 9d. per ton.

Cement.—The lowest tender for best Portland cement, that of Messrs. Greaves, Bull & Lakin, was accepted.

The Bwlchgwyn Roadstone Company, Limited, is prepared to deliver tar-macadam for a radius of 5 miles from the town of Wrexham at 13s. 9d. per ton, and this was accepted.

HAMMERSMITH.—For the enlargement of the school for defective children, for the London County Council:—

Triggs & Co., Clapham	£895
J. Garrett & Son, Balham-hill	860
W. Johnson & Co., Limited, Wandsworth-common	850
A. Roberts & Co., Limited, Kensington	815
T. Bendon, Limited, Hammersmith	797
Lole & Co., Chelsea †	788

Architect's estimate, £810.

HORNCASTLE.—The following tenders for the supply of granite and slag have been accepted by the rural council:—

F. Hodson & Son, Nottingham, 1,200 tons granite one X at 11s. 2d., double X at 10s. 7d.
Groby Granite Company, 2,000 tons at 11s 10d. and 11s. 8d.
Ellis & Everard, Bardon Hill granite, 2,000 tons at 12s. 7d. and 12s. 5d.
Brookes, Limited, Halifax, slag and chippings, 890 tons, 6s. 6d. to 7s.
Renishaw Iron Company, Chesterfield, 2,000 tons ditto, 6s. 2d.
Stanton Iron Works Company, Derby, 1,000 tons ditto, 5s. 4d. to 6s. 1d.

HORSFORTH.—For laying sewers and constructing manholes, for the urban district council.—Mr. H. Raven, engineer:—

Kendall, Pudsey	£1,978
Naylor Brothers, Bradford	1,474
Parkin, Horsforth	1,304
Hudson, Horsforth	1,290
Throupe & Sons, Horsforth*	1,075

Engineer's estimate, £1,300.

KINGSTON-UPON-THAMES.—For levelling, paving, metalling, flagging, channelling, sewering, and lighting Woodbines-avenue, for the corporation.—Mr. R. H. Clucas, borough surveyor:—

T. Adams, Wood Green	£1,032
J. Mowlem & Co., Limited, Westminster	1,027
E. Free & Sons, Maidenhead	981
E. Parry & Co., Putney	964
S. Kavanagh & Co., Surbiton-hill*	937

LEWISHAM.—For the construction of a pipe and concrete sewer, for the borough council.—Mr. E. Van Putten, borough surveyor:—

J. T. Gloag, Catford	£209
Woodham & Sons, Catford	189
Fry Brothers, Greenwich*	180

LEWISHAM.—For the removal of house refuse, for the borough council.—Mr. E. Van Putten, borough surveyor:—

	From Forest Hill Railway Station, L.B.&S.C.R. at per full dust cart load. s. d.	From Lee, Blackheath, Catford, Lower Sydenham and Brockley Stations, S.E.&C.R. at per full dust cart lead. s. d.
J. & B. Martin	3 6	2 11
Hudsons, Limited	3 6	3 3
Postlethwaite, Taylor & Knowles, Limited	3 7	3 2½
G. E. Cloke	3 8	3 9
D. & C. Rutter, Limited	3 8	3 4
T. Wood & Sons	3 9	3 6
J. S. Barth	3 10	3 8
B. Cloke	3 10	3 9½
S. West, Limited	4 0½	3 0½

LLANTRISANT AND LLANTWIT.—For making up private streets, for the rural district council.—Mr. T. Saunders, surveyor, Pontyclun:—

L. Evans, Tonyrefail	£878
G. L. Morgan, Pontypridd	824
P. J. Davies & Co., Penarth	789
W. Thomas & Sons, Llantrisant	780
J. Sutherland, Abercynon	768
H. Murray, Pontypridd	765
Johns & West, Llantrisant	764
H. P. Hames, Efail Isaf	706
Johnson Brothers, Gloucester*	722

NEW HUNSTANTON.—For making up certain streets, for the urban district council:—

Avenue-road (Western part).

F. Southgate & Son, Hunstanton	£428
R. Shanks, Chatteris and Hunstanton	344
E. J. Case, King's Lynn *	320

Avenue-road (Eastern part).

F. Southgate & Son, Hunstanton	£142
E. J. Case, King's Lynn	124
R. Shanks, Chatteris and Hunstanton *	124

Seagate.

F. Southgate & Son, Hunstanton	£285
E. J. Case, King's Lynn	242
R. Shanks, Chatteris and Hunstanton *	210

SOUTHAM.—For the supply of granite, for the rural district council:—

Granite.

C. Abell, Limited, Atherstone.*
Midland Quarry Company, Limited, Nuneaton.*
Judkins, Limited, Nuneaton.*
Mountsorrel Granite Company, Limited, Loughborough.*
B. J. Forder & Son, Limited, Nuneaton.
J. Elbs & Sons, Limited, Rugby.
Clee Hill Granite Company, Limited, Ludlow.
Rowley Regis Granite Quarries, Limited, Birmingham.
Croft Granite Brick & Concrete Company, Limited, Leicester.
Cliffe Hill Granite Company, Limited, Leicester.
Hartshill Quarry Company, Limited, Atherstone.
Jees Hartshill Granite Company, Limited, Atherstone.
Desthill Granite Company, Limited, Tamworth.

Slag.

C. L. Stiff & Co., Birmingham.*
Exors. of F. Phipps, Northampton.*
W. Prestwich & Sons, Sheffield.
T. Boston & Son, Limited, Birmingham.
D. Millington, Dudley.

Basalt.

United Brick, Basalt & Roads Company, Limited, Buxton.

Roubie.

W. L. Ireland, Atherstone.

ST. PANCRAS.—For the installation of a complete system of low-pressure hot-water heating apparatus at Carlton-road school, for the London County Council:—

The Brightside Foundry & Engineering Company, Limited, Westminster	£1,525
Cannon & Hefford, Peckham	1,251
Palowkar & Sons, Queen-street	1,091
G. & E. Bradley, Lever-street	1,065
J. Yetton & Co., Limited, Limehouse	1,060
W. G. Cannon & Sons, Limited, London-road†	998
J. Grundy, Limited, City-road (withdrawn)	897

Architect's estimate, £998

ST. GEORGE'S-IN-THE-EAST.—For extending a staircase at the Betts-street school, for the London County Council:—

W. Harris, North Woolwich	£516
A. E. Symes, Stratford	455
Parrott & Isom, Fore-street	440
J. C. Mather, Islington	430
W. Shurmur & Sons, Upper Clapton	405
Vigor & Co., Poplar	396
W. Bailey, East Greenwich	395
H. C. Horswill, Forest-gate†	385

Architect's estimate, £406.

STEPNEY.—For the erection of an elementary school for 996 children, for the London County Council:—

W. E. Blake, Limited, Plymouth	£22,283
J. Appleby & Sons, Southwark-park	22,268
Brand, Pettit & Co., West Green-road	21,863
H. L. Holloway, Deptford	21,464
Rowley Brothers, Wood-green	21,438
W. Lawrence & Son, Finsbury-circus	21,167
Thomas & Edge, Woolwich	21,073
L. H. & R. Roberts, Islington	20,969
G. E. Wallis & Sons, Limited, Haymarket	20,879
Patman & Fotheringham, Limited, Islington†	20,683

Architect's estimate, £20,576.

WANDSWORTH.—For the erection of an elementary school for 969 children, for the London County Council:—

Leslie & Co., Limited, Kensington-square	£17,515
Holloway Brothers, Limited, Belvedere-road	17,154
McLaughlin & Harvey, Limited, Brecknock-road	16,599
W. Johnson & Co., Limited, Wandsworth-common	16,553
H. Lovatt, Limited, Westminster	16,369
Rowley Brothers, Wood-green	16,353
J. & C. Bowyer, Limited, Upper Norwood	16,089
E. Lawrence & Sons, Limited, City-road	15,967
Patman & Fotheringham, Limited, Islington	15,723
W. King & Son, Vauxhall-bridge-road	15,621
G. C. Kearley, Limited, Great Marlborough-street	15,584
G. E. Wallis & Sons, Limited, Panton-street	15,554
Ashby & Horner, Aldgate†	14,934

Architect's estimate, £15,411.

WEXFORD.—Accepted for the erection of a reinforced-concrete bridge at Deeps, for the county council.—Mr. W. F. Barry, county surveyor:—
Reinforced-concrete bridge—British Reinforced Concrete Engineering Company, Limited, Westminster, S.W., £3,713.
Bascule openings.—Cleveland Bridge Company, Darlington, £1,250

MEETINGS.

Secretaries and others will oblige by sending early notice of dates of forthcoming meetings.

MARCH.

7.—Junior Institution of Engineers: Mr. B. A. C. Herepath, on "The Training of a Colonial Engineer."
8.—Institution of Municipal and County Engineers: Eastern District Meeting, 92 Victoria-street, S.W. 3 p.m.
8.—Institution of Municipal and County Engineers: North-eastern District Meeting at Leeds.
10.—Surveyors' Institution: Adjourned discussion on papers, "Building By-laws and Regulations as Affecting the Housing of the Working Classes," by Mr. Wm. Woodward, and "Some Urban Housing Problems," by Mr. M. Price Holmes. 8 p.m.
13.—Concrete Institute: Mr. H. C. Johnson, on "The Strength of Cement."
14.—Royal Sanitary Institute: Sessional Meeting at Plymouth: Mr. F. W. Lillicrap, water engineer, Devonport, on "The Water Supply of Devonport," Western Law Courts, Guildhall. 7 p.m.
15.—Inauguration of Chingford Reservoir by His Majesty the King. 3.30 p.m.
17.—Royal Institute of British Architects: Mr. F. Billerey, on "Modern French Architecture." 8 p.m.
29.—Institution of Municipal Engineers: Northern District Meeting at Wallsend.

APRIL.

12.—Opening of Building Trades Exhibition, Olympia, by Lord Mayor of London.
15.—Joint Meeting of the Illuminating Engineering Society, the Institutions of Gas and Electrical Engineers, and the Institution of Municipal and County Engineers: Mr. A. P. Trotter, on "Standard Clauses for a Specification of Street Lighting."
21.—Royal Institute of British Architects: Messrs. F. W. Jackson and Bernard Dicksee, on "Modern Steel Construction." 8 p.m.
23.—Royal Sanitary Institute: Ordinary General Meeting. 4 p.m.

MAY.

14-18.—Royal Institute of Public Health: Annual Congress in Paris

JUNE.

6-7.—Institution of Municipal and County Engineers: Meeting at Dundee.
23-28.—International Road Congress in London.

APPOINTMENTS OPEN.

Official and similar advertisements received up to 4.30 p.m. on Thursdays will be inserted in the following day's issue, *but those responsible for their despatch are recommended to arrange that they shall reach* THE SURVEYOR *office by noon on* **Wednesdays** *to ensure their inclusion in the weekly list of summaries. Such advertisements may, in cases of emergency only, be telephoned* (*No.* 1359 *Holborn*), *subject to later confirmation by letter.*

TEMPORARY ENGINEERING AND SURVEYING ASSISTANT. March 8th. Wantage Rural District Council.—Mr. John W. Harris, Engineer and Surveyor, East Challow, Wantage. (242)

PUPIL.—The Borough and Waterworks Engineer of Leamington (A.M.I.C.E.) has a vacancy in his office for a Pupil.—Address, Town Hall.

LYTHAM URBAN DISTRICT COUNCIL.

The Lytham Urban District Council invite applications for the post of Assistant to the Surveyor. Salary £65 per annum.

Applications, in candidate's own handwriting, stating age, accompanied by copies of not more than three testimonials, and endorsed "Assistant," to be sent to the undersigned on or before Wednesday, the 12th March, 1913.

ARTHUR J. PRICE,
Surveyor.

Council Offices, Lytham, Lancashire.
February 28, 1913. (233)

URBAN DISTRICT OF LLANDRINDOD WELLS.

SURVEYOR AND INSPECTOR OF NUISANCES.

The Council of the above-named District intend, on the 14th day of March, 1913, to proceed to the appointment of a Surveyor and Inspector of Nuisances for the District, at a salary of £120 per annum, payable quarterly.

The appointment will be subject to the approval of the Local Government Board, and the person appointed must possess the Certificate of some properly constituted examining authority in regard to his qualifications to act as Inspector of Nuisances. He will be required to devote the whole of his time to the duties, including those of Inspector under the Petroleum Acts, the Housing and Town Planning Act, &c.

As Surveyor he will have charge of the whole of the Council's undertakings, including the Waterworks, but excepting the Pavilion and Recreation Ground.

Applications, on foolscap paper, in candidate's own handwriting, stating age, previous experience, with copies of not more than three recent testimonials, endorsed "Surveyor," should reach the undersigned not later than noon on the 14th day of March, 1913.

Canvassing any Member of the Council, either directly or indirectly, will disqualify an applicant.

D. C. DAVIES,
Clerk to the Council.

Town Hall,
Llandrindod Wells
February 27, 1913. (235)

NANTYGLO AND BLAINA URBAN DISTRICT COUNCIL.

Required in the Surveyor's Office, a temporary Assistant for the Preparation of Plans, &c., for various Street Improvement Works. Candidates must be good Surveyors, quick and neat Draughtsmen, and have had experience in the Surveyor's Office of an Urban District. The appointment will be for four lunar months, but subject to one week's notice on either side. Salary £2 5s. per week. Applications, stating age and experience, with copies of recent testimonials to be delivered at the Office of the undersigned on or before Thursday, the 13th inst., endorsed "Temporary Assistant."

(Signed) W. J. DAVIES,
Surveyor.

Council Offices,
Blaina, Mon.
March 3, 1913. (239)

RURAL DISTRICT COUNCIL OF SEISDON.

SURVEYOR'S ASSISTANT.

Applications are invited for the post of Surveyor's Assistant.

Commencing salary £1 per week, rising to £1 5s.

Applicants must be good Surveyors, Levellers and Draughtsmen, and preference will be given to candidates having a knowledge of Building Construction.

Applications, stating age, experience and qualifications, with copies of three testimonials, to be sent to

WM. CANNAN,
Surveyor's Office,
Wombourne,
Near Wolverhampton,

not later than March 19th next; and from whom further particulars may be had on application.

(237)

CHESHAM URBAN DISTRICT COUNCIL.

TEMPORARY SURVEYOR'S ASSISTANT.

A temporary Assistant is required in the Office of the Engineer and Surveyor to the Chesham Urban District Council.

Candidates must be good draughtsmen, and capable of levelling and surveying. Salary £2 per week.

Applications to be sent to me, accompanied by copies only of three recent testimonials, not later than Saturday, March 15th, 1913.

PERCY C DORMER.
Engineer and Surveyor.

Council Offices,
Chesham.
Bucks. (246)

WANTED, a smart young man as District Road Foreman in large town, North of England, with experience in repairing tar and dry macadam roads, paving, &c. Commencing wage £2 5s. per week.

Applications, in candidate's handwriting, stating age, training and qualifications, with copies of three recent testimonials, to be sent not later than Monday, 24th March, 1913, to Box 1,224, office of The Surveyor, 24 Bride-lane, Fleet-street, London, E.C.

APPOINTMENTS WANTED.

TOWN PLANNING OR SPECIAL MUNICIPAL SURVEYS.—Practical Surveyor, with long and varied experience of special municipal surveys for many local authorities, is prepared to assist Borough Engineers with Town Planning Schemes, &c. Address: M., *c/o* The Surveyor, 24 Bride-lane, Fleet-street, E.C.

(Continued on p. xxii.*)*

BUILDING LAND WANTED.

WANTED, in Finchley, Golder's Green or Hendon District, small plot, leasehold, for erection of Private Residence; frontage about 35 ft.—Adrien D. Leroy, A.R.I.B.A., 21 Gore-road, S. Hackney, N.E. (244)

TENDERS WANTED.

HUNTS COUNTY COUNCIL.

MAIN ROADS.

1913—14.

Tenders are required for the supply of Granite, Slag and Tar-macadam for the Year ending March 31st, 1914.

Form of Tender and Conditions of Contract may be obtained on application to the undersigned, to whom Tenders are to be delivered not later than Saturday, the 15th of March, 1913.

The Council do not bind themselves to accept the lowest or any Tender.

HERBERT LEETE,
County Surveyor.

County Surveyor's Office,
High-street,
Huntingdon.
March 4, 1913. (245)

GAINSBOROUGH URBAN DISTRICT COUNCIL.

ANNUAL CONTRACTS, 1913-4.

The Urban District Council are prepared to receive Tenders for the Supply and Delivery of the undermentioned Materials, as may from time to time be ordered, during the year ending 31st March, 1914:—

1. Broken Granite or Whinstone Macadam.
2. Granite or Whinstone Setts.
3. Broken and Block Slag, Slag Chippings and Dust.
4. York Setts, Kerbs, Channels and Flags.
5. Concrete Flags.
6. Stoneware and Earthenware Pipes, Gullies, &c.
7. Cast-iron Pipes.
8. Tar-macadam.
9. Pitch and Creosote Oil.
10. Portland Cement.

Specification and Forms of Tender may be obtained by written application, addressed to the undersigned.

Sealed Tenders, endorsed "Tender for ——," accompanied by Samples of the Materials to be supplied (except Nos. 4, 7, 8, 9, 10), to be delivered at the Office of Mr. Decimus M. Robbs, Clerk to the Council, 6 Lord-street, Gainsborough, not later than Wednesday, 19th March next.

The Council do not bind themselves to accept the lowest or any Tender.

SAM. W. PARKER.
Engineer and Surveyor.

Council Offices,
Gainsborough.
February 24, 1913.

COUNTY BOROUGH OF STOKE-ON-TRENT.

BURSLEM STORM-WATER DRAINAGE SCHEME.

TENDERS FOR MATERIALS.

The Corporation invite Tenders for the Supply and Delivery of Materials required in connection with the above works as under:—

Contract No. 2. For the supply of about 440 tons of Portland Cement.

Contract No. 4. For the supply of about 6,200 yds. of Stoneware Pipes, 6-in. to 18-in. diameter.

Contract No. 5. For the supply of 18 tons of Cast-iron Pipes.

Contract No. 7. For the supply of Timber.

Conditions of Contract, Specification and Forms of Tender may be obtained on application to Mr. A. Burton, Assoc.M.Inst.C.E., F.S.I., Borough Surveyor, Town Hall, Stoke-on-Trent.

Sealed Tenders, endorsed "Burslem Storm-Water Drainage, Contract No. ——," to be sent to the Borough Surveyor not later than 12 noon on Wednesday, the 12th day of March, 1913.

The successful Contractors will be required to conform to the Council's Regulations as to the payment of standard rate of wages.

The Corporation do not bind themselves to accept the lowest or any Tenders, and reserve to themselves the right to divide any Contract.

E. B. SHARPLEY,
Town Clerk.

February 25, 1913.

CITY OF NOTTINGHAM.

TO CONTRACTORS.

The Works and Ways Committee are prepared to receive Tenders for the Construction of a Sewer from the junction of North-gate and Radford-road to the junction of Marshall-street and Mansfield-street, Sherwood, together with all appurtenant Works.

The Contract will consist chiefly of—

850 yards lin. of Circular Brick and Concrete Sewer, 4′ 6″ internal diam. ... ... (in tunnel)
630 yards lin. ditto ditto ditto (in open cutting)
766 yards lin. ditto ditto 4′ diam. (in open cutting)
215 yards lin. ditto ditto 3′ 6″ diam. (in open cutting)
with Manholes, Junction Chambers, Storm Overflows, &c.

Drawings may be seen, and Specification, Bill of Quantities and Form of Tender obtained, on applying to Mr. Arthur Brown, M.Inst.C.E., City Engineer, Guildhall, Nottingham, on payment of a deposit of Two Guineas, which will be returned on receipt of a *bonâ-fide* Tender and the copy of the Specification.

Sealed Tenders, endorsed "Sherwood Outfall Sewer," are to be delivered to the undersigned not later than 12 o'clock (noon) on Friday, 14th March, 1913.

The lowest or any Tender will not necessarily be accepted, and Tenders will only be accepted from persons who conform to the conditions of the Contract as regards paying the local standard rate of wages, &c., and to the working rules of the Nottingham district.

(By order)

W. J. BOARD,
Town Clerk.

Guildhall, Nottingham.
February 26, 1913.

The Surveyor

And Municipal and County Engineer.

Vol. XLIII. MARCH 14, 1913. No. 1,104.

Minutes of Proceedings.

The Story of the King's Highway.*

There is a ring about the sub-title of this book which would lead the ordinary reader who is not familiar with the aims and methods of the authors to expect a romantic and picturesque account of the many incidents, both legendary and historical, which have as their setting the great highways of the country. To approach the latest work of Mr. and Mrs. Sidney Webb with any such expectation, however, would be to court complete disappointment. True, the story which is told is full of romance, but only of that kind which appeals to the serious student of our institutions. A narrative which (to use the words of the preface) "begins with the war chariot of Boadicea, and is brought down to the motor-omnibus of to-day," cannot fail to be of interest, and a little reflection is sufficient to recall to the mind of the reader its supreme importance. The development of the civilisation of any community is dependent in a peculiar degree upon the creation and maintenance of adequate means of communication; it is not surprising, therefore, that Mr. and Mrs. Webb, in undertaking a systematic study of English local government (of which the present volume is the third to be published in book form), speedily recognised that the evolution of highway administration formed in itself a not unimportant part of their subject. The subject is treated in historical sequence, and the notes and references to authorities which form an appendix to each chapter afford convincing proof, if such were required, that the authors in writing this book have conscientiously pursued their well-known ideal of thoroughness and accuracy.

Prior to the fifteenth century practically nothing is known as to the maintenance of roads in this country, and the whole of this period is rapidly surveyed in an introductory chapter. The earliest highways in England of which there is any sign are the ancient trackways which were used by the British inhabitants.

"So persistent and unyielding is popular usage, and so little thought has there ever been of changing the course of a public thoroughfare, that we may well imagine these ancient hollow-ways and ridge-ways, from Cornwall to Northumberland, to survive in many a sunken lane or moorland track."

But nothing is known of the management of these prehistoric tracks. The great roads which were constructed by the Roman invaders are more certainly visible to-day; but these were military in character, and are probably not strictly relevant to the history of our highway administration. From the earliest historic times road maintenance was a local obligation, having been originally imposed upon each manor. This duty of maintenance, however, consisted in little else than the due preservation of the public right of passage, the science of road engineering not yet having been established. In 1555 there was passed an Act which formed for nearly three hundred years the basis of a new organisation of road maintenance. Under this statute the obligation of maintenance was cast upon "the inhabitants of the parish," who figure so frequently as parties in the reported cases on the subject. The office of surveyor of highways was gratuitous, thus forming an almost exact precedent for some modern appointments! These, too, were the early days of "direct labour," inasmuch as every householder, cottager, and labourer able to labour, and being no hired servant by the year, was either to go himself to work or to send one sufficient labourer in his stead. The story of the transition from a service to be wholly rendered in kind to a mixed system of statute labour and money payments, and from this to a compulsory highway rate, is told by Mr. and Mrs. Webb in a most lucid and instructive way. The next chapter in the story deals with the development of the parochial system up to the year 1835, when the well-known Highway Act was passed. The contemporary criticisms of statute labour at the close of the eighteenth century are full of instruction. For example—

"The days set aside for the performance of the statute labour are, by long-established custom, considered as allotted to play and merriment, and the man who can continue to do the least work with his master's cattle thinks he does him a kindness."

And again—

"When a farmer sends his cart to perform statute duty, it seldom carries more than half a load, and the servants practise every manœuvre to put off time and do as little as possible."

It will thus be seen that even in those days the lot of the surveyor was no enviable one. The duty of the inhabitants of the parish in regard to highway maintenance has been referred to. This duty was enforced by proceedings, which were criminal in form, commenced by preferring an indictment against the parish as a whole; but this procedure very rarely succeeded in attaining the real object—namely, the mending and repair of the roads.

"A parish was not legally required to raise the public right of way from one grade to another, a footway to a bridleway or a bridleway to a carriway. But it was just this transformation of narrow ways into broad, and especially of mere beaten tracks into artificially prepared road surfaces that the circumstances required. What the law tacitly assumed was the maintenance of some imaginary *status quo*. What was being demanded was virtually a new service—a service as different from that of keeping open a free passage as a modern railway is from a country lane."

This demand for an improved form of highway arose from the increase in traffic which took place

* "English Local Government: The Story of the King's Highway," by Sidney and Beatrice Webb. Price 7s. 6d. nett. Longmans, Green & Co.

in the sixteenth, seventeenth, and eighteenth centuries, together with the gradual introduction of wheeled vehicles. Until the end of the seventeenth century travellers usually went on horseback.

"It was in this way that John Hampden journeyed up and down England to stir up the freeholders to revolt; it was in this way that Samuel Wesley took all England for his parish; it was in this way that John Watt moved from Glasgow to London to learn mathematical instrument making. . . ." &c.

The advent of the carriage and cart might have been expected to lead to a new principle in regard to the responsibility for road maintenance, for, in the words of Lord Macaulay, "to demand that a route connecting two great towns which have a large and thriving trade with each other should be maintained at the cost of the rural population between them is obviously unjust. The parochial principle, however, continued to form the basis of the highway system, any relief to the rural parishes taking the form of traffic regulation as regards the construction of vehicles and the limitation of loads! The next phase was the introduction of the toll system, designed to secure "that every person should contribute to the repair of roads in proportion to the use they make of or the convenience which they derive from them." This led to the creation of the Turnpike Trusts, which were established by thousands of separate Acts of Parliament from 1706 onwards. These Acts did not exempt the parishes from their old duty of maintenance, but they were designed, as regards the particular piece of road dealt with, to provide additional revenue, and to give additional powers to the reinforcement of the general law. The Trusts persisted for upwards of a century, and although the turnpike system may be defended as a political expedient, it did not generally succeed in producing the desired result. The opportunity presented by this state of affairs was seized by Telford and Macadam, who, under Government patronage, were enabled to effect something like a revolution in constructional methods. They did not, however, succeed in saving the Trust system.

"What this generation of road reformers accomplished was something quite different. Almost against their will they found themselves promoting the evolution of a new system of highway administration, based, not on tolls, but exclusively on compulsorily levied rates; governed, not by a separate *ad hoc* body, but by the general local governing authority of the geographical district in which the roads were situated; administered, not by self-selected groups of local dignitaries, but by democratically elected representatives of the whole body of citizens; acting, not through the unpaid amateur doing his term of service as surveyor, but through permanent professional salaried officials; and getting the actual manual labour performed, not by any gratuitous common service, but by a permanently employed staff of wage earners. This evolution took nearly the whole nineteenth century to come about."

A chapter on the New Users of the Roads in the Twentieth Century, which contains some outspoken criticism of the Local Government Board, completes a book which is of absorbing interest, and which we cordially recommend every highway surveyor to read.

* * *

Atmospheric Pollution.

The greater attention which has been given in recent years to the subject of atmospheric pollution, as regards both its causes and prevention, is an excellent sign. The evil effects of the enormous fouling of the air of our great cities which takes place from day to day may be seen in a lowering of the standard of the public health, and in the gradual destruction of many of our most notable and beautiful buildings. It may be within the recollection of our readers that an International Smoke Abatement Conference was held in London last year, when a strong committee was formed for the purpose of drawing up the details of a standard soot and dust measuring apparatus and the methods of its use. This committee got to work without delay, and carefully considered the comparative merits of nine methods of measurement which were submitted to them. As a result of this consideration it was decided to adopt the method of collecting the rainfall, obtaining the residue by evaporation, and carefully weighing it. This method renders it possible to ascertain with considerable accuracy the amount of polluting matter which falls on a given area both in rain and during dry weather. The committee have, in accordance with the terms of their reference, drawn up a standard specification for a collector such as that which they recommend, together with standard instructions for its use. A sub-committee are at present dealing with the framing of a standard method of examining the deposit.

The preliminary observations which—as stated in the special article by Mr. John B. C. Kershaw in the present issue—have been made by means of the proposed collector reveal most remarkable results. Three stations were established in London (namely, at Buckingham Gate, Horseferry-road, and Old-street), and one at Sutton, Surrey. The amount of deposit, expressed in tons per square mile per annum, was 500, 420 and 650 respectively at the London stations, and 195 at Sutton. The committee are now in communication with the principal local authorities in the United Kingdom with a view to obtaining their co-operation in an organised attempt to collect reliable data by means of the standard apparatus and methods of examination as approved by the committee. The response has already been most encouraging, many of the largest towns having intimated their willingness to fall in with the proposals of the committee, while others have the matter under consideration. The results of the observations in each city or district will be passed on regularly to the Central Committee, and an annual report will be published containing full statistics, together with the conclusions at which the committee are enabled to arrive as to the practical progress of the smoke abatement movement in those places supplying the required information.

It is true that observations as to atmospheric pollution have been made hitherto in some places, but having regard to the fact that there has been great diversity of method, these have been of no value for the purpose of compiling comparative statistics. It is in this respect that the records which are to be collected under the auspices of the committee will be of peculiar value. The figures that have been obtained in the few tests already made show that the fall of soot and dust may amount to an astonishing total when worked out in tons per square mile. For example, a simple calculation, based on the observations mentioned above, shows that the amount of soot and other polluting matter which is deposited annually over the Greater London area approaches the gigantic total of 76,000 tons. It is certain that no considerable improvement will take place until reliable data are obtained showing the magnitude and extent of the evil which calls for mitigation. It is therefore to be hoped that local authorities will do all in their power to assist the Central Committee in their efforts towards securing a purer and more wholesome atmosphere.

* * *

Asphalt Paving in Stretford.

The experience of surveyors in the London area has enabled them to furnish many useful comparisons between asphalt paving and other forms of paving which it has superseded or with which it competes, and a large proportion of the records of such comparisons in this country relate to the London area. While, however, the range of traffic conditions in Greater London is very large, the kinds of paving with which asphalt can be compared in that area are limited in number, the soils

are mainly of two classes—London clay and eocene, or valley gravels—and the climate and rainfall conditions are nearly the same throughout the area, and differ much from those of the west and north. Several different factors come into play in Lancashire, the climate of that county presenting marked contrasts with that of the Thames estuary; while the classes of paving with which asphalt competes in Lancashire towns include several which are not in ordinary use in London. In Stretford asphalt has, during the past eight years, been adopted to an extent which may be measured by the total expenditure which, including some £18,000 in the estimates for the current year, amounts to over £75,000. In a useful paper which he read on the first of this month, at a North-Western District meeting of the Institution of Municipal and County Engineers, Mr. E. Worrall described the nature of the asphalt paving put down in Stretford and the methods pursued, and discussed the advantages and some difficulties attending its adoption. We regret that the heavy demands on our space prevent us from reproducing the whole of Mr. Worrall's paper; but the extracts which we give on another page include nearly all the technical matter, and the explanatory passages relating to local conditions. The only point on which some further information seems desirable is with regard to the kind of foundations provided for the other kinds of paving, the defects of which were possibly due in part to faulty foundations. Mr. Worrall is to be congratulated on the successful accomplishment of good work as well as upon his lucid presentment of the results obtained and the conditions under which the changes were effected.

* * *

Tramway Accidents. The payment of compensation in cases of accident to passengers is a serious matter for every tramway undertaking of any magnitude, and it is therefore satisfactory that the Court of Appeal have recently reiterated the principle that the only duty of tramway undertakers in regard to safeguarding their passengers is to use all practicable care and skill to ensure their safety. In the case of *Newberry* v. *The Bristol Tramways and Carriage Company* it was stated that the plaintiff was travelling on the top of a car on the defendants' lines when the wheel at the end of the trolley-arm came off the live wire, with the result that the trolley-arm became entangled with the overhead gear and was lifted from the standard, falling on to the roof of the car and injuring the plaintiff. It was proved on behalf of the defendant company that the car was in perfect order and that the system in use was the best and most widely adopted overhead system. On the other hand, it was alleged that the Company had elected to employ a detachable arm with a full knowledge of the risk they were running in so doing, and without taking sufficient precautions to secure the safety of the passengers. The jury took the latter view and awarded the plaintiff £150 by way of damages, but they were unable to suggest, in reply to a question by the learned judge, any precautions which might have been taken by the company by which the accident might have been avoided. The principle as laid down in the summing up was as follows: "The plaintiff can only be entitled to recover if there is negligence on the part of the defendants in carrying him as a passenger. The tramway company are not insurers. They are bound to take every reasonable precaution to ensure the safety of the passengers, not as insurers, but every reasonable care that can be taken." In the Court of Appeal, the Master of the Rolls, in allowing the appeal of the Company, said: "It is sufficient that the company should adopt the best known apparatus, kept in perfect order, and worked without negligence by the men employed." This may be taken as an authoritive statement, and is worthy of note by all tramway authorities, both municipal and private.

The Bolton Improvement Scheme. Mr. L. Morgan, borough engineer of Bolton, like the burgh surveyor of Dundee, has set himself seriously to the task of drawing up a scheme of city improvement, and there seems a probability of his meeting with the success which such efforts undoubtedly deserve. It is stated that the scheme meets with the general approval of the town council, and thus far it has been launched under what may be termed hopeful auspices. Mr. Morgan would appear wisely to have adopted the line of least resistance in so far as he has so arranged that the construction of the new roads contemplated by his scheme would involve the acquirement and destruction of very little existing property. The thoroughfares are all, or mainly so, suggested on lines traversing undeveloped land over nearly the whole of the districts affected. The object sought to be attained is the connection of the whole of the outskirts of the borough with main roads having an average width of 48 ft., which would virtually encompass the existing populous portion of the town. The idea is to link up the proposed new roads with the present main avenues of traffic to the central area of the town from all points of the compass, and at the most convenient points Though the scheme is only tentative, great pains have been taken by its author in working out the details, with the result that Mr. Morgan has evolved a project of far-reaching improvement, which has naturally aroused much interest in Bolton and the neighbourhood. Following the customary procedure in similar circumstances, the landowners affected are to be communicated with and their views ascertained, and it is to be hoped that the scheme will successfully weather this not unperilous preliminary stage, and eventually become an accomplished fact. Anyway, it is not in the mere conventional sense, but with a sincere appreciation of the professional spirit by which he has manifestly been guided, that we congratulate Mr. Morgan upon his praiseworthy and ambitious attempt at town development and improvement.

* * *

Chicago Sewage Disposal. An important decision has recently been issued by the Secretary of War for the United States in connection with diversion of water from Lake Michigan for the purpose of diluting the sewage of Chicago in the drainage canal. At present the authorised volume is 4,167 cub. ft. per second, but the sanitary authority of the city has made application for permission to increase this to 10,000 cub. ft. per second, and supported its application by a special report upon the subject. The application was opposed by twenty-three cities and six States, by the navigation interests of the Great Lakes, the Canadian Government and private interests. The Secretary of War states that he has reached the conclusion that the diversion from Lake Michigan of the extra volume of water now applied for would substantially interfere with the navigable capacity of the navigable waters in the Great Lakes and their connecting rivers, and that every drop of water taken out of the lake at Chicago tends to nullify the costly improvements on the harbours and other matters as well as to inflict even greater loss upon the navigation interests. He also observes that the International Waterways Treaty of 1909 gives Canada certain right which must be respected, and his rejection of the application naturally has given great satisfaction in Canada, and doubtless also to the American cities outside Chicago which are situated on the Great Lakes.

It is also stated in the decision that, on the facts presented, no case of local permanent necessity is made out, so that the sanitary authority of Chicago will presumably now proceed to carry out the various works which have been projected for the treatment of the sewage before it is discharged into the drainage canal.

Atmospheric Pollution: A Standard Method of Measuring its Amount and Character.

By JOHN B. C. KERSHAW, Member of the London Committee for the Investigation of Atmospheric Pollution.

One of the most important resolutions passed at the International Smoke Abatement Exhibition and Conference held in London in March, 1912, was that relating to the framing of a standard method of catching and measuring the more commonly occurring impurities of the atmosphere. This resolution was worded as follows:—

"That in the view of this Conference it is desirable that immediate steps should be taken to decide upon and secure the general adoption of a standard method for the measurement of atmospheric pollution by smoke and the other products of combustion and dust, in order that the data now being collected may possess a comparative value, and that a committee be appointed to draw up details of a standard soot and dust measuring apparatus and methods of its use."

"That the committee do consist of Dr. H. A. Des Voeux, M.D. (Hon. Treasurer, Coal Smoke Abatement Society), Professor J. B. Cohen, B.SC., PH.D., F.R.S. (Leeds University), Bailie W. Smith (Convener of the Air Purification Sub-Committee of the Glasgow Corporation), Dr. Hawksley (Assistant Medical Officer of Health, Liverpool), Mr. J. B. C. Kershaw, F.I.C. (Hamburg Smoke Abatement Society), Dr. John S. Owens, M.D., A.M.I.C.E. (Coal Smoke Abatement Society), Dr. W. N. Shaw, M.A., D.SC., LL.D., F.R.S. (Director, Meteorological Office), and Dr. S. A. Vasey (the *Lancet*), with power to add to its number. Subsequently added:—Dr. R. Lessing, PH.D., F.C.S., Mr. E. D. Simon (Smoke Abatement League of Great Britain), and Mr. J. G. Clark."

"That the conclusions and recommendations of such committee be reported to the delegates forming this Conference, and to all municipal authorities in the United Kingdom."

The committee since its appointment has held three meetings in London, and has given careful consideration to the various methods that have been suggested or tried for the collection and estimation of atmospheric impurity. The following is a list of the various methods which received consideration, with some notes upon the places where they have been tried and upon their relative advantages and disadvantages.

It was decided that the method selected as best must fulfil the following conditions:—

(1) It should measure the actual amount of suspended matter in the air, not the amount relative to other places—*i.e.*, it should give the pollution in, say, grammes per cubic metre.

(2) The foreign matter or impurity should be collected in such a way as to permit of analysis.

(3) It should be as simple as possible, provided conditions (1) and (2) are fulfilled.

METHODS THAT HAVE BEEN SUGGESTED OR TRIED.

(1) *Filtration of a Measured Volume of Air through a Cotton-wool or Collodion-wool Filter, and Examination of the Deposit.*—This method has been used by Russell in London, and by Hahn in Germany, and can be made to give good results. With care, condition (1) can be fulfilled, and when collodion wool is used it can be made to satisfy condition (2). It requires, however, costly apparatus and considerable technical skill; and it possesses inherent defects if a colour scale be employed as measure or gauge of the amount of deposit.

(2) *Collection of Rainfall; Evaporation and Weighing of Residue.*—This method was used in the investigations started by Dr. Des Voeux and the *Lancet* in 1910, in order to obtain the soot-fall of London. It was also used by Prof. Cohen in Leeds. The method does not, strictly speaking, give the amount of air-pollution, but the amount which falls on a given area (*a*) in rain, snow, &c., (*b*) during dry weather. (*a*) and (*b*) are not separated. The apparatus used for collection of the impurities may be very simple, and the technical work can be done at any laboratory.

(3) *Aitken's Dust-counter.*—This was devised by John Aitken for counting the number of dust particles in the air. The method and apparatus satisfy condition (1), but not (2).

(4) *Exposure of Glass Plates to the Air for a Specified Time, followed by Washing in Water and Measurement of the Adherent Deposit that remains by Comparison with Standard Colours.*—This method has been used by Prof. Cohen in Leeds for catching the matter which will adhere to a glass plate—*e.g.*, tarry soot. It would seem that the thickness and colour of the deposit must be affected by the amount of tar present in the smoke of the city. The method aims only at comparative results, and does not fulfil either condition (1) or (2).

(5) *Exposure of Glass Plates Coated with a Drying Oil to a Stream of Air or to the Atmosphere.*—(*a*) Either for a fixed time, followed by measurement of the opacity by comparison with a calibrated scale; or (*b*) for such time as will produce a fixed opacity, and comparison of the time required with a calibrated time scale.

This method has been used by Cohen in Leeds, and by Liefmann in Hamburg, and it might possibly be made to fulfil conditions (1) and (2). It requires, however, elaborate apparatus, and some technical skill, and it is not suitable for application on a large scale, and under the conditions which will obtain for the committee's observations.

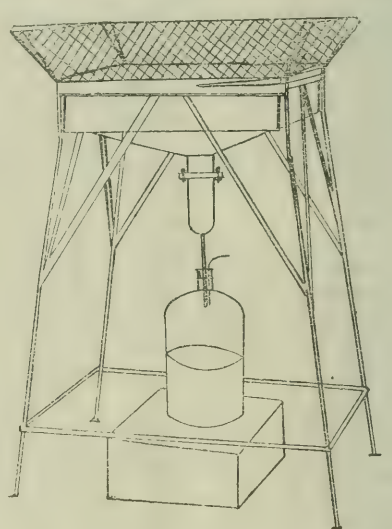


Fig. 1. Soot Gauge used in "Lancet" Investigations.

(6) *The Air is Drawn at a Measured Rate through a Filter-paper, the Degree of Blackness produced in a given time is then Measured.*—This method has been used by Rübner in Germany, and by Bailie Smith in Glasgow. It gives results which depend upon the colour of the matter caught, as well as upon its amount. Condition (2), however, would be fulfilled.

(7) *Measurement of the Transparency of a Column of Air of given length when Illuminated with a Standard Light.*—A modified form of this method has been used for observations of the smoke from chimneys in many towns. The method could probably be arranged to fulfil condition (1) by measuring the transparency of air holding in suspension known amounts of matter, but it would not fulfil condition (2).

(8) *The Rainfall is Caught, and its Transparency is Compared with a Standard Scale of Values made by adding Definite Quantities of Soot to Distilled Water.*—This method is open to the same objections as the second method; neither does it fulfil condition (2). The results would depend also on the nature of the impurity, as well as on its quantity.

(9) *Dust-boxes are Exposed, having a Collection Surface of 1 square foot.*—These boxes have been used by Chief Inspector Fyfe in Glasgow and Aberdeen, and are simply a less accurate means of operating the second method.

As already stated, the respective advantages and

disadvantages of the above nine methods were fully considered by the committee before coming to a decision, and it was finally decided to adopt method (2)—namely, that used by Prof. Cohen in Leeds, and by Dr. Des Voeux and the *Lancet* in London, for the investigations upon the soot-fall of these two cities in the winter of 1910-11.

A specification for a standard form of apparatus and rules for the collection and examination of the deposit has also been drawn up by the committee. The following is a copy of the specification, the details of which will be clearly understood on reference to the Figs. 1, 2, 3 and 4:—

"The instrument consists of a circular open-topped gauge vessel, supported in a galvanised iron frame. This frame is provided with a shelf for carrying a bottle to contain the rain-water which enters the gauge. The gauge vessel is constructed of cast iron, enamelled with a vitreous insoluble enamel. It is of importance that the superficial area of the top of the vessel, included inside the sharp edge, should be constant in all vessels, thus assuring the same catchment area in each. To provide for this, the top edge of the vessel must be machined before enamelling."

Fig. 1 shows one of the soot-gauges used for the *Lancet* investigations in London in 1910, with the

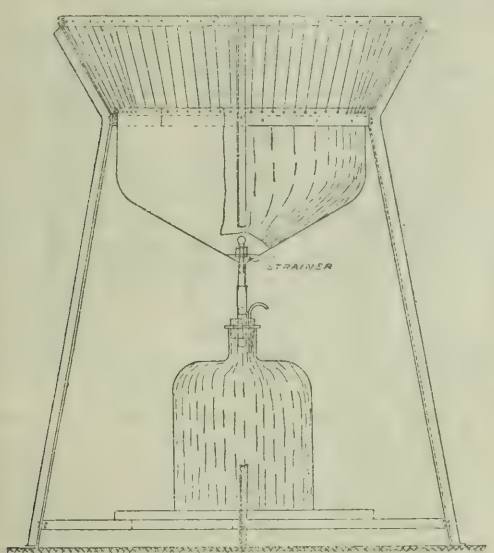


Fig. 2. Standard Soot Gauge.

gauge vessel and bottle in position. Fig. 2 is a sectional elevation of the new standard gauge. Fig. 3 shows the gauge vessel alone, removed from its frame; and Fig. 4 is a plan of the gauge. A well-fitted glass strainer is provided as shown.

The stand is formed of four angle-iron legs riveted at the top to two iron rings, the lower of which is to be of suitable size to receive the gauge and support it. To the upper ring are attached galvanised iron wires of 14 S.W.G. These are fixed at their lower ends to a ring of $\frac{1}{16}$-in. galvanised iron, riveted between the legs and the heavier ring which supports the gauge vessel. A cage is thus formed, surrounding the gauge vessel, but open at the top, which prevents bird-droppings being mixed with the deposit in the gauge. A shelf of 1-in pine is provided at the bottom, the boards being screwed to 1½-in. by 3-in. battens, which fit inside the iron supports riveted to the legs. All metal, except the gauge vessel, is galvanised iron.

Each instrument is provided with four bottles of stock pattern and a capacity of about 2 gallons each, and having rubber bungs, one of which is fitted with holes for the glass tubes.

As regards the method of using this standard soot-gauge, the following preliminary instructions have been drawn up and circulated among the municipal and other local authorities in the United Kingdom:—

(1) All gauges are to be placed on the ground level, in an open space free from abnormal dust.
(2) The bottles containing the water and deposit are to be removed on the last day of each month, and thoroughly cleaned empty bottles are to be substituted.
(3) Before removing the bottles for analysis the gauge vessel is to be washed down with some of the water already collected, a brush of standard pattern being used to remove any adherent matter.
(4) A chemical analysis of the water and deposit is to be made by a standard method, particular attention being given to obtaining the relation between the quantity of tarry oils present and the amount of free carbon.

The examination of the solid matter contained in the bottles may be confined simply to the determination of the total solids (which can be separated either

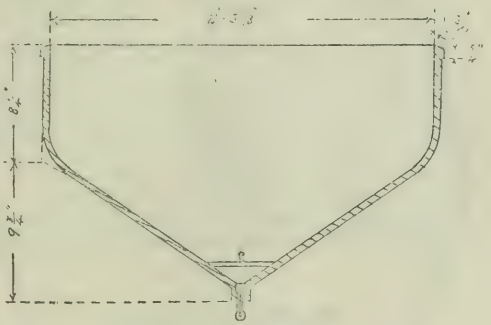


Fig. 3. Section of Standard Soot Gauge.

by evaporation or by filtration), or it may cover detailed separation of the soluble and insoluble portions of the impurities collected from the atmosphere by the rainfall. A sub-committee is at present dealing with the framing of a standard method of examination. This will be used for the observations which are to be carried out under the auspices of the committee.

For the *Lancet* observations, carried out in London in 1910-11, at three stations in the London area, the following constituents were determined: Total solids, insoluble deposit, soluble deposit, soluble volatile solids, soluble fixed solids, sulphates, ammonia, chlorides. The table presented below summarises the results obtained.

Observation station.	Litres of rain.	Total deposit.	Insoluble matter.	Soluble matter.						Tons of total deposit per sq. mile.
				Total.	Fixed.	Volatile.	Sulphate SO_3.	Ammonia NH_3.	Chlorides cc.	
	1	2	3	4	5	6	7	8	9	10
A. Buckingham-gate, S.W.	201·1	71·98	46·33	25·65	12·33	13·31	6·01	5·01	5·69	500
B. Horseferry-road, S.W.	192·0	60·34	33·49	26·85	14·52	12·32	5·94	5·13	4·09	420
C. Old-street, E.C.	192·0	92·81	60·92	31·89	12·65	19·24	10·04	7·54	4·63	650
D. Sutton in Surrey	210·5	27·89	8·36	19·53	10·80	8·72	·89	·34	2·16	195

All results in the above table, with the exception of those in columns 1 and 10, represent the weight in grammes of the deposit collected in the 4-ft. square funnel during 12 months. The detailed figures are given in the issue of the *Lancet* for January 6th, 1912.

The *Lancet* inquiry was confined, as already stated, to observations made at three London stations and to one in the suburban districts of London (at Sutton, Surrey), and its value for comparative purposes was therefore less than would have been the case if

similar results had been available from either cities and towns. The committee appointed at the International Smoke Abatement Conference of March, 1912, therefore decided to communicate with all the principal local authorities in the United Kingdom, and to ask for their co-operation in an organised attempt to collect reliable data, by means of the apparatus and methods of examination approved by the committee for this purpose. It was believed that many of these authorities would welcome the introduction of a standard method of conducting such observations, and that the results would prove of much greater practical value than any number of independent inquiries, based on the use of different apparatus and of different methods of observation. A circular letter sent out by the committee in January, 1913, proved that this opinion was correct, and it is now practically certain that observations will commence in the following important cities of the United Kingdom on or before October 1st of the present year, using the standard apparatus and method recommended by the committee: London, Liverpool, Manchester, Glasgow, Birmingham, Newcastle, Keithly, Bradford, Hull, Leicester, Malvern and Plymouth, with others that are now considering the proposal.

The results of the observations in each city or district will be passed on regularly to the London Committee. An annual report will be published containing all the figures and the conclusions which

Fig. 4. Plan of Standard Soot Gauge.

the committee arrives at as to the practical progress of the smoke abatement movement in the towns and cities which are carrying out these observations.

SOME PRELIMINARY RESULTS.

The observations that have been carried out so far upon the soot and dust fall in different towns and cities have been made under various conditions and with different types of apparatus. The results therefore are of no use for comparative purposes, and until the standard apparatus and method recommended by the London Committee has been in use for some months it will not be possible to say which of the English towns making these observations has the cleanest atmosphere, or which city is making the greatest strides in the removal of air-pollution. But the figures that have been obtained in the isolated and independent tests already made show that the soot and dust fall of the larger towns and cities of this country amounts to an astounding figure when worked out in tons per square mile, and that the subject is quite worth the most careful study and attention of all interested in the preservation of the public health and of city architecture.

As shown in Table I., the total solid matter falling in the City of London area, either as smuts and dust or as ingredients of the rain, amounted to between 420 and 650 tons per square mile per annum. Taking the total London area as one of 117 square miles, the soot and dust fall of this densely-populated district of our country amounts to the enormous total of between 50,000 and 76,000 tons per annum. Even at Sutton, in Surrey, which is quite on the borders of the London area, and might be regarded as possessing a clean atmosphere, the total deposit as revealed by the soot and dust gauge method of observation amounted to 195 tons per square mile per annum.

The observations made in Leeds by Cohen and Ruston in 1909-10 were carried out by three distinct methods.

In one set of observations the rainfall was collected and the soluble and insoluble impurities were separated and examined. This, of course, is the method that has been selected by the London Committee for its investigations, and the only improvement they have made in Cohen's apparatus is that of increased size, the gauge or collector having an area of 4 sq. ft. instead of only $\frac{3}{4}$ sq. ft.

In another set of observations snow was collected after a heavy downfall, and the amount of solid impurities it contained was estimated. The third set of observations were made by the sedimentation method, clean glass plates 1 ft. square being exposed horizontally, and the sticky, tarry matter which adhered to their surface being weighed.

Cohen and Ruston's figures for the soot and dust fall of Leeds and the surrounding suburbs varied from 25 to 539 tons per square mile per annum, the lowest figure being that of Roundhay (a country district to the south-west of the city), and the highest figure that of 539 tons for Leeds Forge, in the heart of the manufacturing district of the city.

These figures, it will be noted, are lower than the London ones, although Leeds is considered the more smoky city. Quite possibly the different methods and apparatus may explain some portion of the difference, the larger gauge used in London being the more likely to give the higher results.

During the winter of 1910-11, Chief Inspector Fyfe, of the Glasgow City Sanitary Department, carried out a series of observations upon the soot and dust fall of Glasgow and other Scotch towns, by means of "atmospheric dust-boxes." These were shallow wooden boxes, 1 ft. square in superficial area, and 1 ft. in depth. They were exposed on the roofs of buildings in suitable situations, at a height of 30 ft. to 35 ft. above the ground. After two months' exposure the boxes were collected, and the contents were carefully weighed and analysed by the Glasgow Corporation chemist. The figures obtained by this very simple and crude method varied from 2·27 cwts. per acre per annum at Bo'ness, on the Firth of Forth, to 19·6 cwts. per acre at Falkirk, equivalent to 72 tons and 627 tons per square mile respectively.

The most astonishing feature of these preliminary results is the comparatively high dust and soot fall in country places like Roundhay in Yorkshire, Bo'ness in Fifeshire, and Sutton in Surrey, and it will be of great interest to see whether the more extended observations of the Committee for the Investigation of Atmospheric Pollution confirms these earlier experimental results.

Winnipeg City Hall Competition.—Plans for a city hall at Winnipeg, to cost £600,000, have been awarded by Mr. Leonard Stokes, the London architect, to Mr. Chapman Clemoska, formerly of Preston, England, and Mr. Frank Portnall, formerly of Shanklin, Isle of Wight, who are now architects in Regina. They receive a prize of £1,000. Thirty-nine British and Canadian architects competed.

Progress of Town Planning.—Mr. Henry Vivian, presiding at a town-planning meeting at Finchley on Monday, made reference to the work of the Local Government Board in connection with better city development. He said that town-planning enthusiasts were fortunate in having the whole-hearted support of the President of the Local Government Board. During the six years Mr. Burns had been in office there had been a greater advance in public opinion on this matter than in the preceding fifty years. The Town-Planning Act was a triumph of which Mr. Burns could justly be proud.—It is understood that the Local Government Board have given authority for the preparation of two further town-planning schemes under the Housing, Town Planning, &c., Act, 1909. The schemes are authorised to be prepared by the Corporation of Scarborough and the Rural District Council of Wirral. In the case of Wirral the scheme is to apply to an area situated in the parishes of Heswall-with-Oldfield, Barnston, Gayton and Pensby, and comprising about 3,430 acres. In the case of Scarborough the scheme is to extend to an area of 40 acres in the borough.

THE INTERNATIONAL ROAD CONGRESS.

PROVISIONAL LIST OF INSPECTIONS AND EXCURSIONS.

The following is a provisional list of excursions which have been proposed in connection with the International Road Congress, and which will be submitted to the General Committee of the Congress shortly for consideration. Any suggestions for rendering them of greater interest to our foreign visitors should be sent to the general secretary, and will be carefully considered. A detailed programme, which is in course of preparation, will set out the points of general interest upon the route, and indicate the particular matters of interest to road engineers. The general secretary would be glad if those county surveyors who have not furnished him with details of the improved forms of road construction on any of the selected routes which should be referred to in the programme, and to which the attention of the visitors should be specially directed, would kindly do so as soon as possible.

GROUP 1.—EXCURSIONS DURING THE WEEK PRECEDING THE CONGRESS.

(The object of these inspections is to enable members to see, before the congress, typical road surfaces which will form subjects of discussion at the congress.)

June 20. Duration of excursion, 2 days.—London to Sidcup, Sevenoaks, Tonbridge, Maidstone, Ashford, Folkestone (stop the night). Canterbury, Rochester, Wroxham, London. (Inspect trial lengths at Sidcup, 150 miles bituminous-bound roads, and Aveling & Porter's works.) Limit of party 50. (In small motor cars.)

June 19. Duration of excursion, 3 days.—London, Wandsworth, Guildford, Petersfield, Winchester, Southampton (stay night). Southampton, Salisbury, Warminster, Bath (stay night). Bath, Marlborough, London. (Inspect trial lengths at Wandsworth, and 100 miles of various types of bituminous-bound roads.) Limit of party 50. (In small motor cars.)

June 21. Duration of excursion, 3—4 hours.—Leave Victoria Station for Sidcup by motor 'bus, at any time. Inspect typical roads through South London and the trial lengths at Sidcup. Return from Sidcup to Charing Cross by train.

GROUP 2.—EXCURSIONS DURING THE WEEK OF THE CONGRESS.

June 26. Duration of excursion, 1 day.—London, Romford, Chelmsford (lunch), reception by Mayor of Chelmsford; visit to Marconi Wireless Works (tea), Epping Forest, London. Limit of party 50. (In motor cars.)

June 28. Duration of excursion, 1 day.—London to Hampton Court, *viâ* Fulham and Wandsworth (inspection of experimental lengths), Kingston. Hampton Court Palace, National Physical Laboratory (inspection of Road Board Laboratory at the N.P.L. at Bushey). Limit of party 100. (In motor 'buses.)

June 26. Duration of excursion, 1 day.—London to Windsor by special train. Visit Windsor Castle. Tea in the grounds at the invitation of His Majesty the King. Return London 6 p.m. Limit of party, 1,000.

June 26. Duration of excursion, 1 day.—River trip. Special train from Paddington to Windsor. By launch from Windsor to Marlow and back. Lunch and tea on board. Return by train to London. Limit of party 200.

June 28. Duration of excursion, 1 day.—Visit to Letchworth Garden City, leaving London at 10.30 a.m. At Letchworth—Demonstration of gyratory traffic, lunch, afternoon drive, tea. Return to London. Limit of party 100. (By train.)

June 26. Duration of excursion, 1 day.—Visit to Berkshire. Leave London by train for Maidenhead. Motor chars-à-banc to Windsor, Ascot and Reading. Lunch town hall. Maidenhead train to London. Limit of party 50.

June 28. Duration of excursion, week-end (2 or 3 days).—London, Croydon, Purley, East Grinstead to Eastbourne. Return to London by rail. Limit of party 50. (By motor car and train.)

June 28. Duration of excursion, week-end (2 or 3 days).—London, Croydon, Epsom, Leatherhead, Dorking, Horsham to Brighton. Return to London by rail. Limit of party 50. (Motor car and train.)

GROUP 3.—EXCURSIONS DURING THE WEEK FOLLOWING THE CONGRESS.

June 30. Duration of excursion, 5 days.—London to Chester. Visit to Eaton Hall (tea on invitation of Duke of Westminster), cathedral, and other places of interest. By motor char-à-banc to Llandudno (stay night). Penmaenmawr (lunch), visit quarries. Bangor to Carnarvon, Bettwys-y-Coed, Llangollen (stay night). Oswestry to Shrewsbury. At Shrewsbury luncheon. Return to London by rail. (Inspection of 130 miles of roads.) Visit Hawarden and Rhuddlan Castles, Bangor Cathedral and Chirk Castle. Limit of party 50.

June 30. Duration of excursion, 6 days.—London by train for Liverpool (stay night). Drive round city by motor char-à-banc, train to Southport, dinner by invitation of Mayor and Corporation of Southport (stay night). Carnforth (motor), the Lakeside to Ambleside (stay night). By coach to Grasmere, Thirlmere, Keswick, rail to Penrith, coach to Pooley Bridge, steamer to Patterdale, coach to Kirkstone Pass and Ambleside (stay night). Return to London by train. (Visit to Liverpool docks and Southport tar-macadam plant. Inspection of 120 miles of roads.) Limit of party 50.

June 30. Duration of excursion, 6 days.—London to Glasgow, dinner at the invitation of the Lord Provost and city council (stay night). By motor car to Stirling, lunch by Provost and town council, Pitlochry (stay night). Braemar or Glyn Lyon and back to Pitlochry (stay night). Oban, dinner by Provost and town council (stay night). By car to Inverary, thence to Glasgow by steamer on the invitation of the Scottish Automobile Club. Morning drive in Glasgow, rail to Edinburgh. Dinner by Lord Provost and city council. Limit of party 50.

June 30.—London to Birmingham. By motor car to Wolverhampton and back (stay night). Coventry, Kenilworth, Warwick, Stratford-on-Avon, return to Birmingham (stay night). Tamworth, Leicester (stay night). Newark, Nottingham. Return to London. (Visit to Kenilworth and Warwick Castles, Shakespeare's home, Stratford-on-Avon, Fosse way. Inspection of 120 miles of roads.) Limit of party 50.

June 30. Duration of excursion, 2 days.—London to Folkestone (stay night). Canterbury (lunch and visit cathedral). Return to London. Limit of party 50. (By train.)

QUERIES AND REPLIES.

We cannot undertake to reply to any queries which are not accompanied by the writer's name and address. These are required as a guarantee of good faith, and not for publication. Sketches accompanying queries should be made separate, on white paper, in plain black ink lines. Lettering or figures should be bold and plain.

896. Glass-lined Cast-iron Pipes.—"A. E." writes: I should be glad if you could give me the names of any makers of glass-lined cast-iron pipes.

Pipes of this kind are, we believe, manufactured by Messrs. Cameron & Robertson, South Bank Ironworks, Kirkintilloch, and Messrs. Wm. Macfarlane, of Glasgow.

The Divining Rod Problem.—A society for the Elucidation of the Problem of the Divining Rod has recently been formed in Germany. The society counts among its members many men of prominence in the engineering and other professions, and represents a serious scientific effort to shed light on a much debated question.

Metropolitan Asylum Extension Scheme.—At their last meeting the managers of the Metropolitan Asylums Board gave approval to a scheme prepared by Mr. T. W. Aldwinckle for the enlargement of Tooting Bec Asylum. The architect's estimate of the cost of the full scheme is £151,500, but the estimated cost of the immediate scheme is £88,000—£15,000 for administrative purposes and £73,000 for the accommodation of patients. In July last the board bought an estate adjoining Tooting Bec Asylum to afford an opportunity of developing and extending the asylum. It is now proposed to erect four pavilions on the site, two for males, with 117 beds each, and two for females, with 188 beds each, or a total of 610 in all, leaving an additional nurses' home to form part of the final scheme. The completed scheme provides for the eventual erection of seven pavilions for patients, giving a total accommodation for 1,103 patients.

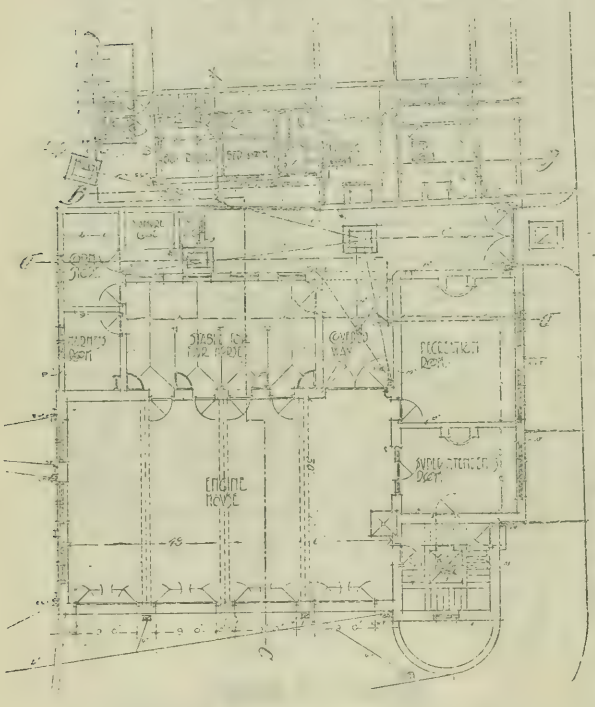
East Ham Fire Station and Firemen's Dwellings.

An application was made to the Local Government Board in July last by the Corporation of East Ham for sanction to borrow the sum of £8,628 for the erection of a fire station and firemen's dwellings at the corner of High-street South and Nelson-street. The loan was duly sanctioned, and it is hoped that the buildings will be completed and ready for use about March, 1914.

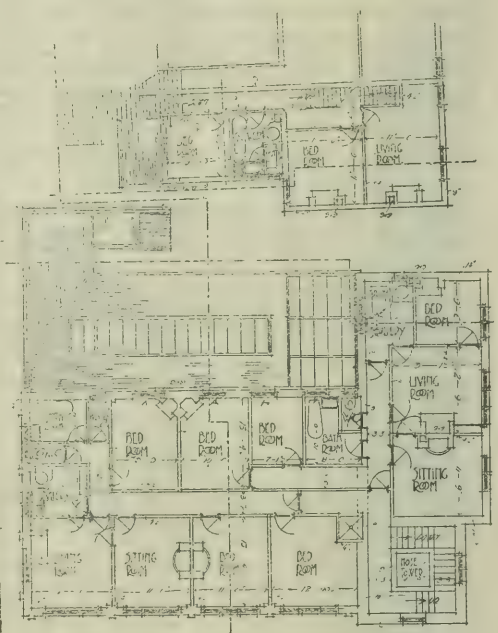
The corner site allotted to the building is a most important one, and the hose tower to the station has been placed at the extreme southern corner of the site, so as to afford as much prominence to the building as possible.

The accommodation in the fire station comprises the following:—

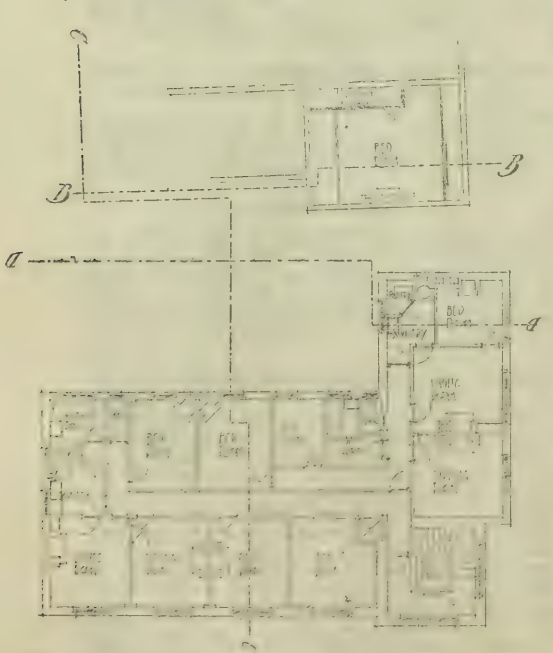
Ground Floor.—Spacious engine-house, 48 ft. by 30 ft., with superintendent's room and telephone room, and men's recreation room leading therefrom; also stables for four horses, corn store and harness room, all of which have been carefully arranged for conversion into engineer's shops, garage, &c., should the corporation decide to purchase motor engines and escapes.



Ground Plan.



First Floor Plan.



Second Floor Plan.

East Ham Fire Station and Firemen's Dwellings: Plans.

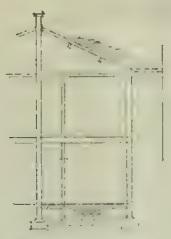
First Floor.—On this floor are the superintendent's quarters (placed at the front of the building and partly on the south side), comprising three bedrooms, sitting and living rooms, bathroom and usual offices; also the assistant superintendent's quarters at rear, and at side overlooking Nelson-street.

Second Floor.—On this floor are first coachman's quarters, comprising three bedrooms, sitting and living rooms, bath and usual offices; also second coachman's quarters, with same accommodation.

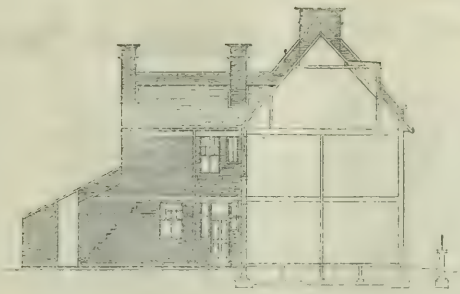
The dwellings facing Nelson-street are on the double tenement principle. On the ground floor the houses have been designed for firemen with small families. There are, however, the same number of rooms on the ground and first floors of the houses, the difference being only in the size of the rooms. The accommodation comprises three bedrooms, one living-room, scullery and bathroom combined, pantry and usual offices at the rear.

The fire station and dwellings will have terra-cotta dressings, cornices, &c., the fire station being faced with red Accrington bricks and the dwellings with red Ibstock bricks.

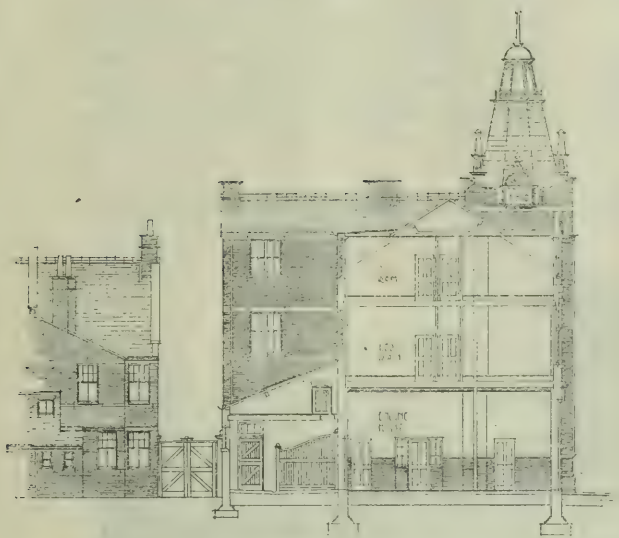
The whole of the plans, bills of quantities, &c., have been prepared by Mr. H. L. Baker, the deputy engineer in the engineer's department, and the buildings are now being erected by the council's own workmen, under the supervision of Mr. J. Birch, the borough engineer.



Section on Line A A.



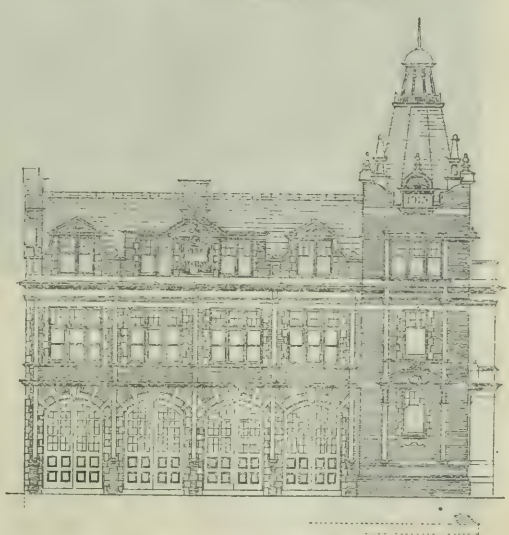
Section on Line B B



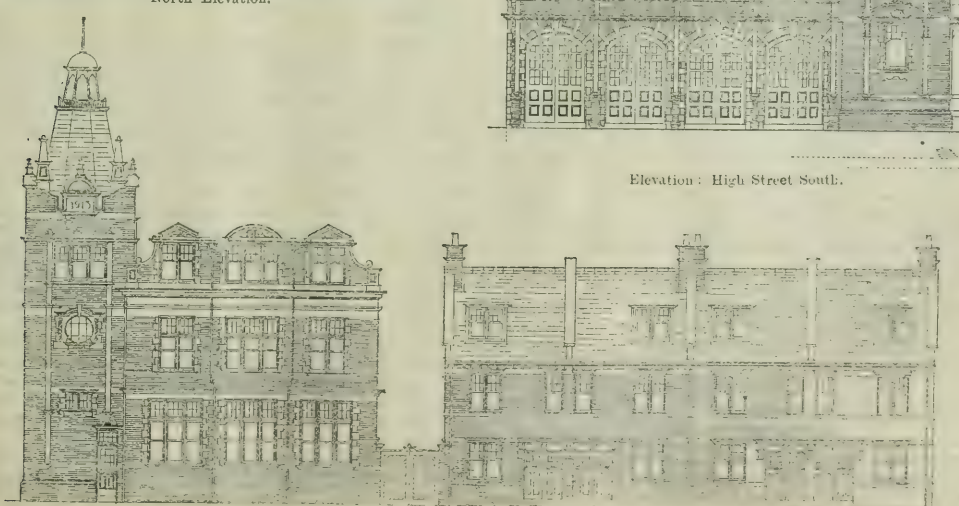
Section on Line C C.

Section on Line D D.

North Elevation.



Elevation: High Street South.



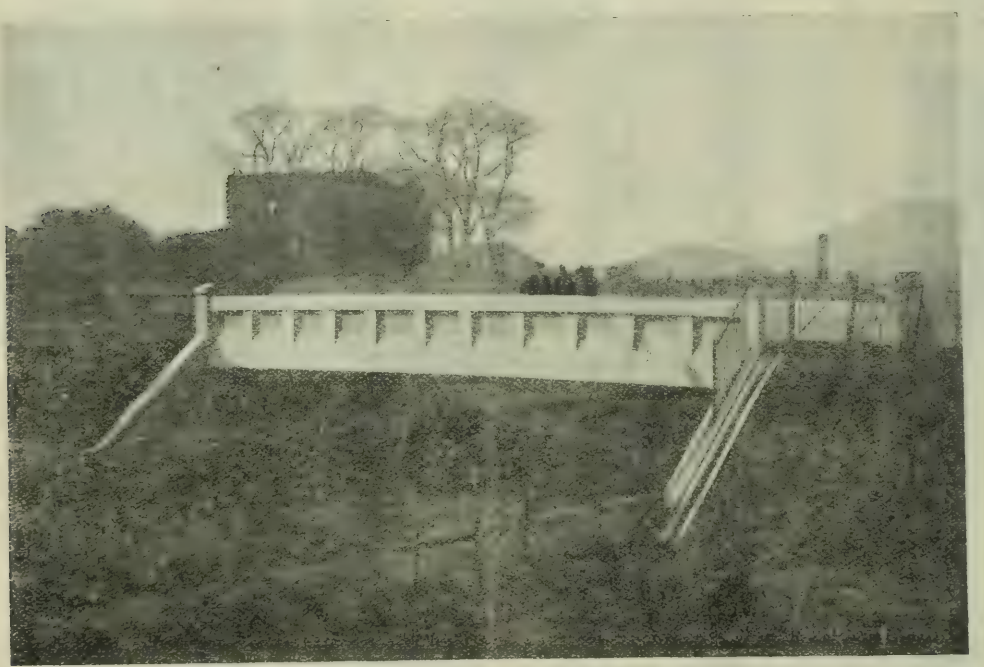
Elevation: Nelson Street.

East Ham Fire Station and Firemen's Dwellings: Elevations and Sections.

Ferro-Concrete Bridge at Neath.

The current issue of *Ferro-Concrete* contains an article by Mr. D. M. Jenkins, Assoc.M.Inst C.E., borough engineer and surveyor of Neath, describing a bridge constructed for the corporation of that town in 1911 for the purpose of providing means of access to a tract of marsh land lying between the river Neath and the Neath Canal, and acquired for the immediate purpose of depositing town refuse. The surface of the land is about 3 ft. below the level of high water at spring tides, and is at present of no practical value; but after the level has been sufficiently raised, it is intended to utilise the reclaimed area as a recreation ground or for some other public purpose.

The weiring of the river some little distance down stream has long been under consideration, and plans have been prepared by Mr. Jenkins for a weir and incidental works, including the interception of sewers, of which the present outfalls are situate above the site of the proposed weir. The reclamation of the land belonging to the corporation, and having a frontage to the river of about one-third of a mile, and the construction of the necessary protection works for the river bank, will permit a riverside promenade and pleasure ground to be laid out in the future.



Neath Canal Bridge.

The bridge has a span of 49 ft., a width between parapets of 24 ft., and a clear headway of 7 ft. 6 in. above the towing-path of the canal. It is constructed on the Mouchel-Hennebique system of ferro-concrete, from the general drawings and specification of Mr. Jenkins as engineer, which embody the working drawings and standard specification of Messrs. L. G. Mouchel & Partners, of Westminster, who were represented on this contract by their district engineer, Mr. Robert G. Clark, Assoc.M.Inst.C.E., of Cardiff.

No solid foundation being available at a moderate depth, the drawings provided for ten ferro-concrete piles, 14 in. by 14 in., which were made on the spot, to be extended upward as columns for the abutments and wings, the wing piles being tied to anchor piles, 12 in. by 12 in., by ferro-concrete ties. The accompanying drawings make clear the structural features of the bridge.

The contract length of the piles was 23 ft., which was based upon the indications of a trial shaft sunk in the marsh about 15 ft. distant from the site of the north abutment, strong gravel having been found at a depth corresponding to a length of pile of 20 ft., and provision made for entering 3 ft. into the gravel. Above this formation the whole of the excavation for the shaft was in a rather soft alluvial clay.

Pile-driving was commenced on the south bank of the canal, and good results were obtained, the final set, measured for ten blows of a 2-ton monkey with a drop of 3 ft., being ⅝ in. to ¾ in. On the north bank, however, no satisfactory set was forthcoming down to and at the contract depths—nothing better in fact than from 3 in. to 6 in. for ten blows. It was then decided to drive an experimental pitch pine pile, 40 ft. long by 14 in. square, on the line of the abutment and near the central pile, but no better result was obtained. The absence thus indicated of the stratum of gravel found in the trial shaft, although it had clearly been reached below the south bank, farther away from the shaft, pointed to a deep "wash-out" of that deposit within very narrow limits; and in view of the uncertainty as to the extent of lengthening of the piles required to reach the solid, the desirability of adopting some alternative plan was considered.

Eventually it was decided, in consultation with Messrs. L. G. Mouchel & Partners, not to lengthen the piles, but to rely upon them as they were to carry a load of 10 tons each and to carry the abutment and wings on a ferro-concrete raft, 5 ft. wide, and from 9 in. to 14 in. thick, which was designed to take the remainder of the total load. The raft was formed *in situ* on the puddled bank of the canal, which is known to have been constructed over 100 years back, and is thoroughly consolidated and sound. The calculated maximum load on the bottom is 0·8 per ton square foot, and the estimate formed of the safe load which the bank could carry has been fully borne out by the result of the test applied (which is described later), and the subsequent traffic over the bridge.

The abutments and wings are built up of ferro-concrete columns, curtain beams and curtains, thoroughly braced together and to the ferro-concrete raft, the wings being formed with a slight batter and finished off with a rectangular coping, also of ferro-concrete.

The superstructure consists of two pilastered main beams, which form the parapets; cross beams, spaced 4 ft. 6 in. apart; and a continuous decking, 5 in. thick,

with cambered upper surface—all moulded *in situ* so as to form a monolithic whole. Holes are left in the parapets, two to each bay, to enable ferro-concrete brackets to be bolted on to carry future footpaths.

The roadway is formed of a hard core, 4 in. thick, of local sandstone, broken to 2½-in. gauge, and a surface coat of tar-macadam, 3 in. thick, a blue brick channel being laid on each side to carry off surface water. At the north end of the bridge self-adjusting unclimbable iron railing and a pair of iron gates are fixed, the gate pillars being bolted down to the decking, and the standards of the railings similarly secured and attached to the ferro-concrete piers by means of ⅞ in. diameter bolts passing through them and enclosed in lengths of galvanised iron tubing.

The approach road on the south side is carried on an embankment, with 1 to 1 batters, covered with sods obtained from the marsh; and on the north side, after the preliminary filling to counteract the outward thrust of the abutment during the process of testing, the surface was brought up to the required level by the tipping of town refuse, and a temporary sleeper road formed. Part of the "Back Cut" of the canal has been enclosed by 18-in. stoneware socket pipes, bedded on and surrounded with cement concrete, and the toes of the embankment are supported by retaining walls of rubble masonry.

In his article Mr. Jenkins points out that there were two special conditions governing the design of the bridge: (1) The superstructure had to be kept up so as to give a clear headway of 7 ft. 6 in., in accordance with the requirements of the Neath Canal Navigation, who have statutory powers, and whose consent had to be obtained in the first place for the crossing of the canal; and (2) the surface level had to be kept as low as possible so as to avoid excessive gradients on the approaches. To meet these opposite conditions, the arrangement was adopted of two main girders, carried up as parapets, with cross beams spaced sufficiently close together to keep their depth within the required limits. Further, for a number of years only limited cart traffic will be required to pass over the bridge, but later on, when the marsh land has been developed, access for the general public will have to be provided. To meet this condition the bridge has been formed to the by-law width of carriageway—namely, 24 ft.—and provision made, as before mentioned, for adding when required a footpath to be carried on cantilevers outside each parapet. This is an economical arrangement, while at the same time it admitted of the distance between the road surface and the underside of the main beam being kept to a minimum—the alternative having been to space the main girders 36 ft. apart, to increase their depth and strength, and incidentally the gradients of the approaches, and to incur practically the whole cost of the finished bridge long before it was necessary.

REFUSE DESTRUCTION AND STEAM RAISING.

The result of an official test of a duplicate front-feed refuse destructor at Nuneaton, which was first utilised for steam-raising purposes in April of last year, appears in the report for 1912 of Mr. F. C. Cook, borough engineer and surveyor of that town.

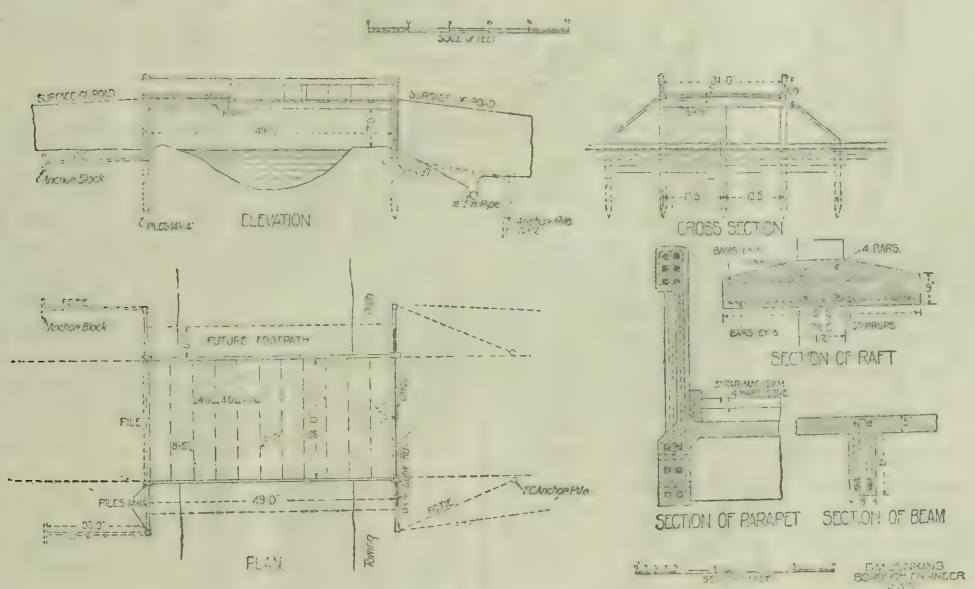
The contractors were Messrs. Heenan & Froude, Limited, of Manchester, and the cost of the furnace, apart from buildings, was £803.

The main results show that during the eight hours of the test the furnace dealt with 61·5 lb. of refuse per square foot of grate area per hour, which is equal to nearly 50 tons per day, and that the water evaporated per lb. of refuse consumed, from and at 212 deg. Fahr., was 1·727 lb.

Very little use was made of the spare coal-fired boiler after the completion of the duplicate destructor. Altogether, the destructors worked for 302 days, and dealt with 2,711 wagon loads and 4,654 cart loads of house refuse, together with 99 loads of trade refuse, equal to a total weight of about 6,382 tons, and representing about 88 per cent of the total house refuse collected. The average weight destroyed per day was 21·13 tons—an increase of nearly 4 tons as compared with the previous year.

The gross cost of labour in destroying the refuse was 1s. 5·75d. per ton, against 1s. 8·83d. in 1911. In 1911 the nett cost (excluding capital charges, and deducting the saving in coal) worked out at 4·9d. per ton; but last year there was an actual saving of £127 15s. 2d. during the time the destructor was at work, as compared with what the cost of raising steam by a coal-fired boiler would have been over the same period. The result is mainly accounted for by the enhanced price of fuel—viz., 3s. 8d. per ton against 2s. 3d.—and to the very great increase in the quantity of sewage pumped, which would have led to a corresponding increase in the weight of fuel used in generating steam.

The sum of over £30 was realised by the sale of tin and galvanised-iron scrap. This is very nearly all profit, as this waste material was previously buried in the tips.



Neath Canal Bridge.

Geological Survey of India.—The Secretary of State for India in Council notifies that one appointment to the Indian Geological Survey Department will be made in July next. A further vacancy is expected to occur in the year 1914.

EASTER HOLIDAYS.

Owing to the necessity for going to press earlier than usual, news and advertisement matter intended for insertion in next week's issue of "The Surveyor" must reach us not later than Wednesday morning, March 19th.

E

Office Conversations.

MORE OR LESS IMAGINARY.

[*Contributed.*]

VIII.—A Biographical Fragment.

Yes, I suppose it's the same in all lines; but I really do think that in municipal engineering the yield of plums is very small indeed. Did you ever hear the history of poor old Smart? You know Smart, don't you? Got the worst job in the office, and 'll never get a better, poor devil! Too old? Well, no, it's hardly that. He's broken hope, ambition, and everything of that kind dead. Drinks? No, not to any extent. Likes his glass and a glass extra perhaps, but whatever he may do after hours he always turns up fit in the morning. Of course, he's not the man he was, and he never will be again, but he does his work (such as it is) well and conscientiously, and he earns his pound a week. That all he gets? Yes, and he has to be thankful for *that*. Why, I had the biggest job in the world to get his appointment through. There were objections to his age, and some of the members were quite sure that he had done something wicked or he wouldn't 've found himself in the position he did.

* * * *

Do I think so? Heavens, no! The man's simply had a run of bad luck—some of us get it like that. He was always a bit cranky, I understand, and he meant to keep his own end up—*he* wouldn't put up with nonsense, and all that kind of thing. Now, it's not the least use running one's head against a brick wall—or a "board"!—and on occasions the candle has to be held to the devil in this life. Smart was always up against the brick walls, and the succession of shocks he experienced made his life a misery. His main contention was that he was not the servant of the council, but their adviser. A very excellent theory, which I quite endorse; but it doesn't pan out. The man who votes you your money is the man you've got to look to, and when the man's multiplied by five-and-twenty you're called upon to do a considerable amount of looking if you want to avoid the wall. Smart stood too much upon his dignity, and he was always rumbling over himself. He couldn't see that his council didn't care a rap whether he stayed or went. Of course, had he been working for a company of business men they'd have valued and appreciated his services. The excellent work he did would have increased their dividends, and they'd have put up with his manner for the simple reason that, after all, he was always in the right. But the council were not running the concern for profit, and, not being a remarkably brainy lot, Smart got on their nerves.

* * * *

Was he properly trained and all that? Oh, yes. His father paid a good premium for him, and he served his articles with a man who really took an interest in his pupils. His articles completed, he remained on for a couple of years as general assistant at the salary he's getting now with me. Only a pound a week? Yes, only a pound a week, and lucky to get it. Poor reward for a big premium and a long pupilage? Of course it was; but then the reward in our profession always is poor. Then came his chance (as he thought), and he obtained a post as surveyor to a small urban district. If ever a man went for roses and found himself among thorns, Smart did then. There were twelve members on the council, and of these three—a watchmaker, a clerk of works, and a jobbing builder—had competed with him for the appointment. He found the district in a wretched condition, and suffering badly from the administration of one of those black sheep which are few and far between, thank Heaven, in the municipal engineering profession. He put his foot down—it was all he could do, poor chap—and within a month he had made two more enemies—small builders on the council whom he was compelled to take action against for persistent breaches of the by-laws. Unlike his predecessor, he was not to be bought, and five enemies stood to his account. The crash came when interference with certain property belonging to the chairman became necessary. Here was a solid half of the council seeking his dismissal, while the scale against him was turned by the power in the chairman's hands of a casting vote.

Did they sack him? Oh no; that would have been too palpable a proceeding. His every action was spied upon, his every report cavilled at, his every recommendation ignored. The jerry builders and the small property owners had the time of their lives. They did just as they pleased, knowing that to thwart the surveyor was to court favour with the council. And all the time complaints that he was not doing his work properly were rife. He might, for example, have cause to complain of the bonding of the brickwork of a certain new building, and he would serve a notice in the ordinary way. The work still proceeding, he would ask the council for instructions to prosecute for breach of by-laws. An expert committee (consisting of two railway clerks and a butcher) would then be appointed to inspect the work, and they would report that no real cause for complaint arose. At the very next meeting he would be upon the carpet for not having reported an alleged breach occurring in some other building in the district. His patience became exhausted at last, and he roundly told the council that it was useless attempting to carry out his duties in a proper manner. A request for his resignation followed, and he had to resign to save himself from dismissal.

* * * *

Was he sanitary inspector also? Oh, yes. And didn't he appeal to the Local Government Board? Oh, yes. Surely they interfered in his behalf? My dear fellow, your innocence is most refreshing. Just you have a try at an appeal to them and see what you'll get. No, he had to go, and the worry and anxiety he'd been through brought on a severe nervous breakdown, which incapacitated him for some months. Then he went back to his old chief as first assistant, and would have done better had he stayed there. But he still hankered after a chief appointment, and regarded his first job as quite an exceptional experience for a man. And wasn't it? Well, it wasn't so in his case, anyway, and I won't say more than that. He certainly was very unlucky, for his next two appointments turned out but little better, the latter of them terminating at the High Courts. Slander? No, merely a matter of account, taken there on appeal. You see, he was one of those obstinate fellows who would have his rights. It was quite a small sum due to him, which he could quite well have foregone and retained his post. Against the best advice he took action. Gain the day? Oh, yes, he won the case, and it cost him about twenty pounds out of pocket to win it. The money he received? His solicitor had that, plus the costs awarded, plus the twenty pounds. And poor Smart was left minus his job.

* * * *

Was he luckier next time? There never came a next time. He threw up the sponge. Tried private practice. You know what that means for a man with neither capital nor influence. His private work consisted almost entirely of devilling or ghosting for other people. There are men known as house and estate agents, who also call themselves architects and surveyors. They have no professional knowledge at all, but with a showy office and plenty of bounce and assurance they contrive to pull in any amount of good professional work. This they sweat out to poor devils like Smart, who do the whole of the work for the shillings out of the guineas. It's not a bad training for a young fellow, as many of our best architects and engineers have proved; but for a man like Smart nothing could have been worse. He was already quite sufficiently embittered against life, and here he was just keeping body and soul together while the incompetents took all the fat. It was at this time that I first came across him, and his opinions then had a decidedly anarchistic tinge. I don't mean that he meditated throwing bombs about, or any nonsense of that kind, although I believe he would willingly have "skied" one or two of his employers. No, he was on the levelling lay, and the free expression of his opinions didn't, as you may suppose, do him any good among the men he mixed with. I took a strong dislike to him myself, and

it was long, even when I heard his history, before I could even tolerate him.

* * * *

And now? Oh, well, I suppose he'll drag his life out here, or as much of it as the council 'll allow him to spend of it. What's his special position? Well, really, it'd be hard to say. He's sort of general factotum—indoor and out. He's a good man all round, but there's a something about him—I can't say what it is—that deters me from placing responsibility upon his shoulders. He's broken—and that's about all I can say. Occasionally it'll take the form of aggravating abstraction. He seems to forget his surroundings altogether. Why, only last week I had him out with me on a survey. I'd ranged a pretty long line, and bother me if he didn't suddenly take it into his head to collect the poles before I'd got the chain out. Thought we'd done for the day, I suppose. Of course, I wouldn't dare to mention such a thing to the council, or out he'd go. Yes, I'm really sorry for the poor devil, and unhappily there are plenty like him. The only bit of bad luck he's avoided is getting married. Heaven knows how he'd have managed if he had had a family dependent upon him.

* * * *

You can't take his as an ordinary case? Well, of course not. I never hinted that it was; but I think it serves to show how intolerable are the conditions under which surveyors only too often do hold their appointments. Unfortunately, he had three practically successive unhappy experiences. Many a man has one, and leaves the service after it. Many again have one and then fall upon their feet. I'm not going to harp upon the necessity for protection and all that sort of thing. It wouldn't interest you. But if ever you should seek municipal honours and attain your ambition, bear in mind poor Smart's case and let the officers down a bit easy. You'll find them, taken all round, an excellent set of fellows, who work largely—now don't smile—for the public good and the love of their profession. The work is interesting, highly interesting, and if a man falls into the hands of a council such as mine, why, his lot's to be envied. Not, of course, that a bit more salary and the certainty of an hour or two off in the evening 'd not be acceptable. Your son? No, old fellow, I wouldn't recommend it. A hundred to one you'd be throwing your money away. Put him in a shop or a warehouse or something of that kind. Contracting (if only for the removal of dust and sweepings) is not a bad line. It's the commercial that pays.

SEWERS IN IRELAND.

"MENTIONED AS A JOKE."

An amusing discussion took place recently at a meeting of the Ardee, co. Louth, Town Commissioners, at which consideration was given to the question of the necessity for providing a water supply for the town, following upon a memorial received from a number of inhabitants. Mr. Yore said the commissioners had nothing to do in the matter at all, they not being the sanitary authority. If they wished, they could make a recommendation that the scheme be carried out.

Mr. Stokes said they would want to give it careful consideration before taking any steps in the matter, or it might end like the Dunleer sewers. At first the sewers were only mentioned in a joke, but when the Local Government Board caught hold of it they insisted on having them done.

Mr. Yore: They may send down an expert to inquire into the matter and raise the rates.

Mr. M'Nello said he remembered John Eakins, an old town clerk, writing to the Local Government Board about sewers, more for devilment than anything else, and in the end the board compelled them to carry out sewers. The town was as well off without them, and it might be the same in this case.

Mr. Stokes said it might involve thousands of pounds.

No action was taken.

"Tarvia."—A dainty little gift reaches us from Messrs. Bristowe & Co., Limited, in the form of a quaint, gilt hand-bell, cask-shaped, bearing only the mystic word "Tarvia." It would be a useful and ornamental adjunct to a municipal engineer's desk, and might be used by him appropriately for summoning a typist to write off "repeat" orders.

INSTITUTION OF MUNICIPAL AND COUNTY ENGINEERS.

NORTH-EASTERN DISTRICT MEETING AT LEEDS.

Mr. Frank Massie, district chairman, presided, on Saturday last, at a North-Eastern District meeting of the Institution of Municipal and County Engineers at Leeds. Those present included Messrs. A. E. W. Aldridge (Skipton), W. E. H. Burton (Wakefield), H. Bottomley (Bingley), W. Dixon (Leeds) J. H. Drew (Wath-upon-Dearne), G. Gledhill (Balby-with-Hexthorpe), T. H. Hailstone (Birstall), H. L. Hall (Batley), W. J. Hadfield (Sheffield), S. S. Haywood (Brighouse), A. B. Holt (Leeds), H. Holmes (Ossett), G. A. Hart (Leeds), W. Green (Castleford), F. O. Kirby (Doncaster), L. Ives (Wakefield) W. T. Lancashire (Leeds), C. Lund (Cleckheaton), E. B. Martin (Rotherham), S. Matthew (Dewsbury), A. Rothera (Liversedge), Leslie Roseveare (South Shields), W. Sugars (Horbury), J. Southwart (Rothwell), W. J. Steele (Newcastle-on-Tyne), F. Thackray (Hoyland), J. P. Wakeford (hon. district secretary, Wakefield), G. E. Wrigley (Sowerby Bridge), C. F. Wike (Sheffield) and R. E. Wilson (Knaresborough), members; S. Dean (Barnoldswick), H. P. Foster (Leeds), J. Hassall (Sheffield), A. C. Hodge (Sheffield), H. Sanderson (Keighley), F. Simms (Sheffield) and S. M. Senior (York), associate members; W. H. Price (Leeds) and J. Wrest (Dewsbury), students. The members were welcomed in the council chamber by the Lord Mayor (Mr. A. W. Bain), who said he recognised that their work was of a very important character. The problems of the municipal engineer were not likely to grow less as years rolled on. The engineering science had developed very rapidly in the past few years, and was at present developing in many directions that affected various cities and boroughs, and he took it that in the future the duties of municipal engineers would become more onerous than in the past.

A paper, entitled "Some Municipal Works and Practice in Leeds"—which is unavoidably held over—was read by Mr. W. T. Lancashire, the city engineer, and the ensuing discussion was contributed to by Mr C. F. Wike (city engineer of Sheffield), Mr. W. J. Steele (city engineer of Newcastle), Mr. E. B. Martin (borough engineer of Rotherham), Mr. C. Lund (borough engineer of Cleckheaton), Mr. L. Roseveare (borough engineer of South Shields), and Mr. Frank Massie (surveyor to the Wakefield Rural District Council).

The Lord Mayor afterwards entertained the members to tea.

HOUSING AND TOWN PLANNING CONFERENCE PAPERS.

At the Housing and Town Planning Conference to be held in connection with the fortieth annual general meeting of the Institution of Municipal and County Engineers at Great Yarmouth, in July next, papers will be contributed as under:—

"Town Design in Practice," by J. E. Wilkes, Dunfermline; "Legals Aspects of Town Planning," by J. L. Jack, town clerk, Dunfermline; "Description of Birmingham Scheme," by H. E. Stilgoe, Birmingham; "Early Examples of Town Planning in the City of Edinburgh," by A. H. Campbell, Edinburgh; "Cities Beautiful by the Sea," by J. S. Brodie, Blackpool; "The Small Dwellings Acquisition Act, 1899," by J. L. Redfern, Gillingham, Kent; "The Housing Question," by R. Brown, Southall; "Factors Causing Bad Housing," by G. B. Hartfree, Alton; "Municipal Electric Cooking Installation at the Torquay Pavilion," by H. A. Garrett, Torquay; "Road Work," by C. J. Jenkin, Finchley.

A paper, the title of which has not yet been settled, will also be contributed by Mr. C. F. Wike, Sheffield.

Paving in Ancient Times.—A lecture on "Paving" was delivered by Mr. Peter Lyall at a recent meeting of the Royal Technical College Architectural Craftsmen's Society, Glasgow. Mr. Lyall said that several cities had paved streets before the Christian era. Nevertheless those which were at present the ornament of Europe (Rome excepted) were destitute of them till almost the twelfth or thirteenth centuries. The Carthaginians were the earliest road makers, and their example was copied by the Romans. Of modern cities the oldest pavement was commonly ascribed to Paris, but it was certain that Cordova, in Spain, was paved as early as the ninth century, and Paris about the twelfth century. Historians asserted that London was not paved in the eleventh century.

Comparative Reports of General Practice.—LXXX.

DUST COLLECTION IN AND AROUND THE METROPOLIS.—(4.)

The present comparative report of general practice—the first portion of which appeared in our issue of February 21st—deals with dust collection in and around the Metropolis, and is reproduced by the courtesy of Mr. Reginald Brown, M.INST.C.E., F.S.I., engineer and surveyor to the Southall-Norwood Urban District Council. Mr. Brown has collected information on the subject from no fewer than sixty-one districts.

District.	Population.	Area in acres.	Storage		Collection.						Disposal. How is your Refuse disposed of (in cubic yards) per annum?						Remarks
			Do you insist upon the provision of galvanised iron sanitary dustbins?	Do the owners or council provide same?	(a) How often is the refuse collected?	(b) Do you collect by contract or by your own staff?	(c) Is there a "house-to-house" collection, or is the "D" Card System adopted?	(d) What is the average number of men and carts employed daily?	(e) No. of cubic yards collected daily.	(f) Have you made any regulations as to assistance to be given by occupiers? If so, what?	Tip.	Brickfields.	Barging.	Destructor	Other means.	Cost.	
Lambeth	298,126	4,193	Yes	Owners	See remarks	See remarks	See remarks	See remarks	182 tons	See remarks	Provided by contractor — 57,000 tons	—	—	—	—	Cost per cubic yard including collecting and disposal by contractors for lump sum contracts. — 8 2 per ton in the six inner wards. 5/2 per ton in the 3 outer wards.	(*a and b*) Previous to March last the council collected the dust from the six inner wards (comprising about half the area of this large borough) by its own staff and plant, the dust from the three outer wards being collected and disposed of for a lump sum contract; but since that date, owing to difficulties in obtaining acceptable barging tenders, the whole of the dust has been collected by three different firms of contractors for lump sum contracts. (*c*) There is a house-to-house collection once a week, and a bi-weekly collection in a small area of the borough near the River Thames. (*d*) 32 vans and 32 carmen and 50 dustmen (82 men) were employed by the council when it collected the dust from the six inner wards by its own staff and plant; 11 vans are used by contractor in collecting the dust from the three outer wards. (*f*) There are no regulations as to assistance to be given by occupiers, except in the case of occupiers of flats, who are required to themselves bring the dust down to the ground floor for collection.
Lewisham	170,000	7,011	—	Owners	Weekly	Own staff	House-to house	36 men, carts and boys, 4 men at station (trimmers)	325	No	—	—	—	—	Contract by rail	3/9 per load	
Paddington	(1911) 142,576	1,356	No.	Owners or occupiers	Weekly, except in special cases	Own staff save in one ward wherein contractor collects	House-to house	56 men, 28 vans	132-3 loads of an approximate capacity of 114 cubic feet each	No	—	—	40760¼ loads = 29,863 tons	—	—	Contractors charge 2/11¼ per ton. This is exclusive of council's wharfage charges.	In one ward the refuse is collected and disposed of by a contractor at a lump sum per annum. This district is not included in the foregoing statistics.

Ruislip-Northwood ...	6,700	6,585	Yes, where possible	Owners	Weekly	By contract. The tip to be approved Contract price for 12 months, £260	The occupiers make application, and we instruct the contractors to call weekly	3 men, 2 carts	12 (4 days a week)	—	—	2,496	—	—	—	2 1	
Richmond (Surrey) ...	33,223	2,534	No (see remarks)	Owners	Weekly (see remarks)	Own staff	House-to house	6 vans per day with driver, and 2 extra men with each van for filling	54	No	—	—	—	—	15,200	1/5·18 per cubic yard*	(a) Generally, however, any other receptacle is condemned by the sanitary inspector as injurious to health, and sanitary dustbin insisted on. (a) Collection. Weekly, with the exception where special application is made for additional collection, where it is made bi-weekly during hot weather, also large business houses. * An annual amount of £1,130 is paid to the contractor for disposal of the whole of the refuse, not exceeding 8,000 tons per annum, and pro rata if beyond that quantity.
Sunbury-on-Thames ...	4,650	2,660	Yes	Owners	Weekly	Contract Council provides dust cart for use of contractor	House-to house	2 men and 1 cart	9 yards	No	2,340 cubic yards	—	—	—	—	1½d.	Refuse is removed by rail under contract.
Stepney	280,024	1,903	Yes	Owners	Daily in commercial areas 2 or 3 times weekly in residential areas	Own staff and vans	House-to house	53 men and vans	193 tons	No	—	—	19,195 tons	35,939 tons	By rail 4,694 tons	By barge, 11d. a ton, destructor, 2/6·51 per ton. By rail, 1/6 per ton	
Southwark	191,962	1,165	Yes	Owners	Once, twice or three times per week, according to class of property	Own staff	House-to house	56 men and 28 horses daily	120 tons	No	—	—	20,000 tons taken to contractor's wharf on river and shot into barges	—	20,000 tons pulverised by machinery at the council's depot and sent away by rail to farmers for use on the land	Year ending March 31, 1912. 3/1¼ per ton, including establishment charges on depot	

(To be continued.)

Assistants' and Students' Section.

Conducted by SYDNEY G. TURNER, Assoc.M.Inst.C.E.

All communications in regard to this page must be addressed to The Editor, St. Bride's House, 24 Bride-lane, Fleet-street, E.C. *Envelopes must be marked "Assistants' Section" in the top left-hand corner. Correspondents are invited to submit questions for consideration and answers to the questions which appear. For the contributions considered to be the most meritorious, one or more premiums in books will be awarded monthly. Diagrams must be drawn to scale on separate sheets, ready for reproduction.*

QUESTIONS.

This week answers are invited to the following questions:—

311. Surveying.—How would you draw a "give and take" line to an irregular boundary to facilitate taking out an area? (C. F. H., *Lincoln.*)

312. Design of Structures.—How can the weights of bridge members be allowed for when designing the structure? (H. V. O., *West Bromwich.*)

313. Mechanical Haulage.—What is the most suitable plant for hauling road metal over weak country roads by mechanical traction? How does the cost compare with horse haulage? ("Ehu.")

314. Concrete Roof.—It is desired to construct a semi-circular barrel roof in concrete of 50-ft. span, reinforced with expanded metal. Show the dimensions of the supporting walls, which are to be 15 ft. high from the top of the footings. The roof is to be ribbed with an extra thickness of concrete over the piers. (H. V. A., *Clapton.*)

315. Surveying: Theodolite.—If the graduated plate of a theodolite is not correctly centred, how may the error arising therefrom be eliminated? Prove that the method adopted does eliminate the error referred to. (T. W. P., *Bexhill-on-Sea.*)

316. Hydraulics. Describe a method of measuring the quantity of water flowing in a wide river. "Enquirer.")

[The Editor is at all times glad to hear from readers who desire to submit questions regarding matters of general interest, points of daily practice, &c., for insertion in the "Assistants' and Students' Section." Questions which are published are taken into consideration, as well as other matter, in awarding the Monthly Premium.]

REPLIES TO QUESTIONS.

309. Water Supply.—In laying a large water main carrying water from a gathering ground several miles from an urban district, and also distributing mains in the district, where and at what points would it be necessary to place air and other valves? Give reasons. (W. L., *Ripley.*)

Valves of several kinds play no unimportant part in the efficient distribution of water to populated districts.

Air valves are used where the mains are laid over a rise of ground to clear the pipes of the air which

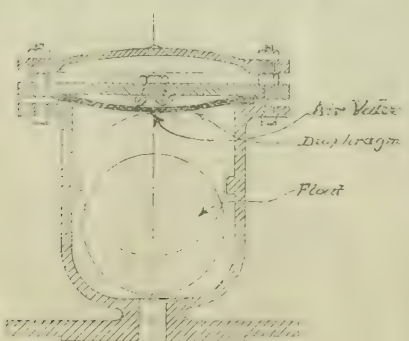


Fig. 1. Air Valve.

always is apt to collect at the top of a vertical bend, however slight, especially if it is near or above the hydraulic gradient line. If this air were not removed it would increase, and probably stop, the flow of water.

The construction of the air valve is shown in the [illegible] Fig. 1. It consists essentially of a spherical float which closes a very small hole in an india-rubber diaphragm, when there is no air present, but as soon as air collects the float sinks and exposes the aperture, so that the air is forced out by the water pressure, and the valve chamber is refilled by water.

At the lower end of a long pipe line the pressure and velocity are usually high, and as there is always

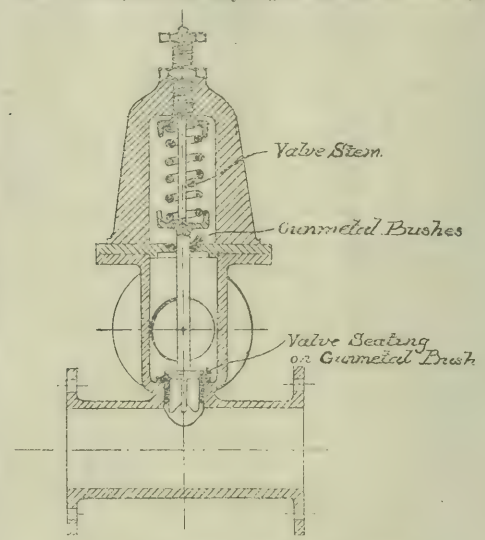


Fig. 2. Section of Safety Valve.

a possibility of a sudden increase of pressure due to ramming, a safety valve is fitted to eliminate the risk of burst pipes.

Ramming is the momentary increase of pressure caused by suddenly stopping the flow, and thus converting velocity head to pressure head. It is

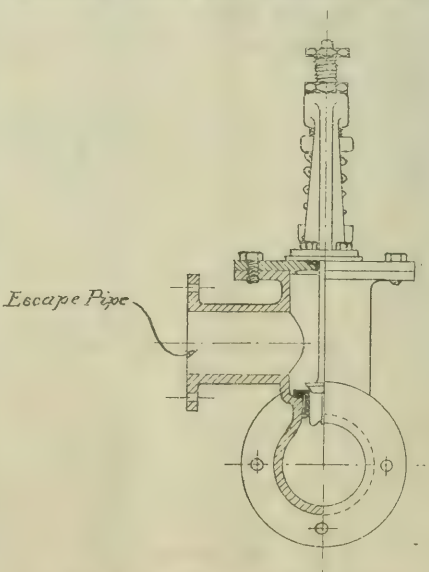


Fig. 3. End View of Safety Valve.

often brought about by the sudden closing of a valve, and is just as liable to occur in high as in low pressure systems. Ramming allows 100 lb. per sq. in. as the increase of pressure likely to be produced.

The safety valve is shown in Figs. 2 and 3. The

disc is held on its seating by a strong spring, which may be adjusted to the required pressure by means of the lock nuts at the top.

An efficient safety valve must allow for a rapid escape, and should not be loaded by dead weights, as the inertia of the load may allow the full effect of ramming to operate before the valve is opened. If a high pressure is required a strong spring might be loaded by weights, so that under a sudden increase of pressure the spring would give immediately and the weights move afterwards.

Sluice valves are fitted at the junctions of mains and distributing mains, so that a given area may be isolated. It is advantageous to be able to isolate as small an area as possible, but this means a relatively large number of valves.

A sluice valve is really a shutter, which may be placed across and completely close the bore of a pipe. In modern construction the disc of the valve is drawn completely out of the pipe, into a receptacle above, by means of slow moving screw gearing, which gives great power, and by its slowness tends to reduce the liability to ramming.

In long mains check valves are placed at intervals of about 1,000 ft., so that in the event of a burst not more than 1,000 ft. of pipe will be drained. The valve consists of a flap, which, suspended from a hinge, is forced open by the water flowing in one direction, but is closed on to its seat by the back pressure when the water tends to flow in the opposite direction. (H. V. O., *West Bromwich.*)

In a large water main intended for the conveyance of water from a distant gathering ground the following valves should be provided: (1) Air valves; (2) washout or scouring valves; (3) stop valves; (4) relief valves; (5) reflux valves.

A pipe line, following the natural undulation of the country it traverses, will require air valves at every summit to permit of the escape of air which gradually accumulates, and washout valves at the bottom of every hollow, for scouring out the sediment that is invariably deposited at these points, and for emptying the main.

Stop valves are required at certain points along the pipe line to regulate the rate of supply and to isolate sections of the main for repair purposes.

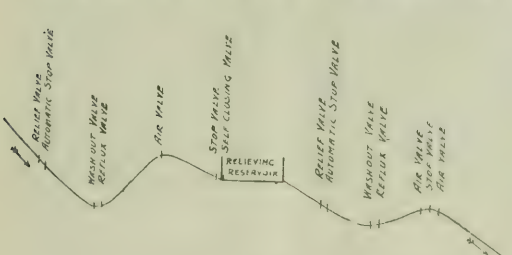


Diagram Illustrating Position of Valves.

The former object is best effected as near as possible to the outlet of any portion of the main—*i.e.*, where it delivers into a reservoir—but for the latter purpose, if situated at depressions in the pipe line, a scouring valve should be placed on each side, and, if at summits, an air valve on either side.

Automatic stop valves are provided where serious damage or inconvenience would be caused by the sudden discharge of water through accidental breakage. These are placed under comparatively light pressure, generally on the verge of deep depressions, where serious fractures are chiefly to be apprehended.

Relief valves are placed on the upper side of this self-closing valve for the purpose of relieving any sudden increase of pressure, and are important in connection with any valve likely to cause any rapid arrest of the motion of the water in a main.

Reflux valves are required to provide against the discharge of water backward through a main in the event of fracture, and are usually placed at the inlets to reservoirs, or towards the delivery side of deep depressions.

In the case of distributing mains, the principal object to attain is to provide an adequate and constant supply of water at an uniform pressure.

The area of supply is separated into districts at varying levels, and the pressure made uniform by the employment of reducing valves, which should be placed on the main immediately above the district supplied.

Air valves are not usually required in distributing mains, as the frequency of service pipes performs the function of the air valve.

Stop valves are very necessary on all branch mains for the purpose of controlling the supply and for waste detection; but their use for "turning off" for connecting a service is now greatly superseded by the use of the "under pressure" drilling and tapping apparatus.

Hydrants are required at suitable positions, according to the requirements of the district, both for fire and sanitary purposes, and are preferably placed on branch mains, leaving the leading main unchecked.

In the event of branch mains having a "block end," a sluice valve and "turn-up end" or a hydrant is required for the purpose of flushing out the main periodically, but in laying down a system of distributing mains every effort should be made to avoid these as far as possible and obtain a through circulation of water in all directions. (D. G. B., *Darlington.*)

310. Decay of Timber. What are the causes of decay in timber placed under water? How can it be prevented?

In general the decay of timber is due to bacteria and fungi, and heat with moisture are indispensable to their action; but, if kept in pure water—that is, perfectly airtight—timber is practically everlasting.

The decay of timber in water is therefore abnormal, and is due, in sea water, to one or other of the sea worms, which are represented in most parts of the world.

The *Teredo Navali* (or "ship worm") and the *Limnoria Terebrans* (or "boring gribble") are perhaps most widespread.

The teredo bores a hole into the wood, and then, working parallel to the grain and under the surface, it makes a tunnel which it lines with a thin calcareous coating. It lives in this hole in communication with fresh sea water, and gradually grows in length and thickness, the average size being ¼ in. to ⅜ in. in diameter and 15 in. long; but specimens as long as 4 ft. have been found.

The teredo works from half-tide level down to the ground, and does not consume the wood, but passes it through its body. It is very rapidly reproduced, something like 1,000,000 eggs being given by one specimen in a season, most of which attain maturity. So great is the action of these animals in tropical waters that 6-in. timbers have been destroyed in six weeks in the Gulf of Mexico.

The limnoria is much smaller than the teredo, being about the size of a rice grain; but it is very numerous, and thrives in both tropical and colder latitudes, and gives trouble in the northern British coasts, whereas the teredo is only found in the warmer waters.

Where timber is liable to be attacked by sea worms a strong antiseptic is necessary for protection. The best preservative is creosote, which is, in fact, good for timber in all exposed situations.

The process of creosoting consists in forcing distilled coal tar into well-seasoned timber.

To do this the timber is placed in steel tanks, which are then filled with creosote oil and then securely closed. The temperature is raised to about 130 deg. Fahr., and a pressure of 160 lb. per square inch is applied for a sufficient time to force the required quantity of oil into the wood.

In England from 7 lb. to 10 lb. per cubic foot is considered sufficient, even for timber liable to be attacked by sea worms; but from 22 lb. to 25 lb. is required for timber to be used in the Gulf of Mexico, which is badly infested.

If the timber is properly seasoned its life is almost indefinite after creosoting. In the North of England creosoted pitch pine piles have stood untouched for twenty years in areas infested with limnoria, whereas ten years is a fair life for untreated piles.

It is now agreed that creosoting is the only process of any value for resisting the attacks of sea worms. Its cost in England is from 4d. to 5d. per cubic foot of timber.

For a good account of timber, treated from an engineering point of view, the reader is advised to consult "Timber," by J. R. Batterden, Assoc.M. Inst.C.E., where a full account of seasoning and

preserving timber is given. (H. V. O., *West Bromwich.*)

The decay of timber immersed in water takes place more rapidly in salt water than in fresh water.

In salt water the destruction is caused by the attack of insects, the principal of which are the *Teredo Navalis* and the *Limnoria Terebrans*, more generally known as sea worms and wood-boring shrimps, the former having been found present in fir piles as long as 2 ft., and ¾ in. diameter.

These insects bore long holes through the timber, generally in the direction of the grain, and so rapid is their action that 12-in. square piles have been eaten through in four to five years.

The limnoria almost always works just under neap tide; it cannot live in fresh water; and while it is destroying the surface of the piles the teredo is attacking the interior.

The methods of resisting the action of these insect may be divided into three classes: (1) By using timber which will resist the action of these sea worms; (2) by subjecting piles to a chemical process; (3) by adopting a mechanical process.

In considering these methods practically the only timber within commercial limits which will resist the action of these insects is "greenheart," and is often used, and the methods of encasing piles with sheet metal or thin concrete, or covering the surface with scupper nails, have proved too expensive for practical utility, and are not satisfactory.

The method generally adopted is to subject the pile to a chemical treatment before use, and the process most extensively used is creosoting. This is performed by immersing the pile, after being dried until it ceases to emit steam, in crude creosote at a temperature of 120 deg. Fahr., and at a pressure of 150 lb. per square inch; by this means some 8 lb. to 12 lb. of oil per cubic foot is absorbed.

Various other methods have been advocated by impregnating with metallic salts, of which, perhaps, the one which has proved to be of greatest service is Kyan's. This process consists of applying, in the same manner as with creosote, a solution of mercuric chloride (corrosive sublimate) in the proportions of 1 lb. of sublimate to 5 gallons of water.

Timber placed in fresh water is not subjected to the ravages of insects, and its decay is attributable principally to the dissolving out of the soluble constituents of the wood. For this reason the most durable timbers for use in fresh water are those containing the least sap, and oak will therefore have a far longer life than any of the pines.

By impregnating the timber with creosote, as previously described, the texture of the wood is closely filled with an insoluble material, thereby preventing the process of solution taking place.

Generally speaking, the process of creosoting is the best for all purposes, especially when it is considered that the cost is about 5d. per foot cube; but the surest method of overcoming the difficulty and obtaining a permanent structure is to abandon the use of timber and use reinforced concrete. (D. G. B., *Darlington.*)

Municipal Lodging-Houses Suggested for Leeds.—The Development Committee of Leeds Corporation have agreed to receive a deputation from the Leeds United Society of Women's Labour Leagues and Guilds on the subject of municipal lodging houses. The Society strongly advocates municipally conducted lodging-houses, and it is urged that Leeds might well follow the example of Manchester, where municipal lodging-houses, conducted on ideal lines, have been found to pay. The corporation have recently come into possession of a number of lodging-houses through the purchase of land in the insanitary areas, but these houses are being continued as private ventures.

Standard Clauses for a Specification of Street Lighting. On Tuesday, April 15th, at the Royal Society of Arts, John-street, Adelphi, W.C., a paper on this subject will be presented by Mr. A. P. Trotter at a joint meeting of the Illuminating Engineering Society, the Institutions of Gas and Electrical Engineers, and the Institution of Municipal and County Engineers. The paper will not be read, but merely briefly introduced by the author. Advance proofs will shortly be available, and can be obtained by those wishing to take part in the discussion on application to the hon. secretary of the Illuminating Engineering Society—Mr. L. Gaster, 32 Victoria-street, London, S.W.

CORRESPONDENCE.

For every ill beneath the sun
There is some remedy or none;
If there be one, resolve to find it;
If not, submit, and never mind it.
A Gentleman.

LAND VALUATION BOARD APPOINTMENTS.

To the Editor of The Surveyor.

Sir,—I read with alarm and great concern "Valuation Assistant's" letter in reply to "Disgusted Parent," and am astounded at the methods employed.

Are the public to understand that their properties are being "valued" by a "valuer" of only six months' experience as valuation assistant, having previously been a draughtsman? "Valuation Assistant" says that only those with the best experience can successfully ascertain the value of collieries, public-houses, railways, canals and underground cables, pipes and sewers, waterworks, gasworks, picture palaces, factories, &c., thereby proving that he is entirely unable successfully to ascertain the value thereof, unless we are to believe six months as valuation assistant is the best experience. Is it any wonder that the owners in many cases, as stated by him, come storming into the office cursing both the Chancellor of the Exchequer and the department generally, when provisional valuations are made by a valuer of such experience?

"Valuation Assistant" states that the supply of qualified men is greater than the demand. Surely it would be in the interests of the public if the Commissioners of Inland Revenue obtained the services of some of these surplus qualified men instead of employing men with no qualifications in valuing?—Yours, &c,

Property Owner.

March 8, 1913.

To the Editor of The Surveyor.

Sir,—I read with great interest the letters in your last two issues by "Disgusted Parent" and "Valuation Assistant." Having had some twenty months in the Valuation Department, which I very much regret, I think I am qualified to be in a position thoroughly to agree with "Disgusted Parent." "Valuation Assistant" is evidently an optimist, and is one of the few who are satisfied with their lot in the department. He states that he was engaged as a draughtsman, which also means a surveyor in the Valuation Department, and that he was later appointed a temporary valuation assistant. That may be so. But he must remember that it was his own choice that he accepted the latter berth. The assistants whom "Disgusted Parent" refers to are those who passed the test examination as surveyors, and thought they would be employed as such in the department. This is exactly where the disappointment comes in. It is not everyone by a long way who has had either a surveying or architectural training who is desirous of doing as "Valuation Assistant"—*i.e.*, following up valuing—and when "Disgusted Parent" states a young surveyor will be no use either to himself or any one else after a year in the department he speaks absolutely the truth. If "Valuation Assistant" requires any proof of this let him look round and see how many young surveyors and architects are anxious to leave, for the simple reason that they see absolutely no prospects for their future careers. If "Valuation Assistant" has been engaged for two years, surely he has noticed that the whole department is seething with discontent. Has he not also noticed how unfairly the salaries are apportioned? Has he not seen that a valuation assistant with 25s. a week has to do exactly the same amount of work as one with 50s. a week? Has he not recognised that some of the so-called valuers who have the plum salaries owe their positions to political influence, and that some of them never saw a provisional valuation until they took up office? Under the above circumstances, I am certain that 80 per cent of the valuation assistants will agree with "Disgusted Parent," and that he is quite right in advising young surveyors not to join the department unless they wish to take up valuation as a profession.

According to the "*Daily Mail* Year Book," at the end of the financial year 1911 there were 667 valuers and temporary valuation assistants and 128 draughtsmen. There are quite double that number now. What is going to become of us all in 1915 or 1916, when it is anticipated that the valuation will be

The Surveyor
And Municipal and County Engineer.

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completed? At present we are working under a cloud. No hope is held out to us, and no encouragement given. Until some definite understanding is arrived at as to the future, nothing but discontent and chaos can be expected. We cannot all hope to be as fortunate as "Valuation Assistant," nor can we all aspire to the imaginary £500 a year he speaks of. The burning question is, What is the Government going to do for about 1,500 professional men when the valuation is completed? Will it be the workhouse?—Yours, &c.,

SITE VALUE.

March 8, 1913.

THE DRAINING OF MOOR ROADS.

To the Editor of THE SURVEYOR.

SIR,—The case of *Cussons* v. *Northallerton Rural District Council*, to which attention was drawn in the editorial columns of your issue of February 28th, is very important from the point of view of rural district councils, and it might be that a short *résumé* of the case will prove interesting to your readers.

The plaintiff, Cussons, claimed damages against the rural district council on account of injuries sustained through being thrown from his bicycle while traversing a hill under the jurisdiction of that authority. The accident was primarily caused through a grip 5 in. deep and 21 ft. long, cut diagonally across a 14-ft. wide road. The plaintiff contended that: (1) The grip was the entire cause of accident; (2) that it was unnecessary; (3) that it was dangerous. While defendants contended that: (1) There was contributory negligence; (2) the grip was necessary; (3) that it was a usual and proper method of draining country roads.

The only case that appears to be quoted is *McClelland* v. *Manchester Corporation*, in which it was held in the King's Bench Division by Mr. Justice Lush that although when a road is dedicated as a highway the public or the road authority, if they accept it, take it as it is with all its defects, yet if a road authority undertake a duty with regard to it they must exercise due care and have due regard to the safety of those who will use it; and the fact that the corporation knowingly made up the street in such a way as to expose passengers to a hidden trap showed that they did not act reasonably and take proper care in exercising their statutory powers in the special circumstances of the case, and that therefore they were guilty of negligence and liable to the plaintiff who suffered damage by reason of such negligence.

Having control of a large length of rural district roads, I should certainly say that a grip constructed in this manner was not reasonable to ensure the safety of the public using the road, and personally I find under similar circumstances that the best way to deal with a steep road such as this is to make it with considerable camber and to pave the gutters. If, on the other hand, the road is subject to a considerable amount of traffic, I am of opinion that it is only fair that it should be properly drained, and sand-boxes put in at required intervals.

I know of only one place where grips are used such as are indicated in the above case, and that is upon the famous Buttermere Hause, which is exceedingly steep, and the grips are used in this case more as a ledge upon which the coaches can rest on their ascent rather than as a means of dealing with the water. It would be a very foolhardy cyclist indeed who would attempt to descend this particular hill.

I quite agree with the evidence given by Mr. Bintley, the well-known Westmorland county surveyor, and must say that, in my opinion, if the case could be taken to a higher court the decision would be reversed.—Yours, &c.,

P. M. HOPE,
Surveyor and Engineer to West Ward of Westmorland Rural District Council.

March 7, 1913.

[A letter on this subject from Mr. Walton Maughan Stoke, Coventry will appear in next week's issue. ED. SURVEYOR.]

THE NATIONAL HEALTH WEEK.

To the Editor of THE SURVEYOR.

SIR,—As vice-chairman of the National Health Week Committee, I should like to thank you for the excellent leader in your issue of the 7th inst. on this organised effort to interest the masses of the people in matters of health, and to express the hope that those of your readers who realise the importance of this work will promptly ascertain what is being done to secure the observance of Health Week in their respective districts.

It may interest some of your readers to learn that Health Week is mainly the outcome of sanitary work in the Territorial Force. The annual training in camp affords many an opportunity for realising how completely the habit of dependence on the excellent sanitary arrangements in our cities and towns has incapacitated those who benefit by them from taking any thought for their own health.

We are told on unimpeachable authority that "the law is the embodiment of everything that is excellent." One of the bed-rock principles of British law is that every citizen is supposed to know the whole of it. Ignorance of the law is no excuse for breaking it. Similarly ignorance of the laws of health affords no immunity from the consequences of their violation. We are more humane in the Army. Every three months the men of each battalion or troop or battery have read to them secs. 4 to 44 of the Army Act, informing them of the rules and regulations under which they serve, and warning them of the penalties of breaking them. Each Territorial unit has the same sections read to it at the commencement of its annual training. Health Week is a systematic attempt to do the same thing for the nation in regard to health. During the week commencing April 6th next, and thereafter from year to year, attention will be drawn to the laws of health in the churches, the schools, at public meetings, and, above all, in the Press. An organised effort will be made to enlist that support for the work of the local surveyor, and to show that he is not the unscrupulous and insatiable squanderer of the ratepayers' money that he is sometimes supposed to be, but that the ratepayer derives as much benefit from his contribution to the rates as from any other part of his expenditure.—Yours, &c.,

ARTHUR J. MARTIN.

7 Victoria-street,
Westminster, S.W.
March 10, 1913.

SEWAGE DISPOSAL AT NUNEATON.

The quantity of sewage dealt with at Nuneaton during the past year amounted to no less than 425,590,000 gallons. This, states Mr. F. C. Cook, the borough engineer, in his annual report, represents a daily average of 1,166,000 gallons, and is 109,831,000 gallons in excess of the quantity treated in 1911.

The increase is mainly due to the heavy rainfall throughout the year viz., 36·02 in. against 19·72 in. in 1911 but the installation of additional pumping plant was an important factor, for many millions of gallons of sewage were pumped for treatment at Hartshill, which, under the old conditions, would have passed into the river direct from the sewers, and would have polluted the stream to this extent.

Of the 402,100,000 gallons treated at the Hartshill outfall works 340,751,000 gallons were dealt with by the filters, and the remaining 61,349,000 gallons by the primary contact beds and subsequent land irrigation. The effluent from the filters was at all times capable of supporting fish life in the outlet channels of the humus tanks, and was therefore discharged direct from the humus tanks into the river.

The seven primary contact beds were filled in the aggregate 7,708 times, equal to a daily average of three times each. The average liquid capacity was 45,900 gallons, as compared with an original capacity of 75,000 gallons, equal to a loss of 38·2 per cent after eleven years' working. In the previous year the average liquid capacity of the primary beds worked out at 40,690 gallons, so that there has been an increase in capacity of 5,210 gallons per bed. The increase, in the opinion of the borough engineer, is probably due to the fact that the beds were worked more as balancing tanks for the percolating filters than as contact beds; consequently the period of quiescence was often materially less than the two hours generally allowed, and there was not the same opportunity for the deposit of suspended matter.

The last of the seven secondary beds converted into percolating filters was brought into use in May, thus completing the work of reconstruction commenced two years ago.

Mr. Cook says: "The continued satisfactory working of the percolating filters is the most gratifying feature of the works. Despite the fact that the medium in each filter consists of fine granite chippings with a 2-ft. 6-in. depth of ½-in. gauge at the surface, it has not needed cleansing in any way. The whole area of 1¼ acres is quite free from ponding. The clean condition of the medium is mainly due to the separating tanks with upward flow roughing filters, which were installed in connection with the recent extension of the works. The total area of the roughing filter in these tanks is only 54 sq. yds., but they have been thoroughly successful in the elimination of such suspended matter as has passed through the silt tanks."

Having regard to the success which has attended the conversion of the secondary contact beds into percolating filters, as well as to the continued increase in the flow of sewage, it has been decided that the primary beds shall be gradually dealt with in the same way. There is always a surplus of chippings produced at the quarry, and these will be utilised as they accumulate for this purpose. Very little expense will be incurred for ironwork until the filling of each bed is completed and it becomes necessary to fix the distributor, the cost of which will be about £600. The expense will be almost entirely in respect of superseding old work, so that it will be properly a revenue charge, and will not be felt so much as in the case of work executed under more rigid conditions. Each filter so provided will be capable of dealing with about 150,000 gallons per day.

The New Delhi.—A message from Delhi states that after the lengthy and acute discussion which has taken place the settlement of the site of Imperial Delhi has been received with feelings of relief. The decision to select the southern site was reached after the Army Committee had stated that the northern site had no cantonment area and the Medical Committee had advised the southern. It is generally considered that Captain Swinton, the chairman of the committee appointed to plan the new capital, and his colleagues, Mr. J. A. Brodie, engineer of Liverpool, and Mr. Edwin Lutyens, have performed their task with much ability.

LOCAL GOVERNMENT BOARD INQUIRIES.

The Editor invites the co-operation of Surveyor *readers with a view to making the information given under this head as complete and accurate as possible.*

INQUIRIES HELD.

Chester-le-Street R.D.C. and U.D.C. (February 21st. Dr. A. F. Farrar). This was an inquiry respecting a proposal to form a joint hospital by the rural district and urban district councils of Chester-le-Street. Mr. Hargreaves, in presenting the case for the councils concerned, said the population of the rural district is 63,878, and the rateable value £312,065; of the urban 14,712 and £53,038. The present isolation hospital is within the urban area, but belongs to the rural council, although the urban council may send their infectious cases there for treatment on payment of certain fees agreed on by the councils. Since the formation of the urban council the hospital has been considerably enlarged, and at present provided accommodation for 24 beds. A further extension is at present being carried out at a cost of £2,400, sanctioned by the Local Government Board, which, when completed, would provide for 36 beds. There was no opposition to the proposal of a joint hospital board as between the two councils, and the only thing they seemed to require assisting in appeared to be the formation of the board and the proportion of representation.

Paignton U.D.C. (February 25th. Mr. A. A. G. Malet). £5,117 for the purchase of a portion of the foreshore and adjoining land at Preston, and £326 for works of sewerage in Blatchcombe-lane, Paignton.—It was stated by the clerk, Mr. R. J. Mill, that the area of the land independent of the foreshore which it was proposed to acquire was approximately 6 acres. It was admirably situated for the purpose for which it was required by the council. The price originally asked for the land was £800 per acre. The council negotiated for a reduction in the price, and the owner expressed his willingness to sell at the rate of £700 per acre, subject to certain stringent conditions. The council endeavoured to have the conditions amended, and the owner was only willing to accede provide that the price was at the rate of £800 per acre. The council was of opinion that it was the best to pay at the higher rate, and thus free the land from the objectionable restrictions. Evidence was also given with respect to the proposed works of sewerage at Blatchcombe-lane.

Salford T.C. (March 11th. Mr. W. H. Collin).—£15,614 for alterations to the town hall. The town clerk, Mr. L. C. Evans, said it was thought that the cost of the alterations could be met out of revenue, but it had since been ascertained that this could not be done. The reasons why the corporation started the work without obtaining the sanction of the board or making an application was due to the fact that it was intended to pay the sum out of revenue. A portion of the work had been carried out, and was practically completed. Mr. Pearson said the Ratepayers' Association would like to have facts, more particularly with regard to the great disparity between the original estimate of £3,500 and the present application. It was all very well to be told it was a speculative estimate. They would not justify in business an estimate of £3,500 and an expenditure of £14,500.

Selby U.D.C. (March 5th. Mr. M. K. North). £600 for the purchase of Brayton Barff, 75 acres in extent, for the purpose of extending the waterworks.—The land, it was stated, lies some 4 miles to the eastward of the town. It is proposed to provide an additional storage reservoir (the present reservoir occupies the top of the Barff), and to use the other land as a protective area. Mr. R. Bruce Gray, surveyor and water engineer to the council, said the present consumption was about 300,000 gallons per twenty-four hours, and the existing reservoir had a capacity of 820,000 gallons. They had plant for supplying 26,000 persons, but were actually only supplying 12,000, including the rural districts. Mr. Gray mentioned, in reply to the inspector, that the present site which they had on the Barff consisted of about 6¼ acres and cost £1,500. The remaining 75 acres would cost about £600. They would probably let the shooting rights. If they found it desirable to cut across the fall of the strata, which dipped to the eastward, they would probably drive adits a considerable depth and catch the water as it fell eastwards.

Witney R.D.C. (February 18th. Mr. F. O. Stanford).—£866 to defray the cost of purchasing the undertaking and works of the Bampton Water Company.—Mr. H. Howard Humphreys described the existing

works, and stated that he had made ten or a dozen openings in the mains, which, as near as he could say without making further extensive openings, consisted of about 128 tons of mains, varying in size from 6 in. to 3 in., and were of the aggregate length of about 3½ miles. There was also a small quantity of 1½-in. water main, and five hydrants with two wash-outs. The rising main, which was also used as a service main, communicated with the tank, which, when full, was capable of containing 12,000 gallons.

Worthing T.C. (March 7th. Mr. Edgar Dudley).—£1,940 for the purchase of property for the widening of Chapel-road at the north end.—The assistant town clerk (Mr. L. H. Cheffins) stated that the matter of widening other parts of this road had been before the board previously. It was a busy thoroughfare, forming part of the main Horsham and London road, and was on the way from Brighton to Portsmouth. At the point referred to in the present scheme it was 38 ft. wide, and the widening would make it approximately 50 ft. throughout.

APPLICATIONS FOR LOANS.

Barrow-in-Furness T.C.—£750 for sewerage works.

Belfast T.C.—£21,572 for completing the new abattoir.

Beverley T.C.—£5 900 for a new school.

Blackburn T.C.—£2,330 for the purchase of property for street improvement.

Blaenavon U.D.C.—£13,700 for extending the water supply.

Bognor U.D.C.—£1,800 for the erection of twelve cottages.

Birmingham T.C.—£2,748 for the extension of the Cambridge-street lighting depot.

Bridlington T.C.—£1,600 for extensions to the sanatorium.

Canterbury T.C. £7,000 for the purpose of road improvement.

Carrickfergus U.D.C.—£1,200 for making new footpaths.

Colchester T.C.—£12,500 for a new school, and £7,660 for electricity extensions.

Coventry T.C.—£412 for surface-water sewerage.

Croydon T.C.—£2,750 for school extension.

Dungannon U.D.C.—£1,500 for water supply purposes.

Halstead R.D.C.—£7,500 for a water supply scheme.

Loughborough T.C.—£800, amended estimate for the New-street improvement.

Malvern U.D.C.—£1,500 for laying new water mains.

Middlesbrough T.C.—£2,190 for paving works.

Newbury T.C.—£1,200 for wood paving repairs.

Newcastle-under-Lyne T.C.—£1,000 for private street works.

Nuneaton T.C.—£500 for works of street improvement, and £750 for sewerage works.

Poole T.C.—£2,000 for road works and surface-water drainage, and £355 for private street works.

Settle R.D.C.—£2,220 for a water supply.

Southampton T.C.—£500 for a Venturi meter and other appliances.

LOANS SANCTIONED.

Brighton T.C.—£6,313 for repaving Old Steine and Pavilion-parade.

Chorley T.C.—£829 for the purchase of a site for a school.

Clacton U.D.C.—£8,000 for a band stand.

Dewsbury T.C.—£1,050 for the Northgate improvement scheme.

Hendon U.D.C.—£23,247 for private street improvement.

Poole T.C.—£600 for laying out Alexandra Park.

Romford R.D.C.—£525 for a road improvement.

FORTHCOMING INQUIRIES.

MARCH.	£
17.—**Taunton.** For the erection of working-class dwellings (Mr. H. Ascough Chapman)	1,722
17.—**Watford.** For the erection of working-class dwellings (Mr. C. H. Eyles)... ...	3,148
17.—**Wembley.** For the purpose of a burial ground (Mr. R. H. Bicknell)	3,085
18.—**Barrow-in-Furness.** For school and recreation ground purposes (Mr. Edgar Dudley)	13,750
18 **St. Helens.** For works of street improvement (Mr. M. K. North)	430
18 **Swansea.** For the purposes of small dwellings (Mr. H. S. Stewart)	1,060
18 **Wimbledon.** For the construction of an open-air swimming bath (Mr. R. H. Bicknell)	1,650
19. **Harwich.** For fire brigade purposes (Mr. Courtenay Clifton)	1,101
19 **Preston.** For street improvement purposes (Mr. Edgar Dudley)	4,500
19. **Watford.** For the improvement of the heath (Mr. R. H. Bicknell)	1,100
20. **Barry.** For the erection of bathing shelters (Mr. H. S. Stewart)	1,250
20. **Burton-upon-Trent.** For works of street widening (Mr. Edgar Dudley)	1,250
20 **Chippenham.** For road improvement purposes (Mr. H. Ascough Chapman) ...	1,000
27.—**Eastbourne.** For the purposes of the infectious diseases hospital (Mr. S. St. George Mivart)	1,200
20 **Manchester.** For the erection of a library (Major J. Stewart)	5,000
20 **Sedgley.** For the purposes of the gas undertaking (Mr. M. K. North)	5,000
27. **Leigh-on-Sea.** For road widening purposes (Mr. Edgar Dudley)	875

LOWER THAMES VALLEY DISTRICT SURVEYORS' ASSOCIATION.

The ordinary monthly meeting of the Lower Thames Valley District Surveyors' Association—which was exceedingly well attended—was held at the Town Hall, Twickenham, on Saturday, the 1st inst., the president, Mr. H. F. Coales, ASSOC.M.INST.C.E., presiding over the gathering.

The president, in the name of the association, welcomed a new member in the person of Mr. R. W. Hindhaugh, of Ham, Surrey.

The meeting further discussed the question of Hill's vacuum motor road-cleansing machine [see THE SURVEYOR, December 20, 1912], the Metropolitan Water Board's Bill, and the London and South-Western Railway Company's Bill.

The various methods of road surfacing were afterwards considered, a number of members giving particulars of trials of different materials. Under the heading of "Surface Dressing" were classified tar dressing, pitch dressing and Tarvia dressing; while under the heading of "Surface Crust" the meeting dealt with water-bound roads, "Plascom," "Tarvia" and granite, "Roemac," tarred slag, pitch-bound roads, lime and tar bound roads, "Tarco," "Roadoleum," "Cormastic," "Roadamant," wood block paving, "Mexphalt," granite-sett paving and asphalt.

A new method, which a member had found most satisfactory for resurfacing roads, was described: The road, it was explained, was scarified, then levelled to the proper contours with the material scarified, and thoroughly rolled with a 10-ton steam roller. This was surfaced with granite broken to a 2-in. gauge, which was spread over the whole surface to a thickness of 2½ in. and rolled. This was sprayed with hydrated tar, and the surface then covered with limestone topping of ¾-in. gauge, similar to that used for footpaths. This was brushed over the surface of the tar-sprayed granite so as to fill up all interstices and afterwards thoroughly rolled. When finished, the surface was sprinkled with ⅜-in. granite chippings, and the roller again passed over. It was found that 1 ton of limestone topping would cover, approximately, 106 super. yds., and the cost was only 1s. 8d. per yard. It was found that this work could be carried out when the weather was not all that could be desired so long as the new granite, which dried quickly in the wind, was dry when the tar was sprayed on.

The association also considered the question of the annual dinner, the matter being ultimately left in the hands of the president and secretary to report upon at the next meeting. The covering in of the ponds of swimming baths during the winter was also considered.

Municipal Work in Progress and Projected.

The Editor invites the co-operation of Surveyor *readers with a view to making information given under this head as complete and accurate as possible.*

The following are among the more important projected works of which particulars appear below: Buildings—Coventry £3,500, Dublin £71,413, Marylebone, Newport (Mon.): housing and town planning—Glasgow £60,000, Penzance £6,000; refuse collection and disposal—Saddleworth; roads and materials—Blackburn, Bradford, Elgin £10,000, Hendon £60,013, Wandsworth £15,850; sewerage and sewage disposal—Flaxton £5,576, Tenby; water, gas and electricity—Accrington, Birmingham £500,000; miscellaneous—Bradford.—Particulars of other works projected will be found on our "Local Government Board Inquiries" pages.

BUILDINGS.

Airdrie T.C.—Mr. Andrew Carnegie has made an offer of £5,500 for the provision of a public library.

Bootle T.C.—A new chapel is to be built in the cemetery at a cost of £2,000.

Coventry T.C.—The building and site of Old Coventry Brewery are to be converted into a general municipal depot, at an estimated cost of £3,500.

Dublin T.C.—The tender of Mr. John Mackay, at £71,413, has been accepted for the completion of the works in connection with the new reservoir at Roundwood.

Gateshead T.C.—A new evening school is to be erected at an estimated cost of £4,300.

Hellensburgh T.C.—The tender of Messrs. P. McBride & Co., of Port Glasgow, at £3,432, has been accepted for the rebuilding of the sea walls between Glasgow-street and Ardencaple Castle.—The public office at the gasworks is to be rebuilt at a cost of £450.

Liverpool T.C.—In connection with the scheme for public baths at Pierhead the Baths Committee have approved a swimming bath, 120 ft. by 40 ft., for gentlemen, and another, 75 ft. by 40 ft., for ladies, each with ample dressing-boxes.

Marylebone B.C.—A freehold site has been purchased in Marylebone-road for £40,000 for the purpose of erecting a new town hall.

Newport (Mon.) T.C.—The Works and Parliamentary Committee have again considered the question of erecting on another site a town hall with police accommodation and assize courts, and have agreed that the present time is not opportune for embarking upon so large an expenditure, and that the scheme for building upon another site should be referred back to the architect, to bring up a proposal for the erection of a town hall and law courts under one roof instead of in separate buildings.

Stockport T.C.—A scheme for a phthisis hospital and dispensary, at a cost of £1,250, has been approved.

Willesden U.D.C.—It has been agreed to erect slipper baths on the Church End and South Kilburn sites, at a cost not exceeding £4,500 in respect of each building, the Church End site being so laid out as to leave room for the provision of a swimming bath at a future date.

HOUSING AND TOWN PLANNING.

Barking T.C.—The tender of Mr. E. H. Glenny, at £5,442, has been accepted for the erection of twenty-six houses in Boundary-road.

Bognor U.D.C.—A block of twelve cottages is to be erected, at an estimated cost of £1,800.

Callington (Cornwall) U.D.C.—Plans are to be prepared for the provision of workmen's cottages.

Colwyn Bay U.D.C.—It has been decided to purchase nearly 7 acres of land for the purpose of a housing scheme, and the surveyor, Mr. William Jones, has received instructions to prepare the plans and other particulars. The price of the land is £1,500.

Glasgow T.C.—A special committee recommend the council to erect 240 cottages at Riddrie, at an estimated cost of £60,000.

Hayes U.D.C.—£500 is to be expended upon a site for a housing scheme.

Liverpool T.C.—The Housing Committee have received the information that the Local Government Board have confirmed the Provisional Order for the acquirement of property in Jordan, Sparling and Gore streets for housing purposes. The committee have adopted the city surveyor's report regarding the supply of hot water to the houses in course of erection in St. Anne-street, the constant supply system being approved. A bath and hot water will be provided in each house.

Lurgan U.D.C.—An extensive housing scheme, estimated to cost £10,000, has been approved.

Penzance T.C.—Thirty-three houses are to be built at an estimated cost of £6,000.

Pontardawe R.D.C.—The council have referred to the Housing Committee the plan prepared by the engineer, Mr. John Morgan, for fifty houses on a site adjoining Penybank-road, Clydach. Mr. Morgan reports that the land would lend itself admirably to the building of houses on "garden village" lines, with open space for recreation grounds.

Torrington T.C.—Dr. Carnworth, Local Government Board inspector, in a report on the sanitary condition of the town, declares that some of the cottage property is worse than any slum property he had seen in the worst part of London. He suggested that the Local Government Board would accept a proposal to start with fifteen new houses, and the council have agreed to go thoroughly into the matter, and report to the board at an early date.

Upton-on-Severn R.D.C.—Subject to the sanction of the Local Government Board being obtained, it has been resolved to proceed with a housing scheme.

Warminster U.D.C.—The question of adopting a scheme under the Housing of the Working Classes Act has been engaging the attention of the council, and will again be considered at a future meeting.

PARKS AND OPEN SPACES.

Birkenhead T.C.—The Local Government Board have declined to accede to the application of the council for a loan for the purpose of acquiring a large tract of land contiguous to the borough, and known as the Storeton estate.

Fort William T.C.—Victoria Park is to be conveyed to the council by the freeholder, Mrs. Cameron Lucy, at a nominal rate of feu-duty, for the use and enjoyment of the citizens. The Parade is to be transferred on somewhat similar conditions.

Middlesbrough T.C.—The Parks Committee have been asked to report upon the question of laying down bowling greens in Albert Park.

Whitby T.C.—Alderman R. E. Pannett has presented the council with the Chubb Hill estate for the purpose of pleasure grounds.

REFUSE COLLECTION AND DISPOSAL.

Cheam P.C.—The tender of Mr. A. Lavender for the removal of house refuse for a year was accepted at £250, a stipulation being that the contractor should supply coverings of metal or wood for the vans in place of tarpaulins as used formerly. Little Cheam thus sets a good example to big London, where every day loaded refuse carts may be seen with no protection of any kind. A few days ago we saw a loaded cart by Blackfriars Bridge with a dustman busily engaged in levelling with his hands the top layer of muck. Needless to say, the superfluous filth was being literally wafted into the faces of passers-by and the adjacent shops.

Saddleworth U.D.C.—Inquiries are being made as to the probable cost of a refuse destructor scheme.

ROADS AND MATERIALS.

Acton U.D.C. The Works Committee recommend a loan of £5,000 for tar-macadam resurfacing works.

Blackburn T.C.—The borough engineer, Mr. W. Stubbs, has prepared a scheme for the improvement of the central streets of the borough, with the object of diverting "through" motor traffic from the main shopping streets, on account of its noise, smoke and dirt. The construction of a road from Darwen-street Bridge to Northgate should, he considers, be

the first undertaking. This should be 60 ft. wide, and, besides being a few feet nearer than the present route from Bolton-road to Sudell Cross, would relieve the Witton to Whalley traffic of its tortuous progress by way of Astley-gate. The next improvement should be a new road from Darwen-street Bridge to Bridge-street, the arching in of the river Blakewater at Water-street, and a continuation of this road through to Whalley Range, thus creating a new main road north and south, and avoiding the gradients of the Penny-street route. The widening of Richmond-terrace and its continuation through to Eanam would make a main road east and west, and a new route from King-street to Jubilee-street, and a widening of that street would give better approaches to the station and take through traffic away from the central shopping area. The extension of Simmons-street, Strawberry Bank, and the widening of Victoria-street are mentioned as minor improvements.

Bradford T.C.—The Sewage Committee have endorsed the recommendation made by the Works Sub-Committee that the council adopt the composite scheme for crossing the Esholt Valley. This scheme will give a road 40 ft. wide in parts, and will be partly of masonry and partly of material from the tank-area and the big tunnel.

Bridlington T.C.—The borough surveyor, Mr. E. R. Matthews, has received instructions to prepare plans for several street improvement schemes.

Bromley T.C. A settlement has been reached with respect to the disputed price of land in Market-square, it being now admitted by certain claimants that it is part of the public highway, and the way is now open for the council to carry out a valuable widening at a congested corner at a very moderate cost.

Calne T.C. Repaving works are to be carried out at White Hart-corner, Kingsbury-street, The Green, The Strand, and High-street.

Chard T.C.—The borough surveyor, Mr. E. W. Hearn, has received instructions to prepare plans and estimates of the improvement of Combe-street corner, and to take a census of the traffic passing the corner with a view to obtaining a grant from the Road Board towards the cost of the work.

Chelmsford T.C.—The surveyor, Mr. P. T. Harrison, has prepared plans for the widening of Rainsford, Broomfield, and Baddow roads, and an intimation has been received that the Highways Committee of the county council were recommending the council to pay £500 on account of the cost of the acquisition of the Old White Hart premises for the widening of Baddow-road corner.

Chesterfield T.C.—The council are recommended by a committee to widen South-street, at an estimated cost of £2,000.

Clacton U.D.C.—A portion of the Marine-parade is to be repaired with Pitchmac.

East Barnet U.D.C.—Lyonsdown-avenue is to be made up, at an estimated cost of £2,355.

Elgin C.C.—Application has been made to the Road Board for a grant of £10,000 for road reconstruction at Forres.

Girvan T.C.—Steps are to be taken to purchase for road improvement purposes a strip of ground skirting the river Girvan as it enters the harbour. The burgh surveyor, Mr. J. A. McLeod, estimates the cost of widening and making up at £218.

Gravesend T.C.—Consideration is being given to proposals for laying creosoted wood blocks in Pelham-road, at an estimated cost of £1,650.

Hendon U.D.C.—Plans have been adopted for wood and stone sett paving works, estimated to cost £60,013.

Lancaster T.C.—Macadamising and asphalt work, estimated to cost £735, has been approved.

Lincoln T.C.—Application has been made to the Road Board for a grant and short loan towards the cost, estimated at £8,120, of surfacing several highways with tar-macadam.

March U.D.C.—A £4,000 road improvement scheme is being considered by the council.

Northants C.C.—An application has been made to the Road Board for a grant of £4,125 towards the estimated cost (£5,500) of tar binding and surface tarring on the main roads.

Southport T.C.—The Road Board have intimated that they are prepared to make a grant of £2,000 toward the cost of improving certain approach roads to Southport. The total cost of the improvements is estimated at £15,083. The chairman of the Town Planning Committee and the borough surveyor, Mr. R. P. Hirst, have been asked to report on the matter.

Teddington U.D.C.—Mr. M. Hainsworth, the surveyor, has prepared particulars of the estimated cost of widening and reconstructing Waldegrave-road, and application is to be made to the Road Board for a contribution towards the cost.

Uckfield R.D.C.—It has been decided to make up Western-road, Jarvis Brook, with flints, at a cost not exceeding £200.

Walmer U.D.C.—Road work estimated to cost £840 has been approved.

Wandsworth B.C. The council have agreed that the plans, estimates, and other particulars required in respect of road works, amounting to £15 850, should be submitted to the Road Board, and that application should be made to the board for a grant of £10,000.

SEWERAGE AND SEWAGE DISPOSAL.

Acton U.D.C.—The Highways Committee recommend the construction of an underground convenience at St. Mary's Mount, at a cost of £700.

Crewe T.C.—Eleven sprinklers are to be provided for the bacteria beds at the sewage disposal works, at an estimated cost of £1,660.

Flaxton R.D.C.—The Sanitary Committee are considering a sewerage scheme for Heworth which is estimated to cost £5,576.

Kensington B.C.—The plans of the borough engineer, Mr. A. R. Finch, have been approved for the construction of an underground convenience at the junction of Golborne-road, Bevington-road and Portobello-road, at an estimated cost of £1,700.

Lanarkshire C.C.—The contract for the new sewage purification works to be erected at the Threeneuk, adjacent to the Clyde, at Cambuslang, has been given to Messrs. Train & Taylor, Dalmarnock.

Lymington R.D.C.—The sewerage scheme for Milford is being amended by Mr. Shenton previous to being submitted to the Local Government Board.

Radstock U.D.C.—An agreement has been entered into with the Midsomer Norton Urban District Council for the treatment of the Clandown sewage.

Romford R.D.C.—Sewerage works are to be carried out at Dagenham, at a cost of £1,400.

Teddington U.D.C.—The Public Works Loan Board has acceded to the application for a loan of £36,865 for sewage disposal extension works, to be repaid as to £8,931 in fifteen years, and as to £26,934 in thirty years, the interest to be 3½ per cent.

Tenby T.C.—Mr. T. J. Moss-Flower, of Westminster and Bristol, has been instructed by the Corporation of Tenby to complete his plans of the proposed new sewerage works, so that application may be made to the Local Government Board for sanction to borrow the necessary money for carrying out the work, which includes construction of cast-iron outfall, 4 ft. in diameter, to low-water level of high spring tides, 6-ft. diameter tank sewer, including penstock and screening chambers, and other subsidiary works, and the reconstruction of the low-level main sewers.

Tendring R.D.C.—A scheme has been prepared for the drainage of Thorpe.

Thirsk R.D.C.—The surveyor, Mr. C. A. Lake, is preparing a scheme of sewage disposal for Pickhill.

Weardale R.D.C.—The county council have intimated that they would be prepared to allow the provision of new sewage purification works at Eastgate and Windyside to stand over until 1914, on the understanding that similar works were provided for Daddry Shields this year. In view of this letter the council adopted a committee's recommendation to offer the sum of £450 for a farm at Daddry Shields in order to erect the works on that land.

WATER, GAS, AND ELECTRICITY.

Accrington T.C.—The borough surveyor, Mr. W. J. Newton, has received instructions to prepare an estimate of the cost of extending the reservoir.

Alnwick R.D.C.—Mr. R. Askwith, of Witton-le-Wear, engineer, has been asked to report on the Acklington water supply

Birmingham T.C.—Being advised by the city engineer, Mr. H. E. Stilgoe, that additional yard space

will be required in connection with the Cambridge-street lighting depot, the Lighting Committee recommend the purchase of freehold land at a cost of £2 673.

—The rapid increase in the consumption of water shortly will force the corporation to undertake costly new works. At a special meeting the Water Committee had before them the question of providing a third pipe line from the Elan Valley to Frankley reservoir, and although no definite decision was come to, the officials are to get out estimates of the cost of the work. The undertaking will, it is believed (says the *Birmingham Post*), involve an expenditure of between £400,000 and £500,000.

Chirk R.D.C. Consideration is being given to a water supply scheme which is estimated to cost £2,450.

Merthyr Tydfil T.C. — The Ransome-verMehr Machinery Company, Limited, Brunswick House, Westminster, S.W., have been favoured with a contract by the Merthyr Tydfil Corporation for the supply of three Ransome continuous filters, which are guaranteed to treat 1,200,000 gallons of water per day of twenty-four hours. The filters will be supplied complete with the firm's patent coagulent apparatus, which continuously and accurately proportions the amount of coagulent in direct ratio to the quantity of water being treated by the filter at any given time. It may interest our readers to know that the company have in operation at their office a small model filter, which shows quite clearly the main features of the Ransome continuous system, and the working of the coagulent apparatus.

Norton (Yorks) R.D.C. Plans of the Leavening water supply scheme have been submitted by Mr. H. Tobie and approved. The cost is estimated at £340.

Tottenham U.D.C.—Owing to the increasing necessity of reducing the cost of fuel, the council propose to instal economisers at the Whiston-street electricity station, at a cost of £1,600. The additional plant is estimated to reduce the coal bill by approximately 10 per cent, and so recoup the outlay, which it is proposed to charge to the reserve fund, in the first twelve months.

MISCELLANEOUS.

Bradford T.C.—It is proposed to purchase two more motor fire engines, costing £900 each.

Manchester T.C.—The Tramways Committee have decided that they will be able to make a contribution of £100,000 in relief of the rates, after allowing for depreciation and other incidentals. The sum is the largest that has been contributed by any municipal undertaking as the result of a year's working.

Association of Engineers-in-Charge.—The eighteenth annual dinner of this body will take place at the Holborn Restaurant on Saturday, April 12th, Dr. Hele-Shaw, the president, in the chair.

Road Tarring and Fish Life.—The Isle of Wight Rural District Council have agreed to pay £325 in settlement of an action begun against them by the proprietors of the trout fishery at Carisbrooke for damage to the fish alleged to have been due to washings from tar-sprayed roads that got into the streams. The contractor for the tar-spraying, who had given a guarantee that the tar-spray used was harmless to fish, paid £200, and the council have to pay the balance, with their own costs, crude tar having been used on the roads on another occasion.

The Work of the Road Board.—In the course of the debate on the incidence of local taxation in the House of Commons on Tuesday, the Chancellor of the Exchequer said: Reference had been made to roads, and complaints had been made that London got only a small contribution from the Road Board. It must be remembered that the motors registered in London tore up the country roads, and there was something to be said for the adjoining counties. This was, however, a question of policy for the Road Board. The object of the board was not merely for the purpose of maintaining roads. It was for fitting them for motor traffic, and, where necessary, for making new roads. The Road Board were considering the question of a fresh order from London, which was very much needed. He would regard it as a bad policy if the board paid all its money in grants for the maintenance of roads, and had not accumulated a penny. He hoped the board would not be asked to scatter its funds, for they would be useful during periods of unemployment when work could be found on well-prepared schemes of road-making.

PERSONAL.

Mr. A. S. West, borough water engineer, Harrogate, has had his salary increased to £350 per annum.

Mr. F. W. Spurr, city engineer of York, on Monday had his salary increased from £500 to £550 per annum.

Mr. Patrick Walsh, of Bonniconlan, Ballina, has been appointed assistant county surveyor of County Mayo.

Messrs. L. F. M. Blake, Wincanton, and C. Borthwick, of Bristol, have been appointed assistant surveyors to the Wincanton Rural District Council.

Mr. F. H. Holford, city property surveyor, Newcastle-upon-Tyne, has had his salary increased by £100 to £700 per annum.

Mr. Arthur Evans, who has been a member of the Salford borough engineer's staff since 1874, has been appointed chief highway surveyor for the borough.

Mr. J. H. de C. Ballardie, A.R.I.B.A., has been appointed city architect and surveyor of Calcutta at a salary of 1,350 rupees per month, inclusive of travelling and other allowances.

Mr. Henry Gregory, of the Aberdeen burgh surveyor's department, last week gave an address on "The Aberdeen Main Drainage Works" before the Aberdeen Association of Civil Engineers.

Col. R. E. Crompton, C.B., Mr. E. S. Shrapnell-Smith and Captain H. H. P. Deasy have been nominated to give evidence on behalf of the Roads Improvement Association before the Select Committee on Motor Traffic.

Mr. H. A Endsor, highways surveyor to the Keynsham (Somerset) Rural District Council, who is leaving for Canada, has been presented by the members and officials of the council with a pair of prismatic field glasses.

Teddington Urban District Council have referred to the surveyor, Mr. M. Hainsworth, the eighty-four applications received for the position of clerk of works, for the preparation of a schedule to be considered by a committee.

Mr. E. W. Hearn, borough surveyor of Chard, was last week presented with a roll-top desk to mark the occasion of his forthcoming marriage, the gift, which was presented by the Mayor, being subscribed for by the members of the corporation.

Mr. R. S. Heath, who recently completed his articles with Mr. H. Holmes, M.INST.C.E.I., borough surveyor and waterworks engineer of Ossett, has been appointed an assistant in the borough engineer's and surveyor's office, Cambridge, at a commencing salary of £80 per annum, increasing by annual increments of £10 to £120 per annum.

Messrs. G. E. Clarke, borough surveyor, Boston, Lincs, G. Kermode, city engineer, Hawthorn, Victoria, E. B. Martin, borough and waterworks engineer, Rotherham, and W. H. Morton, city engineer's office, Wellington, New Zealand, have been transferred from the class of associate member to that of member of the Institution of Civil Engineers.

Mr. Llewellyn Lewis, articled pupil to Mr. C. H. Lawton, surveyor to the Warminster Urban District Council, who has been appointed assistant surveyor to the Weybridge Urban District Council, entertained the Warminster staff and employees to dinner previous to taking up his new duties. In the course of the proceedings Mr. Lewis was presented by Mr. Lawson with a Gladstone bag.

Mr. Allen Gidley, STUD.INST.C.E., an assistant on the staff of the borough engineer and surveyor, Grimsby (Mr. H. Gilbert Whyatt, M.INST.C.E.), has been successful in obtaining an appointment as an assistant engineer in the Public Works Department of the Federated Malay States. On his leaving the office he was, on Saturday last, the recipient from Mr. Whyatt and his colleagues of a volume on "Civil, Mechanical and Electrical Engineering."

Mr. D. MacBean, assistant surveyor to the Middle Ward District of Lanarkshire, has been appointed road surveyor to the First District Committee of Inverness-shire. There were sixty-eight applicants for the position. Mr. MacBean, who is a member of the Institution of Municipal and County Engineers and the Road Surveyors' Association of Scotland, was the recipient of several valuable gifts from the highways department and friends in Hamilton, where he was stationed.

THE NORWICH FLOOD.

WORK OF THE CITY ENGINEER'S DEPARTMENT.

In the synopsis of the work carried out during 1912 by the Norwich city engineer's department, Mr. A. E. Collins, city engineer, devotes some space to the disastrous flood of August last, and the manner in which it was dealt with by the staff. He states:—

"Very great demands were made on the department, under the direction of my deputy, in rescuing persons from houses in the inundated area, the despatch of help in cases where houses had settled, and in preventing the blockage by debris of the city bridges. The services in question were frequently such as to involve much risk to those who performed them. As regards buildings, my department removed dangerous portions of the *Norwich Mercury* Company's former riverside works, and Boston Blacking Company's premises, adjoining St. George's Bridge; it was also called upon to shore up dangerous buildings at Churchill-road, Kett's-hill, Gloucester-street, and many other places. In addition to helping in the work of rescue, my department organised and carried out a system of food distribution to persons who elected to remain in their water-surrounded houses; it subsequently assisted in the issuing of rations at St. Andrew's Hall to those persons, numbering several thousands, who were unable for some days to provide for their own sustenance. Several subsidences took place owing to the excessive rainfall causing sewers to collapse, notably in Churchill-road and passages, Kett's-hill and King-street. Many blockages of sewers were caused, in many cases sewers being found packed tight with silt, and manholes were filled to a height of several feet. In one instance 7 ft. of silt had accumulated in a manhole. In two instances the sealed mains became blocked and were cleared by compressed air. With the exception of these cases the sewers acted well. . . . . Subsequently the department compiled record plans showing the area of the flood from Great Yarmouth to the Yare, Wensum and Bure watersheds. Simultaneously levels were taken at all river bridges, fords, mill dams, &c. A photographic survey was made of the river from Hellesdon to Carrow Bridges. Arising out of the necessity for greatly increasing the discharging capacity of the river through the city, numerous plans and sections have been prepared for the consideration of the Flood Prevention and Housing Committee and for record purposes. The same committee has also considered the question of the demolition, on a large scale, of very old buildings in portions of the flooded area, and the erection in their place of modern dwellings, in accordance with plans and particulars furnished by me."

FOR OTHER ADVERTISEMENTS

See End of Paper.

COUNTY BOROUGH OF IPSWICH.

APPOINTMENT OF BOROUGH ENGINEER AND SURVEYOR.

The Town Council of Ipswich invite applications from duly qualified persons for the appointment of Borough Engineer and Surveyor. The person appointed must be capable of carrying out and performing all the duties of a Borough Engineer and Surveyor, under the Public Health Acts, the Municipal Corporations Act, 1882, and all other Acts incorporated therewith or amending the same respectively; but he will not be responsible for the waterworks, or the Electric Supply, or Tramway Undertakings of the Corporation. He must devote the whole of his time to the duties of the office, and take no private practice whatever. Age of applicants not to exceed 35. Salary £350 per annum, increasing by £50 every other year to £550.

The Council are retaining the services of the present Surveyor as Consulting Engineer and Surveyor.

Applications, stating qualifications, age and particulars of present appointment, accompanied by copies of three recent testimonials, to be sent to the undersigned, endorsed "Borough Surveyor," by four o'clock on Saturday, 12th April, 1913. Canvassing is strictly prohibited.

WILL. BANTOFT,
Town Clerk.

Town Hall,
Ipswich.
March 13, 1913. (282)

CITY OF TRURO.

TEMPORARY ASSISTANT.

A Temporary Assistant is required in the Office of the Engineer and Surveyor for a period of about two months.

Applicants must be neat draughtsmen, accurate surveyors and levellers, and have had experience in sewerage works. Applications, stating age, experience, and salary required, should be sent to the undersigned not later than Saturday, the 29th inst.

FREDK. A. BARNES, ASSOC.M.INST.C.E.,
City Engineer and Surveyor.

Municipal Buildings, Truro.
March 12, 1913. (281)

MIDLOTHIAN COUNTY COUNCIL.

The County Council of Midlothian invite applications for the position of County Road Surveyor, at a salary of £450 per annum, with actual travelling expenses up to £100 per annum.

Particulars of the duties and conditions of the appointment may be obtained on application to the undersigned.

Applications, with testimonials, endorsed "County Road Surveyor," must be delivered to me on or before Monday, 31st March current. Twelve copies of application and testimonials are required.

A. G. G. ASHER,
County Clerk.

County Rooms,
Edinburgh.
March 14, 1913. (283)

FRIERN BARNET URBAN DISTRICT COUNCIL.

ENGINEER AND SURVEYOR'S DEPARTMENT.

Required, a Junior Assistant. Must have a good practical knowledge of Surveying, Levelling and Draughtsmanship.

Preference would be given to a Student of the Institute of Municipal and County Engineers.

Applications, in candidate's own handwriting, accompanied by not more than three recent testimonials, on the Forms to be obtained at my Office, must reach me not later than March 27th, 1913.

Commencing salary at the rate of £50 per annum.

(By order)
E. J. REYNOLDS, ASSOC.M.INST.C.E.,
Engineer and Surveyor.

Council Offices,
The Priory, Friern Barnet, N.
March 12, 1913. (284)

WANTAGE URBAN DISTRICT COUNCIL.

TO GRANITE MERCHANTS AND OTHERS.

The above Council invite Tenders for the Supply and Delivery to Wantage-road Station of about 750 tons of Broken and Unbroken Granite, Basalt and Limestone, in quantities as required, from the 1st April, 1913, to 31st March, 1914.

No Form of Tender is issued, but all information required may be obtained of the Surveyor, Mr. T. C. Betts, Town Hall, Wantage, to whom samples of the Materials quoted for are to be sent.

Endorsed Tenders must be sent to the undersigned not later than Monday, the 31st day of March, 1913.

The Council do not bind themselves to accept the lowest or any Tender.

EDWD. B. ORMOND,
Clerk.

Council Offices,
Wantage.
March 12, 1913. (279)

LANCASHIRE COUNTY COUNCIL.

The County Council invite Tenders for the Hire of Steam Rollers during the year ending 31st March, 1914.

Particulars and Forms of Tender may be obtained on application to the County Surveyor, Mr. W. H. Schofield, County Offices, Preston, to whom sealed and endorsed Tenders must be delivered not later than Saturday, March 29th, 1913.

The County Council do not bind themselves to accept the lowest or any Tender.

(Signed) HARCOURT E. CLARE,
Clerk to the County Council.

County Offices, Preston.
March 12, 1913. (280)

The Consistency of Bituminous Materials: Its Determinations and Value in Specifications.*

By W. W. CROSBY, D.Sc., Chief Engineer of the State Geological and Economic Survey and of the State Roads Commission, Maryland, U.S.A.

(*Conclusion.*)

Reference has just been made to the determination of consistency at different temperatures. Those used are usually 0 deg. or 4 deg. Cent. and 100 deg. Cent. The writer prefers 4 deg. Cent. for the low temperature because of the greater ease of obtaining it, and because he feels nothing is gained by going to the additional trouble of securing 0 deg. Cent. Those determinations made on the normal material are frequently supplemented by others on the residue left after heating the normal material for fixed periods at certain temperatures. These latter determinations of consistency are usually made at only two temperatures (4 deg. and 25 deg. Cent.), and as the quantity of the residue is usually small—less than 50 grammes—hence the desirability in a comprehensive instrument for an ability to perform its work on small quantities of material.

As yet no relation between the different consistencies of the same material at various temperatures seems to exist, and none can, of course, be expected between different bituminous materials at any temperatures. Determinations of consistency are wanted on the normal pitch at 4 deg., 25 deg., and 100 deg. Cent., in order, as before suggested, to know the best methods of using the material offered, or in order to prescribe limits for materials to be offered when the methods of use are predetermined. They may also be wanted in order that the probable results of the use of any materials may be deduced.

Determinations of the consistency of the residues after heating the normal material are wanted for the sake of comparison with the determinations on the normal material in order that deductions may better be made concerning the results of the use of the material in question.

For instance, the writer has learned from experience that an oily pitch compound showing by test the following consistencies: Normal material—

25 deg. Cent. = 22 sec., Lunge (to 1.40).
100 deg. Cent. = 112 sec., Engler.

After evaporation for twenty-one hours at 105deg. Cent., where loss was 1·75 per cent—

Residue at 4 deg. Cent. = too soft to measure with needle.
Residue at 25 deg. Cent. = too soft to measure with needle.

After evaporation for five hours at 205 deg., where loss was 7·8 per cent—

Residue at 4 deg. Cent = 146 with needle.
Residue at 25 deg. Cent. = too soft to measure with needle,

must be heated in order to be applied to the road, would require more than three years to "set up" sufficiently, would flow in the road during warm weather, and would act more as a lubricant between pieces of stone as large as pigeon's eggs rather than as a binder of them.

With a sticky pitch compound showing the following constituencies: Normal material—

25 deg. Cent. = 358 with needle.
100 deg. Cent. = 302 sec., Engler.

Evaporation for twenty-one hours at 105 deg. Cent., 10 sec. = 9·5 per cent—

4 deg. Cent. = too hard for needle.
25 deg. Cent. = 13 with needle,

would require heating before use, gave a resulting surface very hard and slippery in cold weather, but the binding of the stone was excellent, the pitch hardened sufficiently in quick time, and was inclined to be at first susceptible to temperature changes, though this feature gradually disappeared with age, and later to be friable in cold weather.

In a third case, where the consistencies of the normal material were—

25 deg. Cent. 656 sec., Lunge (read to 1·40).
100 deg. Cent 9 sec., Lunge (read to 1·40).

Evaporation twenty-one hours at 105 deg. Cent. loss = 6·5 per cent—

4 deg. Cent. = 14 with needle.
25 deg. Cent. = 59 with needle.

The pitch required heating before use, "set up" sufficiently quickly, bound the stone properly, never has become slippery or hard, never has been objectionably soft in hot weather, and after three years' exposure to traffic shows as yet no signs of loss of life nor of material physical deterioration.

A determination of the consistency of the residue is absolutely necessary in order that a purchaser may know how much "asphalt," "asphaltic base," "pitch," or whatever term for the base you will, he is getting when the delivery is made with this base in a fluxed condition. It is generally the case that this base is the more valuable portion of an asphaltic pitch compound, and that, other things being equal, the value of the compound varies in proportion to the amount of base contained. Such a base is of too complex a chemical character to be exactly defined under the present state of the chemical knowledge of the subject, but its satisfactory description may now be made by the reliance upon a few chemical qualities and a few physical ones, including an expression of the consistency. The writer is of the opinion that such a description may be made clearer and simpler as improved methods of determining and expressing the measure of consistence become recognised.

In this connection it may be of interest to note that where specifications formerly provided that the pitch compound should contain a specific percentage of "asphaltic base of a penetration of 50 deg.," they now require that, the compound having been subjected to evaporation for a definite period at a fixed temperature, the residue shall be at least a certain percentage of the original sample, and shall "show a penetration of not less than —— nor more than ——." The impracticability of evaporating to any definite penetration became quickly apparent when the softer pitch compounds began to be used in large quantities—hence the change in expression. It is now well known that a difference of a small percentage of the loss on evaporation or distillation materially affects the consistency of the residue, or *vice versa*.

VALUE OF CONSISTENCY TEST IN SPECIFICATIONS.

The value of the determination of consistency in specifications has been referred to, and will be admitted as large from the foregoing and from the following:—

As a physical test it is more generally intelligible and appreciable than any corresponding chemical one. As a physical test it perhaps will appear to be more pertinent to physical work than a chemical one. Properly made and expressed it will probably relieve the necessity of several chemical tests, and possibly tend to reduce the number of physical tests specified without any lack of clearness, if not with a real addition to the definition of the material desired.

For instance, in the case of specifications for a pitch compound sufficiently fluid to be applied without artificial heating from a distributing wagon supplied with small orifices, it will be necessary to provide such a consistency for the material at normal temperatures as will insure its flow through such orifices under the method of application. The usual way of so doing is to specify that 50 c.c. of the material will pass an Engler instrument in not more than, say, 1,500 seconds. But, as had been referred to, the Engler seems to have proved unsatisfactory in some cases where the material offered approached the prescribed limit because in practice the distribution of the material did not accord with the expectations. A reason for this unexpected behaviour was indicated by tests with the plungers of the consistometer and by the apparent stickiness of the material revealed on inspection.

With this class of material it becomes desirable to know in advance its probable ability to "set up" or harden in a short time. Hence an evaporation test follows, and the residue of such a test is measured as to the change of consistency occurring—*i.e.*,

* Paper read lately before an American Society.

the penetration of the residue is determined. This penetration is measured at 4 deg. Cent. and 25 deg. Cent. in order to deduce the probable hardness (and brittleness or slipperiness under travel) of the material after such "setting up" has occurred. Tests of consistency at these two temperatures also indicate the probable susceptibility of the material under climatic changes of temperatures, and thus its suitability for use under known local conditions on these lines.

With a similar material to be applied hot, a test for its consistency at 100 deg. Cent. is usually introduced on the normal material, and the tests on the residue are also made for the same reasons as above.

Another reason for testing the residue is that the proportion of the base to the flux and some criterion of the value of the material itself is thus had, as before stated.

With the heavier pitches used for work under the penetration and mixing methods, similar desiderata exist, and the same determinations are made. To them is frequently added another evaporation (or distillation) test at a higher temperature with tests for the consistency of its residue because of the higher temperatures of use and of the greater weathering action expected. With asphaltic cements used for "sheet asphalt" pavements the determination of consistency is most important, as cements outside of the proper limits as to consistency can but produce unsatisfactory results under the customary methods of use.

While it is quite possible that ultimately the consistency of a pitch can be predicted from a thorough knowledge of its chemical composition, this is not possible at present, and it seems doubtful whether such a method of prescribing or determining this characteristic will ever be generally used. Such a method must necessarily be long and complicated, not readily intelligible to many of those engaged in the actual work with such materials, and not easily expressed briefly. Moreover, the interpretation of specifications is much easier and more satisfactory to all concerned when reliance for limited conditions is to be had on clauses describing physical tests than when seemingly theoretical chemical processes are involved. Just as the older custom of specifying the characteristics of both the "asphalt" and the "flux" has given way to the newer and simpler one of specifying the characteristics of the combination of the two into the "asphaltic cement" ready for use, so the tendency now appears to lead to further simplification regarding the characteristics of all pitch compounds wherever safely possible.

The writer hopes that the proper development of consistency tests will do much along this line. Such a test is a determination of "effect," not necessarily of "cause," but knowledge of the "effect" is generally more desirable in actual practice. The exact proportion of naphthalene in a pitch would have far less weight under the conditions of the ordinary problem than a determination, properly made, of the varying consistency of the pitch under changing physical conditions. Again, many specifications contain a "ductility" test. This, though a purely physical test, is one that has caused any amount of discussion, and is still open to question as to its exact value. Its most persistent advocates admit its present indefiniteness. If now a consistency test can be made that will show the characteristics of a material more simply, but along the same lines as the "ductility" test, as perhaps indicated by the earlier remarks of the writer, and as believed by him to be possible, then a further simplification of the ordinary specifications will be secured.

The desirability of specifications as simple and brief as consistent with safety needs no argument here. In the foregoing it perhaps may seem that the writer is inclined to decry the value of chemical investigations and scientific knowledge of the subject of bituminous materials. Such is not the case, and he would really desire to be the last one to do so. In the matter of specifications, however, art must be given, if not more, at least equal consideration with science, though the art must be clearly recognised as being based on the science. Therefore, the highest art can only be reached from the most perfect science.

The writer believes that the scientific knowledge concerning bituminous materials would be much enriched by researches in the matter of their consistency, and that the art of road making would be thereby greatly advanced.

HIGHWAY MATTERS IN NUNEATON.

BOROUGH ENGINEER'S REPORT.

In his report for the year 1912 Mr. F. C. Cook, borough engineer and surveyor of Nuneaton, referring to the cost of highway maintenance in that town, mentions with gratification that this has remained practically stationary during the past five years, notwithstanding the extra expense incurred in respect of street watering and other means of dust prevention.

Notwithstanding the wet season tar-spraying was carried out to a greater extent than in the dry summer of 1911, and 11¾ miles were sprayed, as compared with 8 miles in the previous year. The total cost was £640 against £437, but the cost per square yard was exactly the same—viz., ·97d., allowing 10 per cent for supervision and use of plant.

ECONOMY OF TAR-SPRAYING.

Crude tar was used throughout, and the results obtained were thoroughly satisfactory. Mr. Cook remarks that the lasting properties of tar-sprayed roads depend to a large extent upon the character of the surface when treated; and the method adopted locally of spraying the surface as soon as possible after the road has been re-metalled has been attended with excellent results. The fact that the cost of upkeep has not advanced, despite the increasing expenditure year by year in tar-spraying, is, he considers, an indication of the ultimate economy of the work, apart from the question of comfort to users of the highway during the summer months.

As in former years, the streets in the centre of the town which it was considered inadvisable to tar-spray were treated with a special dust-laying preparation at a cost of £67. The cost came out at about the same as tar-spraying—viz., £54 per mile.

ADOPTION OF NEW STREETS.

At the request of the council the Highways Committee again gave consideration to various points connected with the adoption of new streets, especially with a view to the avoidance of a road being broken up, within a short time of its adoption, for the purpose of making various service connections to buildings. Mr. Cook says: "To delay the taking over of a new street until the completion of building operations would necessitate (in the generality of cases) subsequent proceedings under the Private Street Works Act, and would result in the street being in an ill-kept and insanitary condition in the meantime. On the whole, it was considered that, although the method now in vogue occasionally involves the council in some loss in the way of surface metalling, it was inexpedient to make any alteration at present."

Consideration was also given to the charge of 6s. per lin. yard made by the corporation for paving with concrete slabs the footpaths of new streets after the erection of buildings. Even assuming all concrete slabs used for this work are of the council's manufacture, the loss to the corporation has been 4s. per lineal yard of new street, and it is now decided that in future all new streets (except those for which plans have been already approved) shall be handed over free of cost to the corporation in this respect. It has also been resolved to amend the specification for the construction of new streets so as to provide for 6-in. by 12-in. granite kerbs and 4-in. by 4-in. granite-sett channel, in lieu of blue bricks, as used at present.

SLAB MAKING.

During the year 3,467 sq. yds. of concrete slabs were made at Queen's-road depot, the aggregate used being washed granite chippings from the corporation quarry, and the cost (exclusive of any charge for rent, supervision, or other establishment charges, but including all materials, new moulds, repairs, &c.) worked out at 1s. 11-18d. per square yard. The area of slabs purchased was 1,436 sq. yds., and the total area used, for all purposes, was 4,615 sq. yds.

RIVER WATER FOR STREET WATERING.

The report states that with a view to the extended use of river water for various municipal purposes a special 6-in. main was laid from the overhead storage tank at the electricity station to the Queen's-road depot, and five hydrants fixed on it for the supply of watering carts and so forth. The quantity of water so used was 1,250,000 gallons, and town water was saved to this extent.

Asphalt Street Pavements.

By ERNEST WORRALL, F.S.I., Surveyor to the Stretford, Lancs, Urban District Council.

[Extracts from paper read on the 1st inst. at a North-Western District Meeting of the Institution of Municipal and County Engineers at Stretford.]

The introduction of asphalt for street paving in Stretford was due to circumstances that all present will have experienced in some degree. As in most Lancashire towns, the common type of paving previously used for many years was either the grit or the flag rock sett, of varying size and quality. This was doubtless a marked advance on gravel, cinders, and the early rubble and macadam road surfaces, but the growing call for something better and more suited to changing conditions and ideals, particularly in residential streets, became insistent.

Tar paving had been tried here in some dozen streets, but their condition soon indicated that durability and economy in maintenance would not be attained with it. The maintenance, in fact, became so excessive that it was eventually decided to repave these streets with rock asphalt.

The repayment of loans was sanctioned by the Local Government Board for periods of twenty years for the concrete bed and ten years for the asphalt. It had been computed that the annual instalments of the loans would be less than the maintenance cost of the tar paving; hence the course taken.

The loan periods sanctioned by the Local Government Board for asphalt pavements indicate the conservatism of that body, and the careful hesitation with which it accepts new methods and proposals, rather than the useful life of the material. In this connection members will be familiar with the anomaly perpetuated by the board in the short period of ten years granted to loans for work in reinforced concrete. The generally accepted opinion that its life will be a good multiple of that term, and the fact that several other Government Departments have extensively adopted the system seem to find no recognition with the engineering advisers of the board. The same disability attends the use of asphalt for street pavements. In our opinion, a loan period of twenty years, as in the case of flags and setts, would be amply justified. However, most of our work in rock asphalt has been in private streets completion, and here the maximum loan term for any material of seven years imposes no special disability.

It is doubtless in this direction, at any rate for awhile, that asphalt pavements will extend, and with a greatly extended use of the material it may reasonably be expected that the board will recognise its merits and encourage its use in public street works by granting a longer term of loan repayment.

The contractor's first operation [after the formation work is done] is to relay the kerbs to levels on 6 in. of 4½: 1½: 1 cement concrete; if the kerbs need it, they are also redressed and jointed. The kerbs have invariably settled by unequal subsidence on the new formation. Our experience has shown, too, that when they were not afterwards founded on an unyielding concrete bed, the adjoining pavement being necessarily so founded, the kerbs have settled between it, and for the past few years we have accordingly required the kerbs also to be on concrete.

The kerbs being thus relaid to "bonings," they form the level from which all others are taken.

The carriageway and paths are next excavated 7½ in. and 4 in. respectively below finished surface levels, thus allowing for 6 in. of concrete and 1½ in. of asphalt in the carriageway, and 3 in. and 1 in. respectively in the paths. Where there is little or no end fall in the street, as is commonly the case in a flat district like Stretford, the clearance or water tables must be got from the channels by grading the underbed about 13 in. deep at the gullies and 10 in. at the summit midway between them. The cross fall or camber of a 21-ft. carriageway, with the crown level with the kerbs, lies between 1 in 25 at the gullies and 1 in 50 at the summits. The specification provides for the average—1 in 36. The irregular incidence of crossings on the paths interferes with the correct position of summit and gully in the channels; hence a close approximation to standard falls can only be obtained in practice. In a 42 ft. street with an 8 yds. carriageway similar contours are obtained by raising the crown 1 in. above the kerb level.

Our current specification for the work embodies the result of local experience. Conciseness, simplicity and directness in its clauses have been aimed at, besides the avoidance of that prolix verbiage which is seldom read, and which is a too common feature of engineering and other specifications. I cannot do better perhaps than give parts of it here:—

SPECIFICATION OF MATERIALS AND WORK IN COMPLETING STREETS IN GRANITED ROCK ASPHALT.

Portland Cement.—The cement used throughout the work shall be "Portland" of English manufacture, and of an approved firm and brand. It must be of *first* quality, and in all respects comply with the specification of the Engineering Standards' Committee.

Sand.—The sand for concrete and mortar shall be perfectly clean, sharp, of uniform size, and, if required by the surveyor, shall be washed. None shall be obtained from the site of the works.

Water.—The contractor may obtain water from the hydrants, if any, in the roads, but he shall make all necessary arrangements with the water authority, observe their regulations, and pay their charges in connection with and for the supply.

Excavation.—The contractor shall take up and cart where directed within the district all the existing sett paving, cinders, &c., as the property of the council, and the spoil to the contractor's own tip; the bed ground shall be formed to the proper camber and gradients to permit of a layer of concrete of an even thickness of 6 in. throughout in the carriageways, 3 in. in the footpaths, and 4½ in. in the passages, or as given in the quantities. If any soft places are found in the bed ground they shall be thoroughly wetted and well penned, and, if necessary, an extra thickness of concrete shall be placed in them at schedule rates to the satisfaction of the surveyor.

Concrete.—The concrete shall be composed by measure of 4½ parts of clean broken stone *to pass through a 1¾-in. ring*, 1½ parts of sand, and 1 part of cement. These shall be gauged in measures, and, if hand-made, turned over *twice dry* and *twice wet*, clean water being only *sprinkled* over from an elevated tank until it is of a proper consistency; and it is to be used before setting has commenced, as softening or re-tempering will not be allowed. The concrete foundation shall be laid by skilled men in one layer of full thickness, and it shall be forthwith brought to the proper cross-section and gradient of the road, and finished off by beating to a good surface. Any hollows afterwards found in the surface shall be made good with cement mortar in the proportion of 1 of cement to 1½ of sand. No concreting shall be attempted during frosty weather. The concrete alongside the kerbs on each side of the carriageway shall be graded for water tables.

Asphalt.—The asphalt shall be natural rock Limmer asphalt containing 15 per cent of bitumen from the mines of an approved company, and a block of the asphalt, bearing the stamped imprint of the mines and company, shall be deposited with the surveyor before the contract is settled. It shall be used in the proportion of 56½ per cent to the whole admixture.

During the process of melting a proportion of 3½ per cent of natural refined bitumen, of the specific gravity of 1·2 (and containing at least 70 per cent of pure bitumen and 3 per cent of heavy [950 s.g.] shale or mineral oil), shall be added to the asphalt. The resulting mixture shall have incorporated in it 40 per cent of dry *screened* Dalbeattie ⅜-in. granite chippings free from dust; the asphalt and bitumen to be melted and thoroughly amalgamated with the chippings in a combined cauldron and mixing machine continuously agitated by mechanical power.

The mixed granited asphalt shall be laid by skilled men, of such a depth as will give a finished

thickness throughout its whole area of at least 1¼in. after rolling on the carriageways and passages, and 1 in. on the footpaths; the finished surfaces shall be formed to proper gradients, and the camber or cross fall from centre of roadway to each channel shall be to a true curve at the maximum rate of 1 in. to every 3 ft. of width. At all joints and along each side of the carriageway there shall be an underlayer of fine asphalt.

When the hot granited asphalt has been laid on the concrete, and before it has cooled, it shall be sprinkled with Dalbeattie granite dust raised to a temperature of at least 200 deg. Fahr., and then be finished off by rolling with suitable rollers for indenting the surface.

When completed, and with the consent of the surveyor first obtained in each instance, the finished portions of the pavement shall be opened for traffic in suitable lengths or widths during the further progress of the works.

Conveniences.—The contractor shall, at his own expense, provide proper and portable conveniences for the use of the men, and shall at all times keep the same clean and in a proper sanitary condition; the council's sanitary department undertake only the removal of excreta by arrangement.

General.—Other work not herein specified or comprised in the schedule, and usually done by local contractors in private streets works, shall be done by the contractor at the discretion of the surveyor as part of his contract at usual rates.

Contract.—The contractor will find sureties for and enter into the council's usual form and terms of contract and bond for asphalt pavements.

Note.—The specification will in every detail be strictly enforced, and contractors tendering must provide for this.

The following table shows the extent to which the pavement has been laid in Stretford since it was introduced late in 1904:—

Year ending.	Total cost.	Average cost per sq. yd.		
		Carriageway.	Footpath.	Passages.
	£ s. d.	s. d.	s. d.	s. d.
December, 1905	5,672 14 8	9 3	4 9	6 6
,, 1906	4,257 10 2	8 10	4 9	—
,, 1907	19,976 14 9	8 4	4 9	7 4
,, 1908	6,252 5 5	8 3	4 9	7 6
,, 1909	2,160 11 1	8 5	4 8	7 6
,, 1910	5,181 8 0	6 3½	4 1	6 6½
,, 1911	5,385 17 2	6 1	3 11	5 10
,, 1912	7,970 9 11	6 9	4 8	6 0
(In hand) 1913	18,343 0 0			
	£75,200 11 2			

The average price for passages in 1910 (6s. 6½d.) does not include a batch of passages in Trafford Park, which, being on a peaty bed, were given a special (8-in.) foundation. The price for these was 8s. 3d. a square yard.

Besides the above the following paths have also been paved in the public parks, with ¾ in. of asphalt on 3 in. of concrete:—

In 1906. Hullard and Victoria Parks, £451 8s. 5d., 3s. 11d. per yd.
In 1907. do. do. £1,590 12s. 6d., 1s. 4½d. ,, ,,

Making a total outlay on the work in Stretford of near £78,000.

The foregoing list represents a total of 100 front streets and 36 back streets or passages, which latter include many groups of passages.

The average price of the past three years, 6s. 3½d. and 4s. 2d. a super. yd. for the asphalt and concrete in the carriageway and paths respectively, gives a rate per lin. yd. in a 36-ft. street of £3 2s. 1d. This, compared with Lancashire setts and flags at 6s. 6d. a super. yd., shows an advantage of 11s. 7d. in favour of asphalt per lin. yd. of street—that is, 1s. 11d. per foot frontage.

The other items common to private streets work—excavation, adjusting surface drains and gullies, &c.—are similar in each case, and so do not affect a comparison.

To return to the process of the work itself. The underbed having been formed to falls and contour, the concreting presents no special feature, usual care being taken to ensure that only good cement, sand and aggregate are used. We formerly admitted brickbats, but now require all-stone aggregate, which gives cleaner and harder concrete. This is brought to its finished surface without rendering by a travelling screed which runs on wheels over graded strips laid on the kerbs. A constant difficulty is to prevent the men using too much water—a soft mixture makes less tax on their latent strength. The concrete in ordinary cases is laid 6 in. in thickness in the carriageways, 4½ in. in the passages, and 3 in. in the footpaths, and we require a week for setting before doing further work on it.

A 6-in. bed of concrete is also laid for the 9-in. by 6-in. granite edgings which are used at the street ends or wherever the asphalt will not finish against asphalt previously laid, or kerbs. We have found it essential for the asphalt to be finished at the edges against a rigid material, immovable under traffic or wear, otherwise vibration shatters the loose edge over a gradually increasing area. This has occurred, especially at hinged manhole covers and paved crossings. The latter is now obviated by using granite edgings laid flush with the surface, and an improved iron cover with the frame continued round the hinges has been adopted. The edgings cost, delivered on rail at Stretford, 3s. 10d. a lin. yd., and the covers, weighing 3¼ cwts., cost 21s. each.

The asphalt blocks are broken and thrown into a heated cauldron, in shape like a large tar-boiler, but with gear attachments driven by a portable engine, and rotating an axial shaft with arms on it for continuously agitating the contents. In a large street or group of streets three or four of these mixing machines are driven from one engine, thus giving a rotation of boilings for the asphalter laying the material without a long wait between.

The amount of rock and other ingredients thrown into the cauldron depends upon the size of the machine, which varies from 2 to 7 tons capacity.

A 3½ per cent flux of Trinidad bitumen and oil, as described in the specification, is added early in the melting process, and later, all by weight, 40 per cent of dry screened granite chippings. The moisture in the granite is first evaporated on a dry hearth.

The following table gives in cwts. the proportion of the three ingredients in boilings of from 2 to 7 tons:—

Capcity of cauldron	Rock asphalte 56·5%	Bitumen flux 3·5%	Granite chippings 40%
40	22·60	1·40	16·00
50	28·25	1·75	20·00
60	33·90	2·10	24·00
70	39·55	2·45	28·00
80	45·20	2·80	32·00
90	50·85	3·15	36·00
100	56·50	3·50	40·00
110	62·15	3·85	44·00
120	67·80	4·20	48·00
130	73·45	4·55	52·00
140	79·10	4·90	56·00

The whole admixture is kept in motion during the melting process, which drives off all remaining moisture, and after boiling at a temperature of round 300 deg. Fahr., the "boil" is ready for laying. The boiler man must understand his responsibility and be quite reliable. Any carelessness, or incompetency on his part will spoil the mixture. He is responsible for the proportioning of the ingredients and the temperature and period of the boiling. A material variation in either makes the asphalt either hard and brittle or too soft. The desired medium is just sufficient ductility to prevent cracking and to receive only mild impressions, which roll out under wheeled traffic.

The boiling complete, the asphalt is drawn from the cauldron into strong buckets placed on a flat wagon and run on light rails to the asphalter. His labourer empties the hot mixture where it is to be laid, and it is then floated on the concrete bed to the specified thickness. Either dry granite dust or cement is dusted over the surface to prevent adhesion to the wood float, and the asphalters are followed up by the roller-men, who, while the material is hot, indents the surface with a notched brass roller—18 in. long by 4 in. in diameter and weighing some 50 lb.—attached to a long arm. The object of this indenting is not, as is commonly inferred, to improve the foothold, but rather, like the stippling of a painted wall or ceiling, to break the waviness of a large unbroken surface. The indentations eventually roll out under wheeled traffic, but the waviness that would show badly on a new surface is not then so apparent.

The evidence so far gleaned of the probable useful life of the pavement suggests that it will be longer than that of sandstone setts. The first street we laid

has now been down nine years, and there is no apparent deterioration of its general condition. This longevity may be attributed mainly to two of the properties of asphalt—its ductility and the stability of its chief ingredient, bitumen. The pavement is not without some faults, and those we have experienced may perhaps be noted with advantage. Occasional lateral fissures, chiefly in the carriageways, are so far an incurable flaw. They look bad, although they are seldom wide enough to admit the blade of a knife. They puzzled us for a time, but they were eventually traced to a small shrinkage of the foundation. This shrinkage is perhaps not surprising, in view of the large unbroken area over which the concrete is laid, and at present we see no cure for it. It is also difficult to repair, the fissure being so fine as not to admit any grout, and to cut out and patch the joint seems to make two joints where only one existed before.

Another flaw is an occasional surface swelling of from 2 in. to 3 in. in diameter by ¼ in. high, invariably in the paths. This appears to be due either to an unslaked particle of lime in the cement swelling and forcing up the asphalt, or to imprisoned moisture swelling after frost. The fact that it appears, with little exception, in the paths as distinct from the carriageway suggests that the stronger section of the latter offers too much resistance to the upward force of the swollen particle of lime or moisture.

LOCAL GOVERNMENT BOARD DELAYS.

Attention was called at a meeting of Rhyl Urban District Council on Monday to the serious delay in getting the sanction of the Local Government Board to the carrying out of the East Marine Promenade scheme. It was decided that the council approach Mr. Herbert Lewis, M.P., Parliamentary Secretary to the Local Government Board, asking that he would urge his department to hold the inquiry.

On the same day a special meeting of Bridlington Town Council was held as a consequence of the delay of the Local Government Board in holding an inquiry into an application for sanction to borrow £4,100 for the installation of a new steam generating set at the corporation electricity works. Alderman Collins said the new plant was absolutely necessary owing to the development of the town and the demand for current, and though he did not anticipate that the Local Government Board would place any impediment in the way of the extension, if the corporation was to cope with the summer demand for current the work of installation would have to be proceeded with at once.

The town clerk said application was made several months ago to the Local Government Board for an inquiry to be held.

It was unanimously decided to authorise the committee to accept a tender of £2,867 for the plant required, and to accept the tenders for the installation.

Prevention of Damp.—Many large estates are using the powder Pudlo for the prevention of damp in stoke-holes, garage pits, walls, and other situations. One of the latest orders received by the makers for Pudlo was from the Marquis of Londonderry.

The Extermination of Rats.—The natural hatred of rats by mankind has existed from the earliest times, and of late years eminent scientists have been called upon to find a means for destroying these pests. This has now been successfully achieved by Dr. Danysz, of the Pasteur Institute, Paris. It was brought to the notice of this scientist that rats died in numbers in a certain department in France, and some of the rats were sent to the Pasteur Institute for examination, where it was found that they were all suffering from the same disease. Dr. Danysz took serum from the affected rats and gave it to others, who also died, and further research following on this result led to the discovery of "Danysz Virus," and its preparation in a liquid form. Animals other than rats and mice were then fed on Danysz Virus, but as the latter proved perfectly harmless to them it can be claimed that a genuine rat exterminator that can be used with perfect safety is available in the preparation. Full particulars can be obtained by writing to the sales department of Danysz Virus, Limited, 52 Leadenhall-street, E.C., who, in addition to supplying the virus for destroying rats and mice, also undertake the clearance of all kinds of beetles, &c., from infested areas, at an inclusive price.

INSTITUTION OF MUNICIPAL AND COUNTY ENGINEERS.

President—Mr. R. J. Thomas, M.Inst.C.E., County Surveyor, Buckinghamshire.

NORTH-EASTERN DISTRICT.

A meeting of the institution will be held in the North-Eastern District at Newcastle-on-Tyne on May 2nd and 3rd next.

ANNUAL MEETING: ALTERATION OF DATE.

The date of the annual meeting of the institution has been altered from July 23rd-26th to July 16th-19th.

SCOTTISH MEETING.

A meeting of the institution will be held in the Scottish District at Dundee on June 6th and 7th.

By order of the Council,

Thomas Cole,
92 Victoria-street, S.W. *Secretary.*

INSTITUTION OF MUNICIPAL ENGINEERS.

President—Mr. Frank Latham, M.Inst.C.E.I., F.S.E., Borough Engineer and Surveyor, Penzance.

COUNCIL MEETINGS.

The following council meetings have been arranged: March 26th, London; April 30th, London; May 31st, Manchester; June 28th, London; July 30th, London.

GENERAL MEETING.

A visit will be paid to the Building Exhibition at Olympia on April 12th, by kind permission of the promoters. Full particulars will be issued later.

NORTHERN DISTRICT.

A district meeting will be held at Wallsend on March 29th, when a round of visits will be made to the municipal works and shipyards of the town. Full programme will be issued later.

EXAMINATIONS.

The next examination will be held in London and other centres during the week ending May 17th next. Copies of syllabus and forms of application to sit may be obtained from the secretary. Notice of intention to sit must reach the secretary not later than April 21st.

B. Wyand,
39 Victoria-street, S.W. *Secretary.*

ROYAL SANITARY INSTITUTE.

SESSIONAL MEETING.

To-day (Friday), at a sessional meeting of the institute to be held at the Guildhall, Plymouth, a discussion on "The Water Supply of Devonport" will be opened by Mr. F. W. Lillicrap, water engineer, Devonport. The chair will be taken at 7 p.m.

To-morrow, at 10.30 a.m., visits will be made to the electricity works and the Burrator waterworks.

"THE SURVEYOR" EXHIBITION.

NOTICE TO INTENDING EXHIBITORS.

The Building Trades Exhibition, at Olympia will be opened on Saturday, April 12th, by the Lord Mayor of London.

The Surveyor Section, in the gallery, will, as usual, have a special attraction for municipal engineers and surveyors, the arrangement of this part of the exhibition being in the hands of Mr. C. S. Mason, 24 Bride-lane, Fleet-street, E.C.

Only a very limited number of spaces are now to let, and intending exhibitors are advised to make early application for particulars.

EASTER HOLIDAYS.

Owing to the necessity for going to press earlier than usual, news and advertisement matter intended for insertion in next week's issue of "The Surveyor" must reach us not later than Wednesday morning, March 19th.

APPOINTMENTS VACANT.

Official and similar advertisements received up to 4.30 p.m. on Thursdays will be inserted in the following day's issue, *but those responsible for their despatch are recommended to arrange that they shall reach* THE SURVEYOR *office by noon on* **Wednesdays** *to ensure their inclusion in the weekly list of summaries. Such advertisements may, in cases of emergency only, be telephoned (No. 1359 Holborn), subject to later confirmation by letter.*

TEMPORARY ASSISTANT.—March 15th. Chesham Urban District Council. £2 per week.—Mr. Percy C. Dormer, engineer and surveyor.

SHORTHAND CLERK. March 15th. City Surveyor's Office of the Birmingham Corporation. £60—to £110.—Mr. Henry E. Stilgoe, city engineer and surveyor.

CHIEF SURVEYOR.—March 17th. Gellygaer Urban District Council. £256—£300.—Mr. Frank T. James, clerk.

CLERK OF WORKS.—March 17th.—Bosmere and Claydon Rural District Council.—Mr. R. M. Cook, 6 Providence-street, Ipswich.

INSPECTORS OF WORKS.—March 17th.—Abertillery and District Water Board. £2 10s. per week.—Mr. T. S. Edwards, clerk, 24 Stow-hill, Newport, Mon.

ASSISTANT BUILDING INSPECTOR.—March 17th.—Barrow-in-Furness Town Council. £3 per week.—Borough Engineer and Surveyor.

TEMPORARY ASSISTANT.—March 18th.—Waterworks Department of Rochdale Corporation. £2 12s. 6d. per week.—Engineer and Manager, Waterworks Office, Lord-street.

JUNIOR CLERK IN HIGHWAYS DEPARTMENT.—March 18th.—Greenwich Borough Council. £50.—Mr. F. Robinson, town clerk.

SURVEYOR'S ASSISTANT.—March 19th.—Seisdon Rural District Council. £1—£1 5s.—Mr. W. Cannan, Surveyor's Office, Wombourne, near Wolverhampton.

SECOND ASSISTANT.—March 19th.—Water Engineer's Department of Tunbridge Wells Corporation. £110—£140.—Mr. W. C. Cripps, town clerk.

WORKING HIGHWAYS AND SEWERAGE FOREMAN.—March 20th.—Great Driffield Urban District Council. 35s. per week.—Mr. Herbert Brown, clerk.

CLERK OF WORKS.—March 22nd.—Hinckley Urban District Council. £3 3s. per week.—Mr. E. H. Crump, engineer and surveyor.

ENGINEERING ASSISTANT.—March 22nd.—Corporation of Burnley.—Mr. Peregrine Thomas, town clerk.

CLERK OF WORKS.—March 24th.—Rivers Committee of the Manchester Corporation. £3 3s. per week.—Chairman of the Rivers Committee, Town Hall.

ENGINEERING ASSISTANT.—March 25th.—Corporation of Rotherham. £130—£150.—Mr. Chas. L. des Forges, town clerk.

ROAD SURVEYOR.—March 29th.—Sutherland County Council. £350 per annum.—Mr. A. Argo, county clerk, Golspie.

ROAD FOREMAN.—April 8th.—Woking Urban District Council. £120—£140.—Mr. R. Mossop, clerk.

ASSISTANT ENGINEERS.—May 1st.—Indian Public Works and State Railway Departments.—Secretary, Public Works Department, India Office London, S.W.

SUPERINTENDING SANITARY ENGINEER.—Gold Coast Government. £500—£600, with allowances. Crown Agents for the Colonies, 4 Whitehall-gardens, London, S.W.

TEMPORARY ASSISTANT.—Corporation of Eastbourne. £4 per week.—Mr. A. Ernest Prescott, borough surveyor.

MUNICIPAL COMPETITIONS OPEN.

Official and similar advertisements received up to 4.30 p.m. on Thursdays will be inserted in the following day's issue, *but those responsible for their despatch are recommended to arrange that they shall reach* THE SURVEYOR *office by noon on* **Wednesdays** *to ensure their inclusion in the weekly list of summaries. Such advertisements may, in cases of emergency only, be telephoned (No. 1359 Holborn), subject to later confirmation by letter.*

EXETER.—March 27th.—Designs for a hostel for male students, for the Exeter Corporation.—Mr. H. Lloyd Parry, town clerk.

IPSWICH.—March 31st.—Designs for laying out 26 acres as a working-class suburb on the lines of a modified garden city. Premiums of 50 guineas, 30 guineas, and 20 guineas are offered.—Mr. W. Bantoft, town clerk.

ABERTILLERY.—April 9th.—Plans for an elementary school for 500 boys and girls and 300 infants, for the urban district council. The successful plans will be adopted, and the successful architect appointed.—Mr. N. J. Llewellyn, secretary, Education Committee, Council Offices.

DEVONPORT.—June 14th.—Designs for municipal buildings and a guildhall, for the Corporation of Devonport. Premiums of £350, £150, and £100 are offered. The assessor is Mr. Ernest Newton, R.A., F.R.I.B.A.—Mr. R. J. Fittall, town clerk.

MUNICIPAL CONTRACTS OPEN.

Official and similar advertisements received up to 4.30 p.m. on Thursdays will be inserted in the following day's issue, *but those responsible for their despatch are recommended to arrange that they shall reach* THE SURVEYOR *office by noon on* **Wednesdays** *to ensure their inclusion in the weekly list of summaries. Such advertisements may, in cases of emergency only, be telephoned (No. 1359 Holborn), subject to later confirmation by letter.*

Buildings.

MANCHESTER.—March 15th.—For the erection of a school and caretaker's house, for the Education Committee.—Architect, Education Offices, Deansgate.

BANDON.—March 15th.—For building twelve labourers' cottages for the rural district council.—Mr. A. Haynes, clerk.

LEEDS.—March 17th.—For the construction of an overground transformer chamber, and four underground chambers, for the corporation.—Mr. C. Nelson Hefford, electrical engineer *pro tem.*, 1 Whitehall-road.

BRIDLINGTON.—March 17th.—For extensions to the electricity works, for the corporation.—Mr. E. R. Matthews, borough surveyor.

BARROW-IN-FURNESS.—March 19th.—For the erection of two pavilions and laundry at hospital, for the corporation.—Borough Engineer.

SOUTH SHIELDS.—March 19th.—For the erection of a bowl house and shelter, for the corporation.—Mr. L. Roseveare, borough engineer.

KINSALE.—March 19th.—For the erection of cottages, for the rural district council.—Mr. J. Murphy, clerk.

DEWSBURY.—March 19th.—For the erection of outbuildings, for the corporation.—Borough Surveyor.

WEYMOUTH.—March 20th.—For building new premises for the refuse destructor, for the corporation.—Mr. K. J. S. Harris, borough surveyor.

BISHOP'S CASTLE.—March 20th.—For laying out and erecting cattle, sheep and pig pens, for the corporation.—Mr. E. Griffiths, town clerk.

WEST RIDING.—March 21st.—For the erection of a new school at Castleford, for the county council.—The Clerk, County Hall, Wakefield.

BLAIRGOWRIE.—March 22nd.—For the erection of police buildings, for the county council.—Mr. D. Marshall, county clerk, County Buildings, Perth.

PEMBROKE.—March 22nd.—For rebuilding part of a bridge, for the county council.—Mr. A. Thomas, county surveyor, Haverfordwest.

SHEFFIELD.—March 25th.—For the erection of a light reinforced-concrete bridge, for the corporation.—Mr. S. E. Fedden, general manager and engineer, Electricity Department, Commercial-street.

SHOEBURYNESS.—March 25th.—For the erection of five wooden shelters, for the urban district council.—Mr. Frederic Gregson, clerk.

WEST RIDING.—March 25th.—For the erection of a school, for the Education Committee.—Education Architect, County Hall, Wakefield.

STAFFORD.—March 29th.—For the construction of ward block at isolation hospital, for the corporation.—Mr. W. Plant, borough engineer and surveyor.

FARNBOROUGH.—March 31st.—For the erection of a refuse destructor, with buildings and chimney stack, for the urban district council.—Mr. J. E. Hargreaves, surveyor.

EDMONTON.—March 31st.—For the erection of a public convenience, for the urban district council.—Mr. C. Brown, engineer.

DURHAM.—March 31st.—For the erection of a retaining wall, for the county council.—Mr. J. A. L. Robson, County Secretary for Higher Education, Shire Hall, Durham.

FROME.—March 31st.—For the construction of underground brick water-storage tank, for the rural district council.—Mr. J. A. Beynon, surveyor.

MANCHESTER.—March 31st.—For the erection of a school and caretaker's house, for the corporation.—Mr. Thomas Hudson, town clerk.

NORWICH.—April 1st.—For the erection of six cottages, for the corporation.—Mr. A. E. Collins, city engineer.

COLWYN BAY.—April 1st.—For the provision of labour and materials for erecting a sea wall, construction of slipway, and other works, for the urban district council.—Mr. James Amphlett, clerk.

SURBITON.—April 4th.—For the construction of two public conveniences, for the urban district council.—Mr. F. W. Wood, clerk.

READING.—April 7th.—For the erection of a shed and other works at the cattle market, for the corporation.—Borough Engineer.

CARNARVON.—April 16th.—For the erection of a police station and court room at Llandudno, for the Joint Committee.—Mr. A. Bodvel-Roberts, Clerk of the Peace, Carnarvon.

Iron and Steel.

BASFORD.—March 17th.—For providing and laying about 6,000 yds. of 4-in. and 3-in. cast-iron water mains, with necessary special castings, valves, and service connections, for the rural district council.—Mr. Henry Stone, clerk.

ROCHDALE.—March 18th.—For the supply of cast-iron pipes and special castings, for the Waterworks Committee.—Mr. W. Henry Hickson, town clerk.

BLACKPOOL.—March 20th.—For the supply of ornamental cast-iron standards and ornamental chain, for the corporation.—Mr. J. S. Brodie, borough engineer.

BOMBAY.—March 25th.—For supplying and laying about 19 miles of 50-in. diameter steel main, for the municipality.—Mr. H. J. Trivess Smith, hydraulic engineer, Municipal Offices, Bombay.

YSTRADGYNLAIS.—March 26th.—For the supply of about 375 tons of 8-in. cast-iron pipes and laying same, together with sluice valves and fittings, for a new supplementary main, for the rural district council.—Mr. A. Jestyn Jeffreys, clerk.

HALSTEAD.—March 27th.—For laying and jointing about 7 miles of cast-iron water mains, from 5 in. to 3 in. in diameter, including the fixing of valves and hydrants, for the rural district council.—Mr. R. L. Hughes, clerk.

HALSTEAD.—March 27th.—For the supply of about 300 tons of cast-iron pipes, specials, and the supply and erection of cast-iron water tank to hold 40,000 gallons, for the rural district council.—Mr. R. L. Hughes, clerk.

WOLVERHAMPTON.—March 28th.—Tenders wanted for the purchase of second-hand 15-ton Aveling & Porter steam road roller.—Borough Engineer.

SOUTHEND-ON-SEA.—April 3rd.—For the supply and delivery of cast-iron special pipes required in connection with the sewage disposal works, for the corporation.—Mr. H. J. Worwood, town clerk.

SOUTHEND-ON-SEA.—April 3rd.—For the supply and delivery of sluice and other valves in connection with the sewage disposal works, for the corporation.—Mr. H. J. Worwood, town clerk.

TEDDINGTON.—April 5th.—For the supply and erection of two destructor furnaces, boiler settings, and flues, with two Lancashire boilers, for the urban district council.—Mr. C. H. Salmons, clerk.

Roads.

DARTFORD.—March 15th.—For the supply of broken hard stone of one of the following kinds: Rhenish basalt, Guernsey granite, Clee Hill basalt, Leicester granites, Cornish granites, Penmaenmawr or other North Wales granite, quartzite, or Quenast, for the rural district council.—Mr. E. J. Hobbs, clerk.

ALNWICK.—March 15th.—For providing and laying road materials, for the rural district council.—Mr. J. Short, 22 Duke-street, Alnwick.

WOKINGHAM.—March 15th.—For the haulage of gravel, and steam rolling, for the rural district council.—Mr. John F. Sargeant, clerk.

HUNTS.—March 15th.—For the supply of gravel and sand, for the county council.—Mr. H. Leete, county surveyor, Huntingdon.

WATH-UPON-DEARNE.—March 15th.—For the supply of macadam, tar-macadam, kerbs, flags, and setts, for the urban district council.—Mr. J. H. Drew, engineer and surveyor.

PONTARDAWE.—March 15th.—For the supply of road metal and haulage, for the rural district council.—Mr. J. Morgan, engineer.

TOTNES.—March 15th.—For road repair and maintenance, for the corporation.—Mr. W. F. Tollit, borough surveyor.

HALIFAX.—March 15th.—For private street improvement works, for the corporation.—Mr. J. Lord, borough engineer.

CHORLEY.—March 17th.—For the supply of broken granite and slag, rubble, chippings, setts, flags (natural), and concrete, kerbs, tools, implements, and pitch and oil, for the rural district council.—Mr. John Whitfield, clerk.

THURNSCOE.—March 17th.—For the supply of broken granite, granite chippings, broken slag, slag screenings, flags, kerbs, channelling, asphalt and pipes, for the urban district council.—Mr. T. Bull, surveyor.

NORTHWICH.—March 17th.—For work of making-up, for the urban district council.—Mr. J. Brooke, engineer and surveyor.

FINCHLEY.—March 17th.—For making up twelve streets, for the urban district council.—Mr. E. H. Lister, clerk.

POCKLINGTON.—March 17th.—For the supply of the best blue stone and slag, for the rural district council.—Mr. T. Robson, clerk.

CHISWICK.—March 17th.—For the construction of a new 60-ft. road, including the laying of sewers and construction of culvert and bridge, for the urban district council.—Mr. Ernest F. Collins, clerk.

LLANFRECHFA.—March 17th.—For road metalling and hauling, for the urban district council.—Mr. G. Jones, surveyor.

EAST ASHFORD.—March 17th.—For the supply of flint and haulage of gravel, rock, and granite, for the rural district council.—Mr. Julius Kingsford.

BEDWELLTY.—March 17th.—For the construction of an access road, for the urban district council.—Mr. T. J. Thomas, clerk.

HEBDEN BRIDGE.—March 17th.—For work of tar-spraying, for the urban district council.—Mr. T. Waddington, surveyor.

LONDON.—March 17th.—For the supply of Kentish ragstone and hassock, for the Commissioners of Sewers.—Mr. A. Hurtzig, 2 Queen-square-place, Queen Anne's-Mansions, Westminster, S.W.

BILLERICAY.—March 17th.—For the supply of materials and steam rolling for the ensuing year, for the rural district council.—Mr. C. Edgar Lewis, clerk.

BILSTON.—March 17th.—For the supply of broken stone, for the urban district council.—Mr. Vincent Turner, engineer and surveyor.

BRIDGE.—March 17th.—For the supply of surface-picked and other hard flints and gravel, for the rural district council.—Mr. T. Louis Collard, clerk.

WARRINGTON.—March 17th.—For forming and paving five streets and ten passages, for the corporation.—Mr. Andrew M. Ker, borough engineer and surveyor.

ALTRINCHAM.—March 17th.—For the supply of granite-macadam, Rochdale flags, kerbs, setts, and limestone chippings, for the urban district council.—Mr. W. S. Stokoe, clerk.

STROUD.—March 17th.—For the supply of granite, basalt, limestone, and tarred macadam, for the urban district council.—Mr. E. Northam Mitchell, clerk.

WOLVERHAMPTON.—March 17th.—For making up St. Mary's-terrace, for the corporation.—Mr. George Green, borough engineer.

ANTRIM.—March 17th.—For supplying steam rollers on hire, for the county council.—County Surveyor, Court House, Belfast.

STOCKSBRIDGE.—March 17th.—For the supply of whinstone, dross, and tarred asphalting, for the urban district council.—Mr. G. Dyson, acting clerk.

TONBRIDGE.—March 17th.—For the supply of chert, basalt, rag, quartzite, and tarred ragstone macadam, for the rural district council.—Mr. F. Harris, engineer and surveyor, Broadway, South-borough, Tunbridge Wells.

RICHMOND (Surrey).—March 17th.—For making up a road, for the corporation.—Mr. J. H. Brierley, borough surveyor.

ROCHFORD.—March 17th.—For the supply of granite, flints, and haulage, for the rural district council.—Mr. F. Gregson, clerk, Southend.

SPENNYMOOR.—March 17th.—For making up certain streets, for the urban district council.—Mr. C. R. Spencer, surveyor.

LOWER BEBINGTON.—March 17th.—For the supply of macadam, setts, kerbs, channels, and flags, for the urban district council.—Mr. H. W. Corrie, surveyor.

CROFT.—March 17th. For the supply of broken and unbroken whinstone, ironworks slag and annealed slag, for the rural district council.—Mr. J. Hodgson, surveyor.

COLCHESTER.—March 17th.—For the construction of a new road, for the corporation.—Mr. H. Goodyear, borough engineer and surveyor.

COCKERMOUTH.—March 17th.—For the maintenance of highways, for the rural district council.—Mr. S. K. Gibson, surveyor of highways.

WEST SUFFOLK.—March 17th.—For the supply of tar, for the county council.—Mr. W. L. Jenkins, county surveyor, Bury St. Edmunds.

NEWARK.—March 17th.—For the supply of road materials, for the corporation.—Borough Surveyor.

ABERGAVENNY.—March 18th.—For the supply of broken and unbroken stone, for the rural district council.—Mr. A. J. Willcox, district surveyor.

HEAVITREE.—March 18th.—For making good several streets, for the urban district council.—Mr. J. W. W. Mathew, clerk.

TRING.—March 18th.—For the supply of broken granite and flints, for the urban district council.—Mr. S. S. Gettings, surveyor.

KIDDERMINSTER.—March 18th.—For the supply of broken granite, granite screenings, broken slag, and slag screenings, for the rural district council.—Mr. G. J. Shepherd, surveyor.

ACTON.—March 18th.—For tar-spraying about 100,000 sq. yds. of flint and granite carriageway, for the urban district council.—Mr. W. Hodson, clerk.

LEXDEN.—March 18th.—For the supply of picked stones, sifted stones, gravel, cartage, broken Kentish flints, and hire of steam rollers, for the rural district council.—Mr. George E. Tompson, clerk, Victoria Chambers, Colchester.

WARE.—March 18th.—For the supply of broken blue Guernsey granite, for the urban district council.—Mr. G. H. Gisby, clerk.

POOLE.—March 18th.—For the supply of broken granite and Mendip limestone dust, for the corporation.—Mr. S. J. Newman, borough surveyor.

NEW BARNET.—March 18th.—For the supply of road materials, for the urban district council.—Mr. H. York, surveyor.

TUTBURY.—March 19th.—For the supply of broken granite and limestone, for the rural district council.—Mr. H. S. Tebbitt, surveyor, Tatenhill, Burton-on-Trent.

SEDGEFIELD.—March 19th.—For the supply of whinstone, slag, tar-macadam, and concrete flags for the rural district council.—Mr. W. R. Plews, highway surveyor, 6 South-view, Ferryhill.

LANCHESTER.—March 19th.—For making up back streets, for the rural district council.—Highway Surveyor.

ISLE OF WIGHT.—March 19th.—For the supply of materials and tar, for the rural district council.—The Clerk, 30 Pyle-street, Newport, I.W.

DEVIZES.—March 19th.—For the supply of material and team haulage, for the rural district council.—The Surveyor.

WORTLEY.—March 20th.—For the supply of granite flag, limestone and tarred slag, for the rural district council.—Mr. F. Crawshaw, surveyor.

OLDHAM.—March 20th.—For making up certain passages, for the corporation.—Borough Surveyor.

CROYDON.—March 20th.—For treating road surfaces with Tarvia, for the rural district council.—Mr. R. Chart, junr., highways surveyor.

WHITLEY.—March 21st.—For quarrying and carting stone, for the rural district council.—Mr. J. Lyth, district surveyor.

STEYNING, WEST.—March 22nd.—For the supply of broken granite, flints, and coarse sand, for the rural district council.—Mr. P. Slaughter, engineer and surveyor.

HAMBLEDON.—March 22nd.—For the supply of road materials, carting and team labour, for the rural district council.—Mr. S. B. Hazell, surveyor, Guildford.

ORMSKIRK.—March 24th.—For the supply of granite-macadam and chipping, kerbstone chippings, grit setts and kerbs, granite cubes, and dressing, for the urban district council.—Mr. H. W. Chadwick, surveyor.

NUNEATON.—March 25th.—For the supply of broken granite and haulage, for the rural district council.—Mr. C. Blakeway, clerk.

SOUTHGATE.—March 25th.—For works of street improvement, for the urban district council.—Mr. W. M. Ellenor, clerk.

SOUTHWELL.—March 25th.—For the supply of road material, for the rural district council.—Mr. John Ellis, clerk.

FARNHAM.—March 25th.—For tar-painting main and district roads, for the urban district council.—Mr. R. W. Cass, surveyor.

GOSFORTH.—March 25th.—For road widening, for the urban district council.—Mr. G. Nelson, engineer and surveyor.

GREAT OUSEBURN.—March 26th.—For the supply of whinstones, limestones, annealed slag, and furnace slag, for the rural district council.—Mr. H. S. Thompson, clerk.

WOODHALL SPA.—March 26th.—For the supply of granite, granite chippings, and slag, for the urban district council.—Mr. E. E. T. Bolton, surveyor.

CHIPPENHAM.—March 26th.—For the supply of granite, basalt, and limestone, for the rural district council.—Mr. A. H. Lapham, surveyor.

CHATHAM.—March 27th.—For the supply of broken granite, granite chippings, surface-picked flints, broken Kentish ragstone, granite channel and granite setts, for the corporation.—Borough Surveyor.

HORSHAM.—March 27th.—For the supply of granite, team labour for haulage, hire of steam rollers, for the rural district council.—Mr. A. C. Coole, clerk.

EAST GRINSTEAD.—March 29th.—For the supply of 1½-in. Quenast granite, Quenast granite screenings, tarred granite macadam, hand-picked broken surface flints, 2-in. Kentish ragstone, and brick rubble for the urban district council.—Mr. E. P. Whitley Hughes, clerk.

WANDSWORTH.—March 31st.—For making up and paving Genoa-avenue, Putney, for the borough council.—Mr. D. A. Nichol, town clerk.

MALDON.—April 1st.—For the supply of broken granite, basalt, flints, gravel, picked stone, steam rolling and cartage, for the rural district council.—Mr. Edgar J. Ennals, surveyor.

EASTBOURNE.—April 3rd.—For the supply of road materials, for the rural district council.—Mr. T. E. V. Kirtlan, clerk.

BULKINGTON.—April 7th.—For the supply of stone, for the urban district council.—Mr. H. W. Wilson, surveyor, Attleborough.

TANGIER.—April 10th.—For the construction of a sewer and a road, for the Special Committee of Public Works.—Commercial Intelligence Branch of the Board of Trade, 73 Basinghall-street, E.C.

TANGIER.—April 12th.—For the construction of the second section of Casablanca-road, for the Special Committee of Public Works.—Commercial Intelligence Branch of the Board of Trade, 73 Basinghall-street, E.C.

ERINTON.—March 17th.—For work of tar paving, for the urban district council.—Mr. E. M. Bate, surveyor.

Sanitary.

YEARDSLEY-CUM-WHALEY.—March 15th.—For the construction of stoneware-pipe sewer, manholes, and other works, for the urban district council.—Mr. Sydney Taylor, clerk, 9 Terrace-road, Buxton.

WIRRAL.—March 15th.—For work of scavenging, for the rural district council.—Mr. J. E. S. Ollive, clerk, 54 Hamilton-street, Birkenhead.

SKELTON.—March 15th—April 3rd.—For laying sewers and manholes, for the urban district council. —Messrs. D. Balfour & Son, 3 St. Nicholas Buildings, Newcastle-on-Tyne.

AYLESBURY.—March 15th.—For the construction of a sewer, for the rural district council.—Mr. F. H. Parrott, clerk.

ROYTON.—March 17th.—For work in connection with sewering Gravel Hole and district, for the urban district council.—Mr. Ellis Harrison, clerk.

BILLERICAY.—March 17th.—For the removal of house refuse, for the rural district council.—Mr. R. J. W. Layland, High-street.

KEIGHLEY.—March 17th.—For emptying privies and ashpits, for the rural district council.—Mr. T. Burton, inspector.

CARNFORTH.—March 17th.—For emptying and cleansing privies and ashpits, for the urban district council.—Mr. T. L. Calvert, clerk.

CLEETHORPES.—March 17th.—For work of sewerage and construction of manholes and chambers, for the urban district council.—Mr. J. S. Alford, 9 Victoria-street, Westminster.

DESBOROUGH.—March 17th.—For the construction of sewerage, sedimentation tanks and percolating filters, for the urban district council.—Messrs. Everard, Son & Pick, 6 Millstone-lane, Leicester.

ROCHFORD.—March 17th.—For the removal of refuse, for the rural district council.—Mr. F. Gregson, clerk. Southend.

MITCHAM.—March 18th.—For collecting and removing refuse, for the rural district council.—Mr. E. J. Gowan, clerk, Katherine-street, Croydon.

TUTBURY.—March 19th.—For work of scavenging, for the rural district council.—Mr. H. S. Tebbitt, sanitary surveyor, Tatenhill.

HAWARDEN.—March 20th.—For work of scavenging, for the rural district council.—Mr. H. G. Roberts, clerk, Broughton, Chester.

CHELTENHAM.—March 25th.—For the supply and delivery of 10,000 cub yds. of material suitable for media in connection with sewage filters, for the corporation.—Mr. J. S. Pickering, borough engineer.

BRAINTREE.—March 25th.—For laying a sewer, for the rural district council.—Mr. E. H. Bright, engineer, 17 Railway-street.

SEFTON.—March 25th.—For emptying ashpits, for the rural district council.—The Surveyor, 21 Evored-avenue, Walton.

BRIERFIELD.—March 26th.—For the construction of septic tanks and contact beds, for the urban district council.—Mr. B. Halstead, surveyor.

HINCKLEY.—March 29th.—For laying a new main outfall sewer, consisting of about 416 lin. yds. of 36 in. diameter cast-iron pipes, and 1,102 lin. yds. of egg-shaped concrete tubes, varying from 42 in. by 28 in. to 30 in. by 20 in., together with necessary manholes, for the urban district council.—Mr. E. H. Crump, engineer and surveyor.

SHIFNAL.—March 29th.—For laying pipe sewers and manholes and construction of sewage disposal works, for the rural district council.—Messrs. Willcox & Raikes, 63 Temple-row, Birmingham.

ITCHEN.—March 31st.—For laying sewers and constructing manholes and storm-water tanks, for the urban district council.—Mr. T. A. Collingwood, surveyor, Council Offices, Portsmouth-road, Woolston, Southampton.

Stores.

DARTFORD.—March 15th.—For the supply of broken hard stone of the best description, 6,790 cubic yards of unbroken flints, 1,020 cubic yards of broken Kentish ragstone or Sevenoaks rock, 500 yds. of gravel, labour, haulage, tar-painting and steam rolling, for the rural district council.—Mr. E. J. Hobbs, clerk.

SMETHWICK.—March 15th.—For the supply of road materials, shovels, picks, sanitary ashbins, scavenging brushes, manhole and lamphole covers, cement and disinfectants, for the corporation.—Mr. Alex. Hosken, borough engineer and surveyor.

HEYWOOD.—March 17th.—For the supply of setts, earthenware pipes, bends, junctions, taper pipes, traps, gullies, pitch, creosote oil, limestone chippings, hand-broken granite, granite chippings, kerbs, flags, granite setts, Portland cement, and waste-water closets, for the corporation.—Mr. Geo. G. Bouchier, town clerk.

TILBURY.—March 17th.—For the supply of stoneware pipes, bends, gullies, ballast, sand, hoggin, bricks, castings, ironmongery, tools, cement, Kentish ragstone, Guernsey granite, coal, coke, uniforms, oilskins, sewermen's boots, steam rolling, and disinfectants, for the urban district council.—Mr. Thos. A. Capron, clerk.

EAST BARNET.—March 18th.—For the supply of broken granite or basalt, gravel, hoggin, Portland cement, stoneware pipes, tar-paving materials, distilled tar or other bituminous substance, brooms, forage, horse hire, and cartage, for the urban district council. —Mr. T. A. Buckley, clerk.

GAINSBOROUGH.—March 19th.—For the supply of broken granite or whinstone macadam, granite or whinstone setts, broken and block slag, slag chippings and dust, York setts, kerbs, channels, flags, concrete flags, stoneware and earthenware pipes, gullies, cast-iron pipes, tar-macadam, pitch, and creosote oil, and Portland cement, for the urban district council.—Mr. Sam. W. Parker, engineer and surveyor.

GATESHEAD.—March 22nd.—For the supply of road materials, metal gullies, manhole covers, shones, picks, scavenging brooms, lime, and cement, for the corporation.—Mr. W. Swinburne, town clerk.

LEEK.—March 24th.—For the supply of flags, kerbs, channels, setts, macadam stone and chippings, limestone and slag tar-macadam, Portland cement, sanitary pipes, pitch and oil, scavengers' bass brooms, cast-iron manhole and lamphole covers, galvanised malleable step-irons, and cast-iron gullies and frames, for the urban district council.—Mr. W. E. Beacham, surveyor and water engineer.

ROTHERHAM.—March 25th.—For the supply of broken granite, broken slag, tarred slag, tarred limestone, concrete flags, Portland cement, timber, pitch, and creosote oil, gritstone setts and kerbs, granite setts and cast-iron pipes, for the corporation.—Mr. C. L. des Forges, town clerk.

WORSLEY.—March 26th.—For the supply of granite-macadam, tarred macadam, granite setts, Lonkey setts, grit setts, granite chippings, limestone chippings grit kerbs, Lonkey kerbs, stoneware pipes, pitch, and creosote oil, for the urban district council. —Mr. J. P. Monks, clerk.

KENT.—March 29th.—For the supply of shovels, forks, scavenging brooms, scoops, scrapers, cart grease, tallow, oil, and other tools and materials, for the county council.—Mr. W. B. Prosser, clerk.

NUNEATON.—March 31st.—For the supply of blue bricks, kerbs, coal, slack, disinfectants and soap, earthenware pipes, granite kerbs and setts, iron castings, petroleum, and Portland cement, for the corporation.—Mr. F. C. Cook, borough surveyor.

Miscellaneous.

BELFAST.—March 19th.—For erecting a caretaker's house, erecting barbed wire fence, constructing new roadway, and laying sewer pipes, for the rural district council.—Mr. R. G. Jackson, clerk.

TENDERS FOR MUNICIPAL WORKS OR SUPPLIES.

The Editor invites the co-operation of Surveyor *readers with a view to making the information given under this head as complete and accurate as possible.*

* Accepted. † Recommended for acceptance.

BEDWELLTY.—Accepted, for the supply of retort settings and a scrubber, for the urban district council:—

Retort Settings.—Poulton & Timmis, London, £650.
Scrubber.—W. C. Holmes & Co., Huddersfield, £279.

BIGGLESWADE.—For the erection of a filter-house, for the Water Board:—

C. Schroder, Billericay	£738
F. W. King, Clacton-on-Sea	527
F. Hodson & Co., Nottingham	523
S. Redhouse & Sons, Stotfold	460
J. Allen & Son, Brampton	458
T. Palmer & Co., Merton, S.W.*	445

BIRKENHEAD.—For the supply of granite and Rawtenstall kerbs and channels, Penmaenmawr breaking stone, natural flags and creosoted red deal paving blocks, for the corporation.

Granite Channels.—Penmaenmawr and Welsh Granite Company, Limited, Penmaenmawr.
Granite Kerbs, Channels, &c.—Newry Granite Company, Manchester.
Rawtenstall Kerbs and Channels.—A. H. Evans, Liverpool; W. Chatterton, Lancashire.
Self-Faced Flags.—J. Brooke & Sons, Halifax; J. Farrar & Sons, Limited, Halifax; A. Jagger, Halifax; J. Thomson & Sons, Halifax; United Stone Firms, Limited, Bristol.
Breaking Stone, Macadam, &c.—Penmaenmawr and Welsh Granite Company, Limited, Penmaenmawr; J. Ross & Co., Liverpool.
Pwllheli Granite and Chippings.—Pwllheli Granite Company, Limited, Run orn.
Wood Paving Blocks.—Illingworth, Ingham & Co., Leeds.

BISHOP AUCKLAND.—For the construction of sewage disposal works, for the rural district council :—

J. Crombie & Son, Limited, Cleveland Slag Works, Middlesbrough	£2,179
Lister Brothers, Crook, Co. Durham	1,954
J. W. Henderson, South Gosforth, Newcastle-on-Tyne	1,807
R. Wilson, Barnard Castle	1,701
J. Carrick, Crossgate Peth, Durham	1,701
T. Walton, Crook, Co. Durham	1,650
G. W. Hetherington, Coundon, near Bishop Auckland	1,546

CHELSEA.—Accepted, for the supply and execution of certain articles and works, for a period of twelve months from April 1st next, for the borough council :—

Clothing, Waterproof Goods, &c.—Hodgetton Brothers, for sewermen's clothing, smocks for dustmen, pilot coats for sweepers, dungaree jackets, and mackintoshes for inspectors ; E. Grove, for hats and leggings for sweepers.
Granite Kerbstones and Setts.—J. Mowlem & Co., Limited, for Aberdeen granite kerb, circular Aberdeen or Leicestershire granite blocks, York edge kerb, and Aberdeen granite setts.
The Enderby and Stoney Stanton Granite Co., Limited, for Leicestershire or other approved granite kerb, and Enderby, Narborough, or other approved granite setts.
York Paving.—Henry Heys & Co., Limited.
Broken Granite from the Channel Islands.—The Croft Granite, Brick and Concrete Company, Limited, for 2in. broken granite, and 1½in. broken granite ; Rowe & Mitchell, for 2½in. broken granite and ¾in. broken granite (shot).
Creosoted Wood Blocks for Repairs.—T. Gabriel & Sons and Bartons.
Asphalte Paving Works (for three years).—French Asphalte Company, Limited.
Hoggin, Ballast, and Sand.—H. Covington & Sons, Limited.
Hoggin, Gravel, Ballast, &c.—H. Covington & Sons, Limited.
Scavenging, Horse Hire and General Cartage.—J. Emerton (for three years).
Barging away Slop.—H. Covington & Sons, Limited (for three years).
Removal of Slop by Rail.—Messrs. Hudson's, Limited (for three years).
Barging away Dust.—H. Covington & Sons, Limited (for three years).
Scavengers' Tools, Dust Baskets, &c.—Swinden & Co., Limited.
Tools and Implements.—Swinden & Co., Limited.
Lime and Cement.—A. J. Robbins.
Oilman's Goods.—Middleton Brothers.
Ironmonger's Goods.—Swinden & Co., Limited.
Carbolic Disinfectants.—Burt, Boulton & Haywood, Limited.

DUBLIN.—For the extension of boiler and engine-house buildings at generating station, for the corporation :—

H. Monks, Dublin	£10,450
Collen Brothers, Dublin	9,950
J. Beckett, Dublin	9,800
W. Laughlin & Harvey, Dublin	9,480
J. & R. Thompson, Dublin	9,470
J. & W. Stewart, Dublin	9,195
H. & J. Martin, Dublin	8,895

FILEY.—Accepted, for the erection of a retort house and bench at the gasworks, for the urban district council :—

W. H. Stacey & Co., Halifax, £735.
Drakes, Limited, Halifax, £675.

GLOUCESTERSHIRE.—For a new council school at West Dean Five Acres, near Coleford, for the Education Committee.—Mr. R. S. Phillips, architect :—

Orchard & Peer, Stroud	£4,112
S. Lovell, Bristol	4,100
W. J. Nelmes, Coleford	4,080
A. S. Cooke & Son, Stroud	4,041
W. F. Drew, Chalford	3,900
W. Jones, Gloucester	3,900
E. J. Flewelling, Lydbrook	3,830
E. Wilding, Coleford	3,833
W. J. B. Halls, Gloucester	3,494
E. Walters & Son, Bristol	3,467

HALSTEAD.—For the erection of public baths, for the urban district council :—

Grimwood & Sons, Sudbury	£1,540
J. Trudgett, Colchester	1,510
Pudney & Son, Colne Engaine	1,490
Geo. Sudbury & Sons, Halstead	1,397

Surveyor's estimate, £1,280.

HIPPERHOLME.—For the supply of macadam, for the urban district council.—Mr. G. Wharton Thompson, engineer and surveyor :—

T. Teather, Exchange Buildings, Mirfield.

KETTERING.—For the supply of granite, slag, and tar-macadam, for the rural district council.—Mr. W. Hadley Darby, surveyor :—

Granite.—Enderby & Stoney Stanton Granite Company, Leicester.
Tar-macadam.—W. Prestwich & Sons (Corby Branch), Yorks.
Slag.—New Cransley Iron Company, Kettering ; Kettering Coal and Iron Company, Kettering ; W. Prestwich & Sons, Kettering.

MACCLESFIELD.—For laying sewers, manholes, and flushing tanks, for the rural district council :—

J. Chapman & Co., Whaley Bridge	£842
S. Hutton & Co., Northwich	717
F. Parke & Son, Stoke-on-Trent	680

ROMFORD.—Accepted for the construction of sewerage works, for the rural district council.—Mr. W. J. Grant, surveyor :—

W. Muirhead & Co., Limited, London, E.C., £1,166.

SOUTH SHIELDS.—For providing and laying *in situ* concrete for footways and back streets, for the corporation :—

G. Thornton & Co., South Shields.

STAFFORD.—For the construction of a sewer, for the corporation :—

W. Thorpe, Hollywood, near Birmingham	£692

WANTAGE.—For supplying and laying about 550 yards of 2in. and 3in. cast-iron mains, the construction of service reservoir, syphon chamber and brickwork to mains, for the rural district council :—

G. Porter, Hackney	£449
E. Gregory, Wantage	428
J. P. Farrett, West Hanney	420
G. P. Freestman, Birmingham	392
W. J. Godwin, Farford, Glos.	375

MEETINGS.

Secretaries and others will oblige by sending early notice of dates of forthcoming meetings.

MARCH.

14.—Royal Sanitary Institute: Sessional Meeting at Plymouth. Mr. F. W. Lillicrap, water engineer, Devonport, on "The Water Supply of Devonport," Western Law Courts, Guildhall. 7 p.m.
15.—Inauguration of Chingford Reservoir by His Majesty the King. 3.30 p.m.
17.—Royal Institute of British Architects: Mr. F. Billerey, on "Modern French Architecture." 8 p.m.
20.—Institution of Municipal Engineers: Northern District Meeting at Wallsend.

APRIL.

2.—Institute of Sanitary Engineers: Mr. Arthur H. Barker on "Heating and Ventilation." 8 p.m.
12.—Association of Engineers-in-Charge: Annual Dinner, Holborn Restaurant.
12.—Opening of Building Trades Exhibition, Olympia, by Lord Mayor of London.
15.—Joint Meeting of the Illuminating Engineering Society, the Institutions of Gas and Electrical Engineers, and the Institution of Municipal and County Engineers: Mr. A. P. Trotter, on "Standard Causes for a Specification of Street Lighting."
21.—Institute of Sanitary Engineers: Mr. Frank R. Durham on "House Drainage on the Continent." 8 p.m.
21.—Royal Institute of British Architects: Messrs. F. W. Jackson and Bernard Dickson, on "Modern Steel Construction." 8 p.m.
23.—Royal Sanitary Institute: Ordinary General Meeting. 4 p.m.

MAY.

14-18.—Royal Institute of Public Health: Annual Congress in Paris.
19.—Institute of Sanitary Engineers: Dr. H. R. Kenwood on "Micro-Organisms and Public Health." 8 p.m.
23-24.—Surveyors' Institution: Meeting at Oxford.

JUNE.

6-7.—Institution of Municipal and County Engineers: Meeting at Dundee.
23-28.—International Road Congress in London.

APPOINTMENTS OPEN.

Official and similar advertisements received up to 4.30 p.m. on Thursdays will be inserted in the following day's issue, *but those responsible for their despatch are recommended to arrange that they shall reach* THE SURVEYOR *office by noon on* **Wednesdays** *to ensure their inclusion in the weekly list of summaries. Such advertisements may, in cases of emergency only, be telephoned* (**No. 1359 Holborn**), *subject to later confirmation by letter.*

HINCKLEY URBAN DISTRICT COUNCIL.

The Hinckley Urban District Council invite applications for the appointment of a Temporary Clerk of Works in connection with the construction of a new Main Outfall Sewer.

It is anticipated that the work will take about 5 months.

Applicants must be good practical men, and be between the age of 35 and 45 years of age, and must have had good experience in this class of work, including the laying of large iron pipes and concrete tubes, &c., in running sand, timbering work, &c., and dealing with water in excavations, and should also be quite capable of setting out work, taking levels, and measuring up.

The person appointed will be required to work at night time or on Sundays when necessary without extra payment.

The salary will be at the rate of £3 3s. per week.

Applications, stating age, qualifications and experience, and accompanied by not more than two recent testimonials, to be sent to the undersigned on or before March 22, 1913.

The work will be commenced about the middle of April next.

E. H. CRUMP, Assoc.M.Inst.C.E.,
Engineer and Surveyor.

Council Offices,
Hinckley.
March 4, 1913. (253)

GREAT DRIFFIELD URBAN DISTRICT COUNCIL.

APPOINTMENT OF WORKING HIGHWAYS AND SEWERAGE FOREMAN.

The Council invite applications for the position of Foreman of Highways (a Street Mason preferred).

The weekly wage is 35s. Candidates must specify their age, and will be required to devote full time to the Council's work.

A practical knowledge of Flagging, Asphalting, Tar-macadam, Steam Road Rolling, and of Sewerage Works is required.

Particulars of the conditions and duties of the position can be obtained from the undersigned.

Applications, endorsed "Application for Foreman," must be received at the Office of the Clerk on or before noon on the 20th March, 1913.

Canvassing, directly or indirectly, will be regarded as a disqualification.

HERBERT BROWN,
Clerk of the Council.

33 Exchange-street,
Driffield, E. Yorks.
March 11, 1913. (275)

BOROUGH OF ROYAL TUNBRIDGE WELLS.

BOROUGH AND WATERWORKS ENGINEER'S DEPARTMENT.

SECOND ASSISTANT.

The Council are prepared to consider applications from persons between the ages of 23 and 30 years, for the post of Second Assistant in the Borough and Waterworks Engineer's Department. The person to be appointed must be a good Draughtsman and possess practical knowledge of the work of a Borough Surveyor's Office. He must also have had experience in the preparation of Plans, Quantities and Estimates, and in the use of the Theodolite and Level. Other things being equal, preference will be given to Candidates holding the Diploma of the Institution of Municipal and County Engineers.

Any further information may be obtained on application to Mr. W. H. Maxwell, ASSOC.M.INST.C.E., Borough and Waterworks Engineer.

Salary commencing at £110 per annum, rising by annual increments of £10 to a maximum of £140.

Application to be in Candidate's own handwriting, and to state age, past experience and date when duties can be commenced, to be accompanied by copies of not more than three testimonials, to be sent to the undersigned not later than 10 a.m. on Wednesday, the 19th day of March, 1913.

W. C. CRIPPS,
Town Clerk.

Tunbridge Wells.
March 5, 1913. (249)

RURAL DISTRICT COUNCIL OF SEISDON.

SURVEYOR'S ASSISTANT.

Applications are invited for the post of Surveyor's Assistant.

Commencing salary £1 per week, rising to £1 5s.

Applicants must be good Surveyors, Levellers and Draughtsmen, and preference will be given to candidates having a knowledge of Building Construction.

Applications, stating age, experience and qualifications, with copies of three testimonials, to be sent to

WM. CANNAN,
Surveyor's Office,
Wombourne,
Near Wolverhampton,

not later than March 19th next; and from whom further particulars may be had on application.

(237)

COUNTY BOROUGH OF ROTHERHAM.

ENGINEERING ASSISTANT.

The Corporation of Rotherham invite applications for position of Engineering Assistant to the Borough and Water Engineer.

Candidates must have experience in the work of a Borough Engineer's Office, and must also have passed either the examination for the Associate Membership of the Institution of Civil Engineers or the Institution of Municipal and County Engineers.

Commencing salary, £130, rising by annual increments of £10 to a maximum of £150.

Applications, endorsed "Engineering Assistant," stating experience, accompanied by copies of three recent testimonials, must be sent to me not later than the 25th instant.

Canvassing, directly or indirectly, will be deemed a disqualification.

CHAS. L. DES FORGES,
Town Clerk.

Town Hall,
Rotherham.
March 6, 1913. (269)

COUNTY BOROUGH OF EASTBOURNE.

Wanted, Temporary Assistant for a period of about three months to take tidal observations and to test currents.

Previous experience in this class of work will be a recommendation.

Salary £4 per week.

Apply, stating age, previous experience, with testimonials, to

A. ERNEST PRESCOTT,
Borough Surveyor.

Town Hall,
Eastbourne.
March 11, 1913. (274)

PUPIL.—The Borough and Waterworks Engineer of Leamington (A.M.I.C.E.) has a vacancy in his office for a Pupil.—Address, Town Hall. (229)

APPOINTMENTS WANTED.

PUPIL (18), finishing at the end of April a term of three years with Architect and Surveyor, desires Appointment as Junior Assistant to a Borough Surveyor. London or Suburbs preferred.—Brown, Queen-street, Deal. (278)

(Continued on p. xxvii.)

TENDERS WANTED.

KENT COUNTY COUNCIL.

The Bridges and Roads Committee invite Tenders for the Supply of—

Shovels,
Forks,
Scavenging Brooms,
Scoops,
Scrapers.
Cart Grease,
Tallow,
Oil, &c.,

And other Tools and Materials.

Particulars and Forms of Tender may be obtained on application to the County Surveyor, Maidstone.

Sealed Tenders, endorsed "Tenders for Tools," are to be sent to me on or before 12 o'clock noon on Saturday, the 29th March, 1913.

The lowest or any Tender not necessarily accepted.

W. B. PROSSER,
Clerk of the County Council.

Sessions House, Maidstone.
March 8, 1913. (270)

HORSHAM RURAL DISTRICT COUNCIL.

The above Council invite Tenders for the following:—

(1) About 4,500 cub. yds. of Granite or other approved Stone.
(2) Team Labour for Haulage of Materials at per cubic yard.
(3) Hire of Two Steam Rollers for about 75 days, commencing October next.

Further particulars and Forms of Tender may be obtained, on receipt of stamped addressed envelope, of the Surveyor, Mr. W. Dengate, 58 Park-street, Horsham.

The Council do not bind themselves to accept the lowest or any Tender.

Tenders must reach me, the undersigned, on or before March 27th next, marked "Granite," "Team Labour," &c., as the case may be.

(By order of the Council)

A. C. COOLE,
Clerk.

9 Carfax, Horsham.
March 11, 1913. (276)

FARNHAM URBAN DISTRICT COUNCIL.

TO CONTRACTORS.

TAR PAINTING.

The above-named Council invite Tenders for Treating the following Main and District Roads—namely: Hale-road, Guildford-road, Coxbridge-road, Crondall-lane (part), within the District, with a mixture of Dehydrated Coal Tar, Pitch and Batching or Asphaltum Oil, according to a Specification prepared by their Surveyor, which Specification, also Form of Tender, may be obtained on application to the Council's Surveyor, Council Offices, South-street, Farnham.

Tenders to be on the prescribed Forms, and to be delivered to Mr. J. W. Wright, Clerk to the Council, Council Offices, South-street, Farnham, not later than four o'clock p.m. on Tuesday, the 25th day of March, 1913.

The Council do not bind themselves to accept the lowest or any Tender.

ROBT. WM. CASS,
Surveyor.

Council Offices,
Farnham, Surrey. (277)

The Surveyor

And Municipal and County Engineer.

Vol. XLIII. MARCH 21, 1913. No. 1,105.

Minutes of Proceedings.

The Engineer as Arbitrator.

In discussing some time ago the position of an engineer who is called upon to act at the same time as professional adviser to one of the parties to a contract and as arbitrator in case of a dispute arising under the contract between his principal and the other party thereto, we had occasion to refer, in a "Minute" on the subject, to the effect of some recent decisions of the courts on the legal result of an arbitration clause which embodies such an arrangement. An agreement to refer disputes to arbitration does not, of course, operate to oust the jurisdiction of the ordinary courts of law, but the courts will not entertain an action relating to any matter so referred unless the arbitrator has given a decision, or some sufficient reason can be shown why the matter should not be referred in accordance with the submission. There are three main classes of cases in which it has been held that an engineer-arbitrator ought not to act in the latter capacity—namely, (1) if circumstances affecting his impartiality arise after the contract has been entered into; (2) if, in acting as arbitrator, the engineer would be judge in his own, as distinguished from his master's, cause; and (3) if the engineer's personal conduct is of the essence of the dispute. We are led to refer to the matter again because of the case of the *Bristol Corporation* v. *John Aird & Co.*, which was before the House of Lords last week. In that case the respondent company brought an action upon a contract entered into between themselves and the appellant corporation for the construction of a wet dock and other works at Avonmouth. The contract contained an arbitration clause, in spite of which this action was brought to recover a sum of about £171,000 for work done. The corporation sought to stay the proceedings on the ground that there was an agreement to refer the matter to arbitration; but the House of Lords, confirming the decisions of the lower courts, held that in the circumstances the engineer ought not to sit as arbitrator, and that the action must consequently proceed.

In the course of his judgment—fully reported in the *Times*—Lord Moulton gave a most interesting account of the history of the relationship between arbitration and the courts of law in this country. He said that it had long been recognised as a principle of the law of England that no man could effectively withdraw himself from the protection of the courts of law. But submission to arbitration had been more and more respected by the Legislature and by the courts which administered legislation during the last half century. The great step which had been given to the present status of arbitration proceedings was taken in the Common Law Procedure Act, 1854. Up to that time a man could repudiate submission to arbitration, no matter how plainly he had contracted to submit, the only remedy against him being an action for damages, which might be utterly ineffective because no damages could be proved. Since 1854 matters had been in a very different position, when the Legislature permitted submission to arbitration subject to the indirect decree of the court—that was that the court had a discretion to refuse its assistance to a person who had bound himself to go to a domestic tribunal, and that nothing had happened which would make it unjust for him to keep his bargain.

In that way the right of the court was preserved, and at the same time a contractor was bound to keep the bargain he had made as to the settlement of dispute. No one who had experience of the great engineering works of the last half century could doubt that no well-advised corporation would accept the offer of a contractor to carry out important works which it desired to execute without having an arbitration clause in the contract, and without insisting that the engineer who was employed to superintend the works should be the arbitrator over disputes. He looked on this arbitration clause, from a business point of view, as a substantial portion of the contract. The courts had acted rightly in requiring that good reasons should be shown why that part of the contract should not be fulfilled. Incidentally his Lordship remarked that clauses in the contracts for important works were getting daily wider and wider, and so complex as to be almost incapable of reasonable construction; and it became a matter of judicial discretion for the court appealed to to take the view whether or not good reason had been shown why disputes, which wove themselves into the whole execution of the works and the conduct of the engineer, should be referred to arbitration or tried in court. He agreed that the appeal failed.

* * *

The Treatment of Road Surfaces.

As was pointed out in a recent "Minute," the manner in which modern traffic attacks a road crust is such as to suggest that it may be advantageous to adopt in some cases a method of surface

renewals which will be cheap enough to be done as often as may be necessary, and will at the same time be of the nature of crust renewal, and not a mere carpeting or surface treatment. There is a tendency for a carpet to be worn off when it is worn out; the material is to a great extent lost, and the difference between the remaining patches of carpet and the exposed patches of the crust proper leads to rapid wear. If, on the other hand, a surface treatment, such as tarring, be adopted, we may get similar effects, or we may preserve the surface so effectively that the crust is never grouted from above with fresh material or its own detritus, its lumps are not worn off, nor its hollows filled; it becomes jolty or wavy, and tends to a sudden breaking up or a hopelessly puddly condition of the road. The difficulty of producing and maintaining a crust which will sustain a large amount of wear and, as it wears away, continuously present a satisfactory surface, is, we believe, by no means so great as is usually supposed. It is, nevertheless, desirable that the possibilities of "armouring" and short-interval stiffening methods shall be fully gauged by practical trials.

The method which we recently described is an adaptation to modern main road conditions of the periodic crust renewals which tend, under swift motor traffic, to excessive consumption of material or, as an alternative, to long periods of bad surface conditions. A new surface is needed long before 3 in. of stuff has been usefully worn away. In this case the armouring is also crust renewal, but there are other methods which may be called "stiffening" methods or "surface feeding," or may combine one or both of these effects with a temporary carpeting, the wearings of the carpet being worn into the crust proper to a considerable extent. This combination of effects is possibly obtained to some extent by one of two methods recently described in *Engineering and Contracting*, and consisting in the formation of a hard-rolled carpet of trap-rock chips on and, it may be presumed, partly in the surface layer of a gravel road. The screenings are first rolled dry, so as to shake the dust into the chinks in the gravel crust, and afterwards the carpet is rolled wet for grouting effects and consolidation. If the road is one subjected to fast motor traffic, it is oiled. In the case of the unoiled road, it may be suggested that a more generally useful method, and one specially applicable to certain kinds of silicious crusts, would be to feed the gravel with much thinner spreadings of chips at frequent intervals.

The other method of surface strengthening referred to by our contemporary consists in first treating an ordinary broken-stone road crust with waste sulphite liquor, half a gallon of 1 to 3 solution per square yard, and next, after an interval of two or three weeks, oiling the road and blinding it with sand. The important item is, of course, the treatment with waste sulphite liquor, which, as a road binder, seems to possess qualities deserving of the attention of road surveyors. Being slowly soluble, it keeps sinking into the crust, and its gummy nature makes it in the meantime a dust abater, while its behaviour as regards crystallisation, explained in our issue of June 9, 1911, is worthy of close study. This material seems, indeed, to be a very promising road binder, especially in those cases in which tar is unsuitable on account of its remaining too persistently at the surface. There may be some definite objections to the use of waste sulphite liquor, but so far none has been brought to our notice.

* * *

The Chingford Reservoir.

The Metropolitan Water Board may be congratulated upon the successful inauguration of the new works at Chingford. The vast reservoir, at present empty, is an example of economical construction, and when working will be not only one of the largest of storage reservoirs, but will also be one of the most simple and remarkable works for the purification of water to be found in the world, for it is purification by long storage that is to be effected. Added to this is the fact that water is being lifted to the reservoir in enormous volume by silent pumps which contain practically no moving parts, and which have no engines to drive them. It seems that we have at Chingford an example of that simplicity and efficiency which shows the skill of the engineer at its highest. Through the courtesy of the Water Board officials we have been provided with the fullest information, including detail drawings, from which the description of the works contained elsewhere in these pages has been prepared. It is almost superfluous to comment upon the construction of the reservoir dam, which is practically a reproduction of the earthworks which already enclose the other large reservoirs of the Metropolitan Water Board, and abundant evidence exists as to their trustworthiness. From experience gained hitherto it is to be concluded that the satisfactory results of purification by storage will be confirmed at Chingford, while from their simplicity and present working there is very little room for doubt as to the satisfactory nature of the Humphrey pumps. On the contrary, it is probable that the installation of pumps of this new type at Chingford will mark the beginning of a new period in the history of pumping, for it is evident that if water can be lifted at Chingford by the direct pressure of gas upon its surface, the same principle can be applied elsewhere. The main fact in connection with the new pumps is that all the intermediate machinery which generally exists between the force of the explosion and the water to be pumped is dispensed with. To have done away with the driving engine and gearing, cranks, and pumps in the ordinary sense of the term, at one step is certainly a most impressive feat. We have yet to learn the extent to which the principle can be applied to smaller pumps, and to higher or lower lifts. The earliest steam pump was one in which the steam pressed upon the surface of the water, and the sole reason why other types of pump superseded Savery's engine was the loss of power caused by the condensation of steam coming in contact with the water, but since explosive gas has taken the place of steam, the old objection no longer applies, and it may therefore be seen that the Humphrey pump is a return to first principles. The only point for wonder is that such an obvious fact was not grasped before. It is satisfactory to remember that this advance has taken place in England: that an English engineer has invented the pump; and that it has been adopted by the greatest water authority in the world, the Metropolitan Water Board of London.

* * *

Cast-iron v. Lead Soil Pipes.

It is one of the peculiarities of London government that the metropolitan borough councils who administer the drainage by-laws have practically no voice in the framing of them, the responsible body for this work being the London County Council. As a result, an administrative authority may be compelled to enforce a requirement which has been proved by experience to be undesirable, the only remedy in such a case being that of making a representation to the county council to obtain the rescission of the objectionable requirement. This the Westminster City Council are now doing in regard to the metropolitan by-law governing the material and construction of soil pipes. The by-law in question provides very rightly that, wherever practicable, a soil pipe shall be placed outside a building. The materials permissible in such a case are either lead or cast-iron pipes conforming in weight and thickness with a table of requirements. Often, however, in

crowded districts a soil pipe must of necessity be placed, for at any rate a portion of its length, inside a building, and the by-laws require that soil pipes placed inside a building must be formed of lead, the use of cast-iron in such a position being not permissible. Possibly when the manufacture of cast-iron soil pipes was in its early stages, and flaws in the material were of occasional occurrence, the provisions of the by-law could be justified. Now, however, when a high standard of excellence has been attained, in all probability a cast-iron soil pipe will prove to be more satisfactory, when placed inside a building, than one of lead. An hydraulic-drawn lead pipe will, of course, for all practical purposes, be flawless; but, lead being a comparatively soft material, there is the risk that, if uncased, a lead pipe may have a hole accidentally knocked in it. It is assumed that the county council will be inclined to turn a sympathetic ear to the representations of the Westminster authority, for it is within recent knowledge that a late chairman of the county council was compelled by a decision of the High Court to remove a cast-iron soil pipe that had been placed inside a building of which he was the owner. At the same time useful weight might be given to the representation if other metropolitan borough councils also declared in favour of the amendment of the by-law.

* * *

Port Glasgow Sanitary Officer's Report.

There is so much rare candour of tone about the annual report which Mr. John Halliday, sanitary inspector of Port Glasgow, has submited to the town council of that place that no excuse need be made for drawing attention to it here. Primarily we are told that Port Glasgow, "whatever her other failings may be," has a scavenging system "that might well be the envy of many a larger and wealthier town." All the refuse from tenements is collected daily, all the streets are swept once a day, and the refuse is cremated within a few hours after it is collected. This is admittedly a highly satisfactory method of dealing with the refuse, but it is, it seems, subjected to such constant attack from the thoughtless and provocative action of all and sundry that Mr. Halliday cannot refrain from unburdening his soul on the matter. Somewhat in King Cambyses' vein, he alludes to contractors' carts which spill the contents of their loads in the streets, to housewives who sweep passages after the municipal staff have performed their task, and to "enterprising shopkeepers" who use the streets or footpaths as a store for cases which, when unpacked, yield a plentiful harvest of packing material which, if removed by a breeze, lightens the tradesman's task, and this "counts for much in these days of bustle and bounce." In addition, there is the workman who, after mixing lime or cement, "leaves a contribution to the common good" in the roadway, and contractors who scatter engine ashes over private and sometimes public streets as an easy method of disposing of such refuse. Mr. Halliday has reserved a special paragraph of his indictment for people who thoughtlessly cause blocks in sewers by allowing foreign matter to find its way into these receptacles. These individuals prompt Mr. Halliday to remark, almost despairingly, "We have so many in our midst who regard neither God nor man, so we cannot expect them to have regard for what belongs to a common foe." Finally, we have Mr. Halliday unburdening himself as follows with respect to the early abatement of minor nuisances: "A few are learning, if only at a snail's pace, that there are other duties in life that must be attended to than the collecting of rents, difficult as that must often be." Mr. Halliday has, it would appear, produced a report which in so far as it is a counsel of perfection might, perchance, render a cleansing department unnecessary, and which in so far as it is a moral essay is not so much edifying as novel and startling.

Municipal Work in Leeds.

A very interesting paper was read by Mr. W. T. Lancashire, M.INST.C.E., the city engineer of Leeds, at the recent North-Eastern District meeting of the Institution of Municipal and County Engineers. Among the greatest undertakings of the Leeds Corporation in recent years must be reckoned the housing scheme in the York-street and Quarry-hill areas, comprising together over 66 acres of fully built-up land. Fortunately, the corporation were able to carry out the demolition and clearance at a time when certain districts in the neighbourhood of the condemned area had been considerably overbuilt, so that the Local Government Board found it possible to relax their usual requirements as to rehousing. Another section of Mr. Lancashire's paper was devoted to an account of the pipe and cable subways which have been constructed in connection with certain new main thoroughfares in the city. The cost of these subways has been upwards of £20,000, so that it is hardly surprising that in certain quarters there has been some revulsion of feeling against further expenditure on this class of work. The authorities must be content to wait until time shall justify their outlay, and there can be little doubt that after the lapse of a few years the avoidance of the necessity for breaking up main streets, with its accompanying inconvenience and expense, will be looked upon as ample compensation for the cost now being incurred in the pursuit of a far-seeing policy. Other matters dealt with by Mr. Lancashire (whose paper will be found in another column) included street widenings and improvements, town planning, and the local procedure in the laying out of new estates.

* * *

A Sewage Nuisance.

Considerable difficulty has been caused in connection with the disposal of the sewage in the Brownhill urban district owing to the leakage of water from the subsoil into the sewers. So long ago as October, 1911, an injunction was obtained against the urban district council to restrain them from allowing sewage to escape from the collecting tank into the Ford Brook. This injunction, however, was suspended for four months in order to give the council an opportunity of installing a more efficient means of dealing with the sewage. New pumps were installed, but these have not proved effective in abating the nuisance complained of owing to the ingress of subsoil water during long periods of wet weather. Further proceedings have therefore been taken against the council for the purpose of enforcing the injunction. There was a conflict of evidence as to the continued existence of the nuisance, it being alleged on the one side that the brook was filthy, and on the other that it was clear and capable of supporting fish life. Mr. Justice Swinfen Eady, however, was satisfied that the nuisance still arose, and on the council giving an undertaking to keep the pumps working day and night, as far as practicable, he ordered the motion for a sequestration to stand over.

* * *

The Words "Asphalt" and "Bitumen," and their Meanings.

As a contribution to the settlement of the question of the proper use of the terms "asphalt" and "bitumen" we have prepared an article, which will be found in another part of this issue, in which we make suggestions as to how the scope and limitations of each word should be decided. This article was written after a careful study of the letters on the subject which we have published; but if any of our correspondents think that we have failed to attach due importance to considerations which he has put forward, we shall be glad to have our attention called to the point. The matter seems to be quite a simple one, and the approaching road congress would seem to provide an excellent opportunity for coming to some general agreement as to the use of these words.

London's Water Supply.

KING INAUGURATES NEW RESERVOIR AT CHINGFORD: FULL DESCRIPTION OF THE WORKS.

The great new reservoir of the Metropolitan Water Board at Chingford was formally inaugurated on Saturday afternoon last by the King, the Queen being also present at the ceremony.

Their Majesties reached Chingford at half-past four, and were received by the chairman of the board, Mr. E. B. Barnard. Replying to an address from the chief engineer to the board, and Mr. Barnard. A stone commemorating the completion of the reservoir was unveiled, and subsequently their Majesties were conducted over the pump-house, leaving at half-past five for Buckingham Palace.

In 1893 a scheme showing the capability of the Lee to yield additional water was laid before the Royal

Plan of Chingford Reservoir.
(Scale 3 inches to a mile.)

Water Board, the King said the citizens of London would do well to remember that after three centuries they still owed a debt of gratitude to the Lee for the remarkable purity of their water supply. The large sums which the Metropolitan Water Board had found it necessary to spend in new works bore witness to the magnitude of their task, and it was easy to realise

Commission on Water Supply by Mr. William Booth Bryan, M.Inst C.E., who was then the engineer to the company and is now the chief engineer of the Water Board. This scheme showed a chain of reservoirs extending northwards up the Lee Valley from Walthamstow to Enfield Lock; it included the construction of six new reservoirs and the raising of the level

Chingford Reservoir Pump House.

Inlet Pipes and Weir.

the heavy burden which fell on those responsible for the policy and administration of such great undertakings. They were justly proud of the reservoir, which was a splendid monument to the energy of their officers, the skill of their engineers, and the industry of their workmen.

His Majesty afterwards started the pumping machinery, at the same time naming the reservoir "King George's Reservoir." The King and Queen stood for some time watching the water issuing from the five outlet pipes, and talking with Mr. Bryan, the

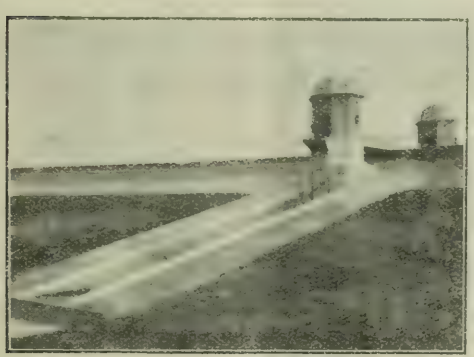
of an existing one by 9 ft. In the following year Parliament authorised the construction of the first instalment of this scheme, and in 1897 a second instalment was sanctioned; all these have been finished and in use for some years. In 1900 the company acquired powers for the completion of the scheme by constructing the last two of the series, with a capacity of 5,400 million gallons, and though they proceeded to acquire some 1,000 acres of land for the purpose, the decision of Parliament in 1902 that the London water undertakings should be trans-

ferred to the Metropolitan Water Board unavoidably delayed the construction of the works, and it was not until April 11, 1908, that the first sod of the Chingford reservoir was cut by Mr. E. B. Barnard, the present chairman of the board, who was at that time chairman of the Works and Stores Committee. The reservoir is the most northerly of the reservoirs which Mr. Bryan proposed to the Royal Commission.

Intake from River Lee.

and the last but one of those reservoirs to be constructed.

In constructing reservoirs in the provinces the object in view is usually accomplished by placing a dam across a moorland valley. Such a solution is not practicable in the case of London, for the reason that suitable valleys are non-existent, or are inadequately supplied with water. The alternative is to seek out a tract of land upon a bed of impervious clay and contiguous to a river of adequate flow. This tract of land is then enclosed with a waterproof wall of clay or puddle many feet thick, extending down-



Forebay and Outlet Towers.

wards to a watertight union with the underlying clay, and upwards to a height above the top water level of the intended reservoir. This wall of clay is then supported on each side with a sloping bank of earth, the internal bank being covered with stone, brick or cement in order to resist wave action. Such in outline is the method adopted at the Chingford reservoir.

The extreme length of the reservoir at water line is 1 mile 1,190 yds. and it has a capacity of about 3,000 million gallons; the area occupied, including bank., is about 500 acres; the top water area is 416 acres, and the length of the embankment 4½ miles. A short embankment has been thrown across the centre to prevent excessive wave action during high winds. This embankment has three openings, giving free access for water to each side.

The main banks of the reservoir contain about 2,400,000 cub. yds. of earth, &c., of which 253,000 cub. yds. are of puddle—*i.e.*, clay. The inner banks are lined with about 105,000 sq. yds. of concrete and brick paving.

The reservoir will be filled from the northern end with water pumped from the river Lee. This water will be stored in the reservoir for a considerable period, and after this the water will flow through regulating towers into a tunnel, and then along a channel nearly 2 miles in length to the existing distributing basin adjoining the Chingford Mill pumping station, thence by existing channels to the chain of reservoirs, twelve in number, constructed under the earlier Acts of the East London Waterworks Company. The outlets from these reservoirs are connected to a wide, open channel about 2,100 yds. in length, which conducts the water to the beds at Lee Bridge, where it is filtered and thence pumped into the district.

The river Lee, which ran longitudinally through the site of the actual reservoir works, has been diverted into the new channel 3¾ miles long, and extending from a point north of the reservoir near to Enfield Lock to the Chingford Mill pumping station. This diversion was one of the first parts of the work undertaken, and has been of the greatest utility during the construction of the reservoir, since it efficiently carried off all the winter floods and saved the reservoir works from inundation.

An intercepting channel 3¾ miles in length has also been constructed for the purpose of collecting surface

River Lee Diversion, from Centre of Eastern Embankment.

water from the eastern side of the valley and discharging it to waste into the river Lee below the intakes.

In its journey of 2 miles from the reservoir to the distributing basin the stored water is therefore protected from pollution by the intercepting channel on the east and the river diversion on the west.

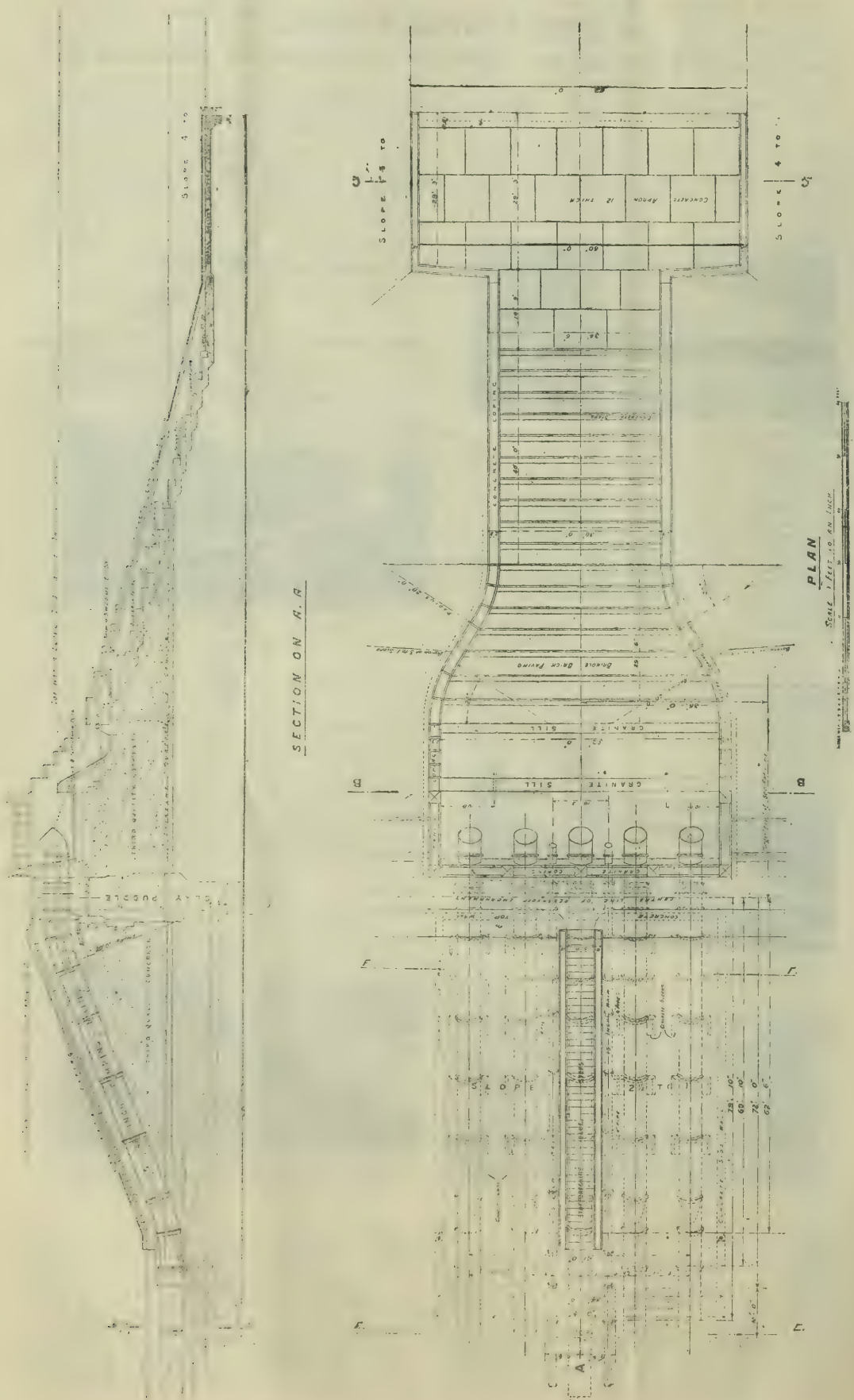
In substitution for the old and inconvenient Lee Valley-road, which was covered with water in flood time, a new road has been constructed across the valley between Ponders End and Chingford, and is carried by bridges over the river Lee diversion, the

River Lee Diversion, Road Bridge, Outlet Channel and Intercepting Channel.

outlet channel and the intercepting channel. Occupation bridges have also been constructed across those waterways at various points.

The "Humphrey" Pumps.

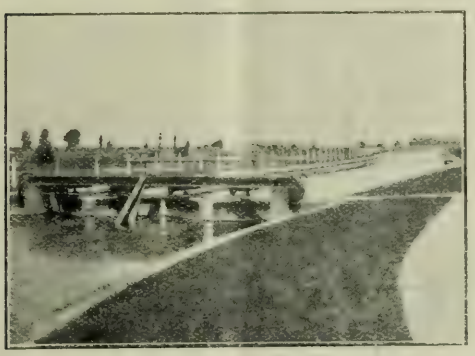
The pumping station is at the north end of the reservoir, and unusual interest attaches to it by reason of the fact that the pumping plant employed is unique in waterworks construction, consisting as it does of an installation of "Humphrey" pumps, in which the action of the internal combustion cylinder is directly applied to the raising of water.



Chingford Reservoir: Inlet.

The pumps have been designed by the inventor, Mr. H. A. Humphrey, M.Inst.C.E., of the Pump and Power Company, Limited, and constructed by Messrs. Siemens Brothers' Dynamo Works, Limited, of London and Stafford.

The great economy of these pumps results from the employment of the internal combustion principle, and as the explosion takes place in direct contact with the water to be lifted, there are no transmission losses, and the apparatus is of the simplest possible construction.



Balance Gates at South End of River Lee Diversion.

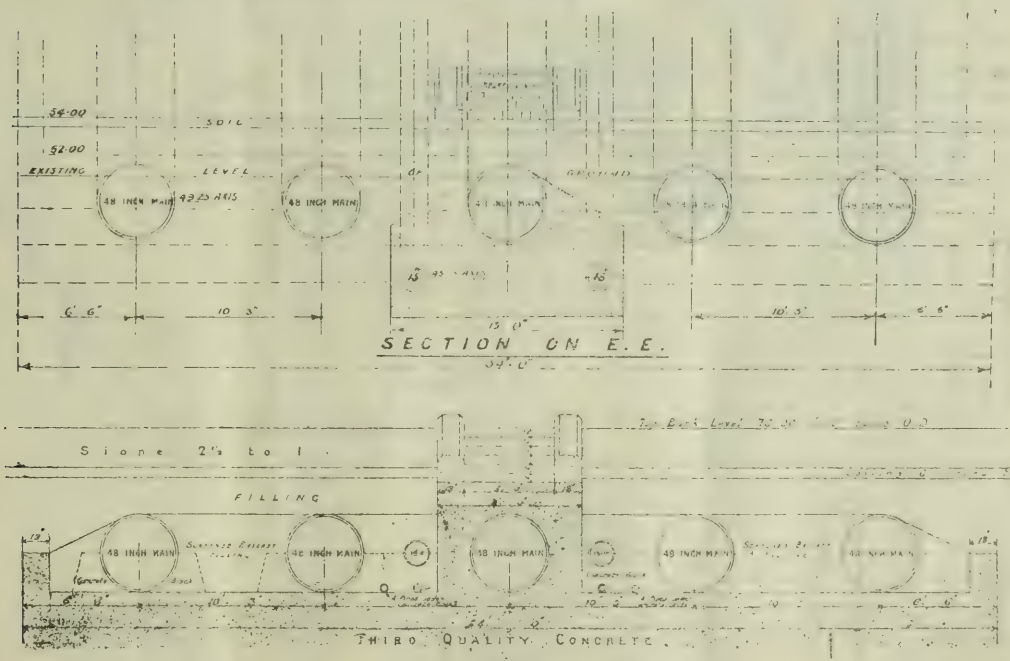
Distributing Basin at End of Outlet Channel.

Each pump may be looked upon as a gas engine and pump combined, but without piston, cross head, connecting rod, crankshaft, flywheel, bearings, gearing or stuffing boxes. All these parts found in ordinary pumps are dispensed with in the Humphrey pump.

The five Humphrey pumps erected at the Chingford reservoir include four large units and a smaller one. Each large unit is capable of delivering 40,000,000 gallons of water per day. The small pump is of one-half that capacity, and the total installation will therefore deliver 180,000,000 gallons per twenty-four hours.

The action of the pump can be best understood by picturing a horizontal pipe, connected by two bends at its ends with a vertical closed top combustion chamber and an open top water tower respectively. The parts thus connected are nearly full of water, forming a heavy mass or column, which is made to oscillate under the action of the explosion. This oscillation is quite free, and occurs in such a manner that the movement of the water causes the intake of a fresh combustible mixture, the compression of the mixture, the explosion and expansion which give the power stroke and the exhaust of burnt products. There are thus four primary movements of the water during each cycle, two being from the combustion chamber towards the tower and two in the opposite direction.

The success of the pumps is due to the use of the momentum acquired by the moving mass of water, for it is this momentum which enables the outward swing of the water under the action of an explosion to continue after the expansive force of the gases has finished, and thus to draw in scavenging air and to



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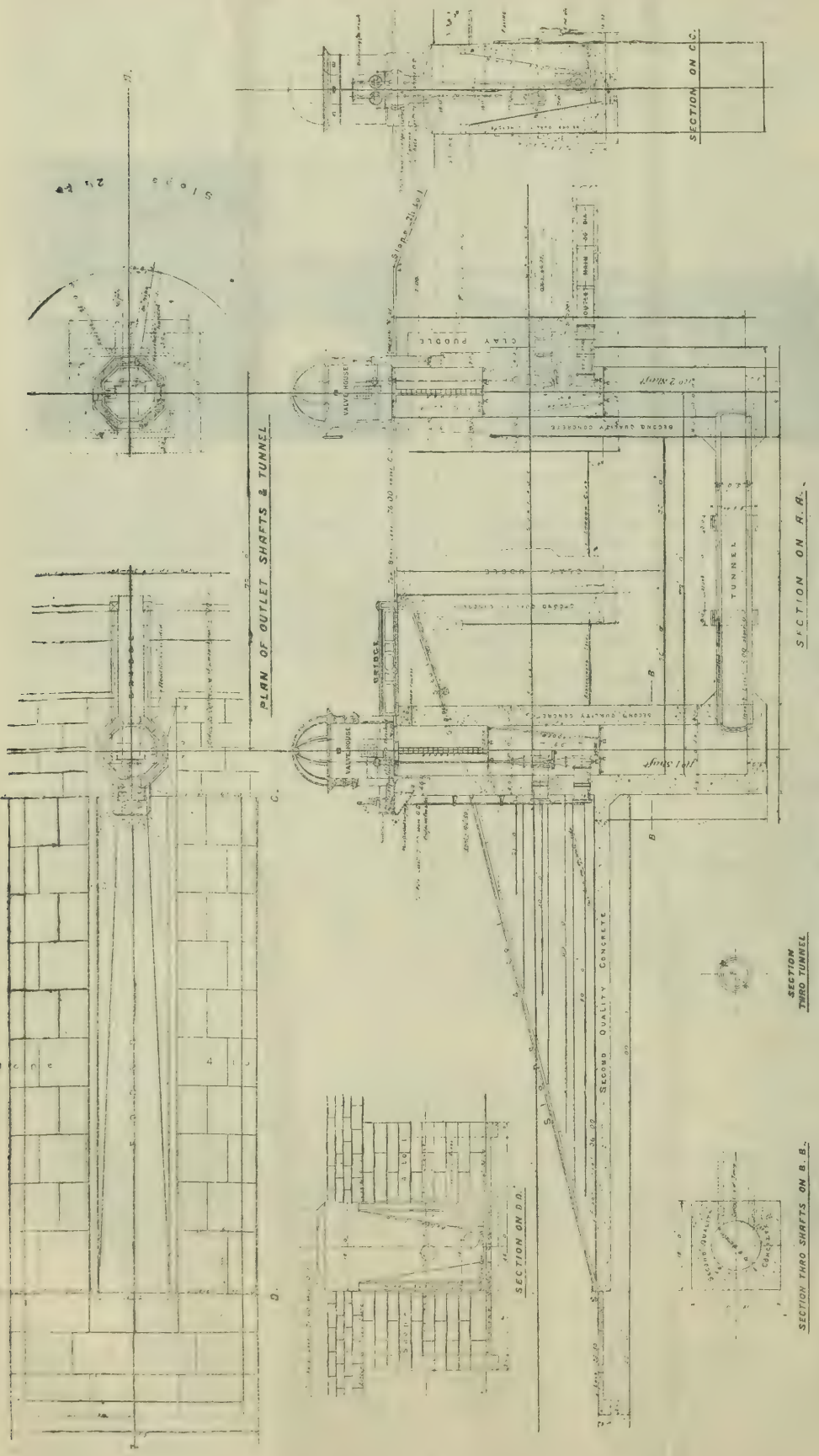
Chingford Reservoir: Details of Inlet.

cause the intake of fresh water from the low level during the first outward stroke. On the first inward stroke, which takes place under the head to which the water has been lifted, the column of water is allowed to acquire velocity and momentum while merely exhausting the burnt gases, and then the momentum is utilised to compress a cushion of scavenging air imprisoned in the top of the combustion chamber above the exhaust valves. Energy is

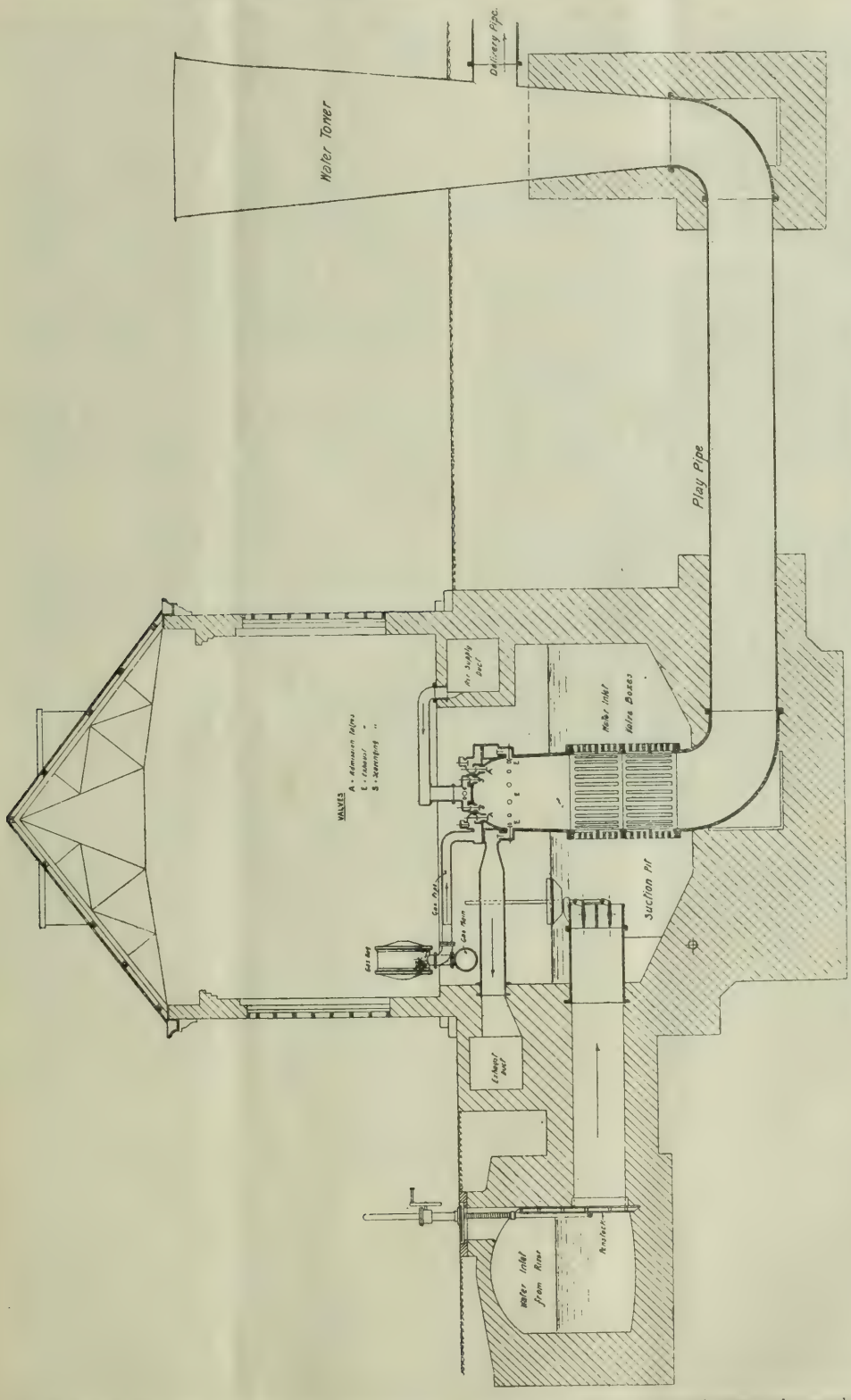


Chingford Reservoir: Outlet Shafts and Tunnel.

thus stored in the compressed cushion, and this cushion expands, giving the second outward stroke, and, again, it is the momentum which is relied upon to carry the water column far enough to draw in behind it a fresh mixture of gas and air. The second return stroke now takes place and the explosive mixture is compressed, and once more, owing to momentum, the compression pressure far exceeds that which would be due to the static head of the liquid, and thus permits a high thermal efficiency.

The only working parts are the valves, and of these the admission valves for combustible mixture and the exhaust valves for burnt products are placed in the combustion chamber, and the valves for admitting fresh water are placed circumferentially round a vertical valve box situated between the combustion chamber and the bend which connects to the horizontal pipe.

To give some idea of the size of one of the larger pumps, it may be mentioned that the combustion



Chingford Reservoir: General Arrangement of One of the Five Humphrey Pumps.

chamber and valve box are both 7-ft. diameter, and the bend connecting them with the horizontal pipe is 7-ft. diameter on one face and 6-ft. diameter on the other face. The horizontal pipe is 6-ft. diameter throughout, and the vertical tower at the other end gradually increases in the shape of an inverted cone until it is 15-ft. diameter at the top. If a person passed from end to end inside the apparatus, he would find a perfectly clear and unobstructed waterway, and it would look more like a big empty pipe than a piece of machinery.

On each explosion in one pump 12 tons of water will be taken out of the River Lee and delivered into the reservoir.

The best popular conception of the apparatus is that of a huge swinging pendulum, formed of the mass of water, which moves to and fro, but always in such a manner that at each cycle 12 tons of water leave the apparatus at the high level, while 12 tons of fresh water enter at the low level to take its place.

The pumps can be stopped and started instantaneously by merely controlling a switch on the electric ignition circuit, so that it is possible to have all five pumps at rest one moment and yet all working at full load half a minute later.

The reservoir, river diversion, bridges, roads pumphouse, cottages, and other buildings and works were designed by the Water Board's chief engineer, Mr. William Booth Bryan, member of the council of the Institution of Civil Engineers, and have been constructed under his supervision by Messrs. Charles Wall, Limited, contractors to the board.

The cost of the works amounts to some £550,000.

NEW WORKS REQUIRED.

The task of the board in keeping pace with the ever-increasing demand necessarily involves constant capital expenditure. This has already amounted to nearly £3 000 000 since the waterworks passed under public control in 1904, and has added 50 per cent to the storage capacity by raising it to 13 000 million gallons. The board are now occupied with the building of two other reservoirs at Littleton, in the Thames Valley, which will again increase their storage by 7 000 million gallons at a cost of £1,600 000 being part of a loan of £4 100 000 for the execution of works and the purchase of lands authorised by Parliament in 1911. Powers are also possessed for a further reservoir at Staines, and for the final one in the East London Company's Lee Valley scheme; while sanction is being sought in the present session of Parliament for various works in Kent.

Glasgow Water Supply.—The Water Committee of Glasgow have agreed to recommend the corporation to apply for Parliamentary powers to include Loch Voil and Loch Doine in the area of water supply. The scheme involves the raising of these two Balquhidder lochs between 30 ft. and 40 ft., the construction of a dam at the east end of Loch Voil, and of an aqueduct from the west end of the valley and thence through the hills to Loch Katrine, a distance of between 5 and 6 miles. When completed, which it is expected to be eight years hence, the scheme will increase the available daily water supply of Glasgow by from 40,000,000 to 50,000,000 gallons, bringing up the total supply to about 130,000,000 gallons per day.

The Roads Improvement Association.—Mr. Robert Todd presided at the March meeting of the council of the Roads Improvement Association, held on the 13th inst. The annual general meeting was fixed for April 17th, at 15 Dartmouth-street, Westminster, S.W., at 4.30 p.m. The draft annual report and statement of accounts for 1912 were approved for submission to membership. A leaflet is to be prepared for the use of roadmen giving simple and clear rules for carrying out road-tarring work; a number of complaints of unsatisfactory results of tarring have been traced to lack of knowledge of the men actually engaged on the work. The question of excessive camber, or side fall, on a number of streets and roads was again discussed, and it was resolved that the association prepare a memorandum setting out road users' views upon this subject. Special action is to be taken whenever roads are being resurfaced to bring the desirability of reducing the camber prominently before the responsible authorities. Counsel is to be briefed, on behalf of the association, in support of the application of the Corporation of Croydon to raise the £20,000 necessary to carry through the relief road scheme.

SOME RECENT PUBLICATIONS.*

The Elements of Heating and Ventilation. By A. M. Greene, junr. Price 10s. 6d. nett. London: Chapman & Hall, Limited.

The time has long since gone when architects and engineers were content to deal with problems concerning the warming and ventilation of buildings by purely empirical methods, and such questions are now invariably dealt with on strictly scientific lines. This book will therefore be welcomed by heating and ventilating engineers, inasmuch as the author has brought together in one small volume the necessary data from which to design a heating and ventilating system for any building. The various methods of heating and ventilating are discussed in considerable detail, and there are, in addition, excellent chapters on Loss and Gain of Heat, Methods of Calculating Heat required for Rooms, and Temperature Control. The text is illustrated by many very clear diagrams, and there is much information which has been arranged very conveniently in tabular form. As a logical and well arranged treatment of the subject Mr. Greene's book has much to recommend it, and those who are interested in this important branch of design would do well to study it carefully.

"The Surveyor" Book Department.—Our readers are reminded of the facilities afforded by this department for the prompt supply of technical and scientific books, a selected classified list of which will be sent post free to any applicant. Address the Manager, Book Department, 24 Bride-lane, Fleet-street, E.C.

Royal Charter to Scottish Surveyors.—The Society of Ordained Surveyors and the Glasgow Institute of Measurers, who have amalgamated under the title of "The Faculty of Surveyors of Scotland," have been granted a Royal Charter with the right to the members to style themselves "Fellow of the Faculty of Surveyors" and to use the letters "F.F.S."

Change of Address.—Messrs. Herbert Morris, Ltd., Empress Works, Loughborough, have, owing to the rapid growth of their business in the metropolis, under the management of Mr. F. H. Jeens, removed their London office from Norfolk-street, Strand, to 39 Victoria-street, S.W. Their new telephone number is 740 Regent and their telegraphic address "Comorris, Vic., London."

London Sewer Accident.—While endeavouring to locate an escape of gas, an employee of Kensington borough council was asphyxiated and four other men were rendered unconscious in a sewer in Pembridge-street, Notting-hill, on Tuesday, and in the work of rescue two firemen also lost their lives. The sad occurrence was reported to the county council at their meeting during the afternoon, the chairman of the Main Drainage Committee Mr. J. H. Hunter stating that the men were overtaken by sewer gas. The sewer was a local one and not strictly under the jurisdiction of the council. In addition to the two firemen who had lost their lives two others were seriously injured. Mr. Hunter said he was sure that every member of the council would receive the news with the deepest sorrow. The chairman, Mr. Cyril Cobb, also expressed the grief of the council at the terrible accident and their sympathy with the relatives of those who had lost their lives.

Association of Bituminous and other Paving Materials Manufacturers.—The first annual dinner of this body was held at the Westminster Palace Hotel on Tuesday, the 11th instant, when the chairman of the council, Mr. F. E. Bristowe, presided in the absence abroad of Lord Montagu, the president. Sir George Gibb, chairman of the Road Board, and other public representatives were present. Mr. Bristowe, the chairman, explained the aims and objects of the association, which were, he said, for mutual co-operation and the advancement of the good roads movement, adding that they constituted in no sense a trade organisation. In replying to the toast of "The Visitors," Sir Geo. Gibb made special reference to the policy of the Road Board and to its attitude with respect to new materials for, and new methods of, road construction. They desired, he said to encourage experimental work in regard to them by road engineers, and by manufacturers and contractors.

* Any of the publications reviewed, or referred to as received, will be forwarded by the St. Bride's Press, Ltd., on receipt of published price.

Asphalts and Bitumens.

THE NEED FOR USING A SUFFICIENT NUMBER OF SUITABLE WORDS.

The discussion which has been taking place in our correspondence columns with respect to the meanings of the words "asphalt" and "bitumen" has, we think, prepared the way for a general agreement as to the meanings which should be attached to those words.

The fact which has first to be recognised is that both words have been used, commercially, to describe materials containing as the essential substance, a mixture of hydrocarbons which comes under the chemist's definition of "bitumen," and, in addition, a proportion of mineral matter. The latter may be in large proportion, as in the case of rock asphalts, or in quite a small proportion, as in the case of such materials as Trinidad Lake asphalt. The second fact is this. When a material which is one of the wide class above referred to contains a large proportion of the mixture of hydrocarbons, it is sometimes called "bitumen." For instance, the material already alluded to as Trinidad Lake asphalt is sometimes called Trinidad Lake bitumen. The third fact is that various materials produced by the treatment of products found in natural deposits, by adding mineral matter to them, or by the mixture of several of them in different proportions, are called *asphalts*, with various adjectives which give some further information as to their nature. The fourth, and last, of these preliminary considerations is that various mixtures of artificially produced bituminous substances with mineral matter—such as coal-tar and pitch mixed with sand and gravel—are often called *asphalt*.

Now, the chief difficulty in the way of a practical settlement of the matter is the reluctance of the persons concerned to use a sufficient number of words to convey the facts, and to indicate the natures of the materials alluded to. Suppose that a golfer tried to play his game with two clubs only—a cleat and a putting iron, say—we should think him a foolish man if he wasted time in argument as to which was the driver, which the lofting iron, and which the mashie. He would be trying to fit words and facts to suit his limited equipment, instead of providing an equipment to suit the conditions. It would be even worse if he used a croquet mallet from time to time, and argued on the question whether it was or was not a golf club when used *for the same purpose*. Now, if engineers try to make two words serve all their purposes in describing or alluding to the materials to which we are referring, they will involve themselves in difficulties of the same kind as those confronting our imaginary golfer. Tar paving, pitch concrete, tar-pitch concrete or, generally, bituminous concrete, correspond, in this sense, to the croquet mallets of the golfer; good mallets, but not golf clubs; good paving, but not asphalt. If we use the word "asphalt" for a concrete, we shall want another word for asphalt as a binder for broken stone road crusts.

We *must* have a word to describe the homogeneous materials, such as those found in a natural state It is equally clear that we must have a word to describe the mixture of hydrocarbons, which is an essential element of such materials, but is also capable of having a separate existence. Since chemists call it "bitumen," that is probably the best word we can use. Only in the last resource should a new word be made. The chickens of language can be beheaded, but they do not die; and it is a horrible thing when the headless birds come home to roost.

Another important fact with regard to the development of language is that, as life becomes more complicated, different words used to describe the same thing can, when the thing multiplies its meanings, be severally used to describe the several things. For instance, "gate" and "road" have both been used for a thoroughfare, but one now means a very short thoroughfare, or the barrier across it, and the other means a long thoroughfare. So it does not matter at all that the words "pitch" and "bitumen" used to be applied to the same thing; each can now mean a different thing, or one may be general in its application, the other precise. Language usually changes of itself but we may give a push to the changes now and then; and such a push is needed in the present case.

If no one wants the word "pitch" for a natural bitumen already called "pitch," we can use the word for artificial products, and "bitumen" for natural products; or we could do so if we had not need of a general word for both. As such a need seems to be felt, and we are already tied by the use, in both senses, of the word "bituminous," we must fall back on the two adjectives "artificial" and "natural."

Next let us recognise the fact that, having the two words "asphalt" and "bitumen," these will serve us best if we separate them completely from each other. Since "bitumen" is already used of the mixture of hydrocarbons, let us clear the word "asphalt" from this meaning, leaving it free for another purpose, as the general word for the materials as found in their natural state. Should any of these materials contain more than a certain percentage (to be agreed upon) of bitumen, it may be called "bitumen."

The giving up of this term in the case of a material not having a sufficiently high percentage of hydrocarbons may involve some sacrifice on the part of individuals, who may be appealed to to make the sacrifice in the interests of the profession and the public.

It may be proposed, then, that the word "asphalt" may be used to describe such of the materials of the class to which we are referring as are found in natural deposits, or are made by combination of several such, or by the addition of mineral matter in a finely divided or amorphous state; the word "natural" being prefixed to imply that nothing has been added to the material and nothing done to it, the term "natural, refined" being used to denote that the material has been treated without the addition of anything, and "treated," say, to denote treatment which may include the addition of artificial materials.

The word "bitumen" can then, as suggested by our correspondent, be used with the adjectives "natural" and "artificial"; the former term, it may be suggested, being applicable when the material is derived, without any important change, from a natural material in which it was present *as bitumen* before the treatment, and "natural untreated bitumen" being used when there is no treatment. The term "natural refined bitumen" could be used for materials to which other substances have been added, up to some proportion agreed upon; for higher proportions of added substances the word "natural" would be left out; but the proportion of the natural material could be stated.

We are unable to agree with Mr. Cecil Nathan's proposal that the two words "asphalt" and "asphalte," with an "e" can usefully be employed, since the former word is really the same as the latter, and is, in fact, its successor in the pages of The Surveyor. A better case could be made out for the use of "asphaltum" for such a purpose as that suggested by Mr. Nathan, who regards the words as applicable to the pitchy residues, or "bituminous" in our wider sense, derived from the distillation of asphaltic or semi-asphaltic petroleums. The word "maltha" is also one which might be used.

In conclusion, we may conveniently repeat here the following definitions from Mr. Prévost Hubbard's bulletin on "Bitumens":—

Asphalts.—Solid or semi-solid native bitumens, consisting of a mixture of hydrocarbons of complex structure, largely cyclic and bridge compounds, together with a small proportion of their sulphur and nitrogen derivatives, but free from any appreciable amount of solid paraffins, melting upon the application of heat, and evidently produced by Nature from petroleums containing little or no solid paraffins.

Solid or semi-solid residues produced from probably similar oils by artificial processes are sometimes called asphalts, but should more properly be termed oil asphalts.

Native asphalts, with few exceptions, contain water, extraneous organic or vegetable matter, and inorganic matter, such as clay, sand, &c. A large proportion of these impurities is removed by a rough refining process without otherwise changing the character of the asphalt.

Bitumen.—Bitumens are mixtures of native or pyrogenetic hydrocarbons, and their derivations, which may be gases, liquids, viscous liquids, or solids. If solids, they melt more or less readily upon the application of heat, and are soluble in carbon bisulphide, chloroform

and similar solvents. They may be divided into two main classes—(1) Native bitumens, and (2) artificial bitumens. Bitumens, being mixtures of hydrocarbons, can have no melting point, although this term is often used to denote the temperature at which they soften sufficiently to flow. [This applies also to asphalts.]

Malthas.—Malthas are very viscous, semi-asphaltic or asphaltic native bitumens holding an intermediate position between the petroleums of an asphaltic nature and the native asphalts.

Pitches.—Semi-solid or solid residues produced in the evaporation or distillation of bitumens. The word is often prefixed by the name of the material from which it is derived, and as oil pitch, coal-tar pitch, &c.

Other definitions will be found on p. 383 of our issue of March 10, 1911.

CORRESPONDENCE.

For every ill beneath the sun
There is some remedy or none;
If there be one, resolve to find it;
If not, submit, and never mind it.
— Anon., *circa* 1843.

THE DRAINING OF MOOR ROADS.

To the Editor of The Surveyor.

Sir,—As you ask for the experience of surveyors who have had charge of moorland roads, I beg to give some particulars which may be useful as the outcome of several years' experience in charge of some of the most mountainous moorland roads in this country—*i.e.*, those crossing the Pennine Chain.

These real moorland roads are high "passes" for the most part and generally very steep, rising, as they do often, in a mile or two from valleys, say, 400 ft. or 500 ft. above sea level to cross heights up to 2,000 ft. and even more; so you will know that, owing to the exceptionally heavy rainfall, the question of drainage is in such districts a special problem in itself.

Again, many of these roads—especially across peaty and boggy moors—are unfenced, long poles at intervals serving to guide the "wanderer" when all is level with snow, though many lives have been lost in the deep roadside ditches or bog holes—often many feet deep—"gouged out" by storms.

In fact, all such roads as those between Northumberland and Cumberland (Alston and Allendale Moors), and Yorkshire (W.R.) and Lancashire (Holmfirth and Saddleworth Moors), might be fenced and drained by the aid of grants from the Road Board, who in many ways are looking closely after the safety of road users.

Your correspondent last week is, I think, in error in taking the "grips" in the case referred to to mean the ordinary grips in the roadside *verge*, though as a one-time surveyor under the Norfolk County Council I can both endorse his remarks and commend his exemplary intelligence. The flat Norfolk roads, however, are wholly dissimilar from those where the accident referred to occurred, and have usually only about one-fourth the rainfall of the Pennine districts, where also the adjoining land is seldom on a level on both sides of the roadway, as it is for the most part in East Anglia.

I take the "grips" such as those which gave rise to the case to mean grips, or channels, *across the roadway*, which in very hilly districts are either laid with edgestones (thin kerbs) in the form of a shallow V or a slight concave depression diagonally across the roadway, or channels are laid with setts, though in many instances the water makes its own channel in the macadam, which, remember, on these severe gradients must "wear rough," or at least "gritty," so as to provide foothold for horses, and hence must be comparatively soft, and not like granite, which would better resist the scouring action of the fast-running water.

It will immediately be asked, "But are these grips necessary?" Personally I agree with the Westmorland men, and especially their able county surveyor, Mr. Bintley, who according to the report in a local paper, declared that these grips were "very dangerous," and I would sooner take the word of one real expert in charge of, perhaps, hundreds of miles of similar roads, than that of scores of "pseudo-experts," who probably have seldom ever seen real moorland roads—especially in times of storm. While in charge of the district I refer to I managed to remove every one of these grips by extending the side channels or drains, relaying with larger pipes, duplicating same in connection with additional catchpits, gratings, &c., or, when I could not shorten the "run" of the surface water, or get it across underneath the road—as in long cuttings through rock, &c.—by paving a wide crossing. To merely pull out these old-time channels or grips without making provision for dealing with the immense volumes of water which, because of the contour of the ground, must come down the roadway or channels, there being often no "verge," is worse than fatuous—it is criminal, as I have seen both side channels and the whole of the metalled roadway "gutted out" in places 2 ft. or 3 ft. deep during exceptional storms, when the debris has been piled up or washed into adjoining fields in cartloads—all owing to clogging of gratings or the insufficient provision of drains or outlets which can hardly be too numerous in such places. In every district liable to such storms or conditions the whole area should be "planned out," and a certain number of catchpits and gratings scheduled to each roadman (preferably those nearest his home), and both foremen and surveyor should see that the requisite attention is given to all these during and after every storm.

With the present-day "high-speed" traffic, however, the diagonal gutters such as I have described should not be tolerated, for if these are "very dangerous" in the case of an ordinary bicycle—at the 12 miles per hour as stated—what must the risks be, say, in the case of a motor bicycle and side-car combination, when, as in the case of a diagonal grip only 6 in. deep, the heavy side must be at least 1 ft. lower than the light side, which latter is, moreover, being tilted up, while the other is dropping in crossing every such "grip"? and the motor car and horse and trap are alike in being only "less dangerous."

Besides, our roads should be made as safe as possible, not only to the "legitimate" user—and we cannot all travel as leisurely as our worthy judges—but, in cases of emergency—*e.g.*, "brake failure" and "runaway" cases, both of which experiences I've tasted along, doubtless, with thousands of other careful men.

The whole case is but one more bit of support to the contention that "the time has arrived," as our Parliamentarians would say, when the whole administration of the law respecting our roads should be placed in the hands of a central road authority or tribunal equipped with both knowledge and power, and assisted by thoroughly qualified and practical men—real experts, and mostly "doers" rather than "talkers"—and I think the Road Board might well form the nucleus around which the best brains of the country could be gathered—*before* 2913.—Yours, &c.,

Walton Maughan.

Stoke,
Coventry.
March 11, 1913.

[Mr. Maughan points out, in a postscript, that his reference to "last week's correspondence" is to Mr. W. Adley's letter and not Mr. Hope's contribution. He also remarks that the water crossings should be wide and shallow, and that the setts should be grouted and laid in a concrete foundation. The "painting" (tar-painting) of the side channels helps to prevent scour, and similar painting of the road surfaces adjoining the paved crossings is likewise a useful precaution. The subject is an important one, and we are therefore preparing a special article in which the points raised by our correspondents will be discussed, and the sketches which Mr. Maughan has sent us with his letter will be reproduced.—Ed. Surveyor.]

LAND VALUATION BOARD APPOINTMENTS.

To the Editor of The Surveyor.

Sir,—In reply to the letter of "Property Owner," expressing his astonishment at the department appointing a man whom he considers is not qualified to fill the position of valuation assistant, let me assure him that there is no need for his alarm or great concern.

Yes, the public are to understand that certain properties are being valued by a valuer who, primarily only, had six months' experience as a valuation assistant in the department; and why not? Experience is not governed by the length of time employed, but by the amount of work done.

Does "Property Owner" contend that a man with three or four years' experience in a private office,

doing valuations only occasionally, is better qualified to carry out valuations under the Finance Act, 1909-10, than a man who has daily for six months been assisting an experienced valuer, and a Fellow of the Surveyors' Institution by examination in all classes of valuation work? If so, his contention is wrong.

The average value of the property valued by us was about £80,000 per month. How many valuers in private practice have work to this amount passing through their hands in one year? Very few, I guarantee.

On the same basis, therefore, I can safely say, without fear of contradiction from those who understand the subject, that my experience of six months in the department was better than six years in an ordinary private valuer's office.

If "Property Owner" will again refer to my letter he will observe that I did not say that I valued collieries, public-houses, factories, &c., but that only those with the best of experience valued them—which is so. There are special mineral and colliery valuers, special licensing valuers, &c. Had he read carefully before he rushed his reply into print much misrepresentation would have been avoided.

For the first few months I was engaged only on small cottages and 6s. 6d. per week houses, and gradually worked to houses of a higher rental.

I should have added in my former letter that, although the owner comes storming into the office, objecting to the valuations, he invariably leaves perfectly satisfied that they are quite correct. The chief reason that there were any objections at all was in my case, that, as the property was leasehold, the owner confused "the amount attributable to structures" with his leasehold interest, whereas these two amounts might or might not agree.

With regard to the last paragraph of "Property Owner's" letter, I can only reply that the heads of the department are valuers not only of real estate, but also of men. Hence my promotion. Had "Property Owner" been in the same position perhaps he would have remained a draughtsman.

In reply to "Site Value," he is hardly correct when he says the whole department is seething with discontent. It is only a discontented few, and such would seethe anywhere, even in regions like Klondyke. I imagine the Canadian surveyors would be glad of a few seething friends at certain seasons of the year.

"Site Value" will, no doubt, remember that applicants stated the salary desired, and it is their own look-out if they are willing to work for 25s. a week. I agree that many of the valuers never saw a provisional valuation until they took up office, the reason being that they were appointed to dispatch them, not to receive them. The mere sight of a provisional valuation would not help much.

After all, it is not the department which is to blame, but the source which made the young surveyor enter it.—Yours, &c.,

Valuation Assistant.

THE ACTION OF OILS ON CONCRETE.

To the Editor of The Surveyor.

Sir,—In your issue of January 3rd, which has just come to my attention, you give a review of a paper by Mr. W. Laurence Gadd, F.I.C., M.C.I., before the Concrete Institute. I have been unable to obtain a copy of Mr. Gadd's paper, and my only knowledge is from the review mentioned. It contains the statement that "Mr. Gadd disposed very effectively of the proposal, which has gained some ground in America of late, to incorporate a certain small amount of oil or fat with concrete so as to render it dustless and waterproof." It closes with the statement "that oil-mixed concrete is not rendered more waterproof."

As Mr. Gadd's results are so at variance with my own, and as I have carried on an elaborate series of experiments on the subject for the last three years, I think it may be of interest to your readers to see some of the data which I obtained. I am therefore enclosing you a copy of a paper that I recently issued on the subject, which you may review if you consider the matter of sufficient importance.

It has long been known that animal and vegetable oils will disintegrate concrete; but mineral oil, particularly the asphaltic residual oils, have not, in my three years' experience with them, had any more weakening effect on concrete than any of the materials used in waterproofing. I have also obtained better waterproofing results both by the absorption and permeability tests, as well as in practice, than with any other waterproofing materials.—Yours, &c.,

L. W. Page,
Director of the United States Office of Public Roads.

Washington, D.C.
February 7, 1913.

[Some reference to Mr. Logan Waller Page's experiments and their results has already appeared in The Surveyor, but we shall take an early opportunity of publishing fuller details, and of discussing the significance of any tests which seem to be at variance with those carried out by Mr. Logan Waller Page. In the meantime, we apologise to Mr. Page for the somewhat cursory nature of our remarks in the issue of January 3rd, and hasten to say that we believe that they do not do full justice to the results of his tests. —Ed. Surveyor.]

THE VALUE OF EXPERT ADVICE.

Last year the tank of an Ilkeston gas-holder burst, and the escaping water caused considerable damage to property, and the death of a girl, who was drowned in a flooded house. An inquiry was held in due course by the Home Office, and the report and findings of the inspector (Mr. A. G. Drury, engineering inspector of the Local Government Board) were published on Monday last. He attributes the accident to structural defects, and adds:—

"As events have proved, the town council were somewhat ill-advised in not calling in a specially skilled engineer to advise them in the choice of a design, and the initial mistake was the acceptance without question of a specification and design from a manufacturer in competition with other firms. This is a practice which has come increasingly into vogue during recent years, and it cannot be too strongly deprecated. There is nothing to be said against, and, in fact, a great deal is to be said in favour of, inviting firms who have made a speciality in the manufacture of a certain commodity to submit prices and their own designs. It is too often the case, however, that public and other bodies, with a mistaken idea of economy, elect to dispense with the services of a qualified adviser because not only do they grudge his fee, but they fear that, as the result of such action, they might be compelled, against their inclinations, to adopt more substantial and costly works. But there is little room for doubt that in the long run, and in the interests of all concerned, it is the best and the cheapest policy, and it has been amply exemplified in the present instance."

Electrical Engineering.—Messrs. Jones & Attwood, Limited, Stourbridge, announce that, in addition to heating and hydraulic engineering, they now have an electrical department for the manufacture, supply and erection of electrical plant for lighting, heating or power purposes. A large showroom is in course of erection at Stourbridge, where electrical requisites, together with other specialities, will be open for inspection. Mr Bannister, a former associate of the Institution of Electrical Engineers, is manager of this department.

Sewage Purification by Electricity.—Electrolysis as an aid to sewage purification, which did not in this country fulfil the expectations it aroused some years ago, is being used in the United States at Oklahoma City, where, says *Scientific American*, there has been installed "a plant where this treatment is successfully applied. A slow stream of city sewage is run through flumes between batteries of iron electrodes. A current of 270 amperes and 2·5 volts is passing between the electrodes, and, of course, produces considerable electrolysis of the salts contained in the sewage. The result of such electrolysis is to liberate a great deal of oxygen and some ozone at the anodes. This active oxygen and ozone oxidises the organic matter into harmless and unobjectionable products. At the cathode some metallic hydroxides, or bases, are formed, and these assist in coagulating the floating filth. Colloidal particles in fine suspension are also driven to the electrodes, and collected in masses large enough to settle. This Oklahoma plant has a capacity of 750,000 gallons every twenty-four hours, at a cost of operation of only $2·16 (9s.). The municipality is now building a plant for the electrolytic formation of a flocculent precipitate, capable of treating 4,000,000 gallons daily."

Comparative Reports of General Practice.—LXXX.

DUST COLLECTION IN AND AROUND THE METROPOLIS.—(5.)

The present comparative report of general practice—the first portion of which appeared in our issue of February 21st—deals with dust collection in and around the Metropolis, and is reproduced by the courtesy of Mr. Reginald Brown, M.INST.C.E., F.S.I., engineer and surveyor to the Southall-Norwood Urban District Council. Mr. Brown has collected information on the subject from no fewer than sixty-one districts.

District	Population.	Area in acres.	Storage.		Collection.						Disposal. How is your Refuse disposed of (in cubic yards) per annum?						Remarks
			Do you insist upon the provision of galvanised iron sanitary dustbins?	Do the owners or council provide same?	(a) How often is the refuse collected?	(b) Do you collect by contract or by your own staff?	(c) Is there a "house-to-house" collection, or is the "D" Card System adopted?	(d) What is the average number of men and carts employed daily?	(e) No. of cubic yards collected daily.	(f) Have you made any regulations as to assistance to be given by occupiers? If so, what?	Tip.	Brickfields.	Barging.	Destructor.	Other means	Cost.	
Staines (Urban) ..	6,756	1,905	Yes	Owners	Weekly	Own staff	House-to-house	1 cart and 2 men constantly and 1 cart and 2 men extra 1 day per week.	10	No	3,120	—	—	—	—	1/-, including collection.	
Shoreditch ...	See remarks	664	Yes	Owners	Part daily, remainder twice or three times weekly	Own staff	House-to-house	22 vans, 44 men	240	See remarks	—	—	Trade refuse, clinkers &c. 16,72· tons	All house refuse, 28,408 tons	—	—	Population 111,463 at night, estimated over 3 million by day. (f) Those streets scheduled by police to be clear before 9 a.m. Occupiers place receptacle on footway.
Southall-Norwood ...	26,334	2,575	Yes	Council	Weekly (see remarks)	Hire horse and 1 man, supply cart and another man (for each district)	House-to-house	5 carts, 10 men (5 districts)	30	No	7,800	—	—	—	—	2/2½. removal and disposal	(a) In some special cases twice weekly.
Southgate	36,000	3,597	Yes	Owners or occupiers	Weekly	See remarks	House-to-house	8 vans each with own man and sometimes 2 own men, and a hired driver, also a foreman	72	No	—	—	—	21,600 See remarks	—	—	(b) Hired horse and driver, but on each beat council's own man (with own van) collects and supervises *Disposal.*—If shut down for repairs a few of these must go to a tip.

St. Marylebone	116,155	1427·8	Yes	Owners	See remarks	Contract	House-to house	40 vans	Variable, according to season	See remarks	—	—	—	—	—	No information available, work done by contract	(*a*) Weekly for private houses, 2, 3, or 6 times, according to accumulation. (*f*) Where kerb collection is in vogue, occupiers put bins on kerb or in easily accessible position on premises.
Sutton (Surrey) ...	21,270	1,836	Yes	Owners	Weekly	See remarks	House-to house	6 men and 6 lads, 6 carts	54 yards approx.	No	14,040	—	—	—	—	No information available	(*b*) By council's staff. The district is divided into six portions, each man responsible for the district allotted to him.
Staines (Rural)	14,000	5,500	Yes	Owners	Weekly	See remarks	House-to house	3 to 4 carts 6 to 8 men	4 loads, 6 yards per cart	No, occupiers make too much fuss	See remarks	—	—	—	—	—	(*b*) Hire horses, and one man to each horse, council private carts and 1 man. All refuse is shot into old disused gravel pits and covered with layers of gas lime and earth.
St. Pancras	218,453	90 miles	No (see remarks) *	Owners or occupiers	See remarks	Own staff	House-to house	40 vans, 2 men with each	About 140 tons or 600 cubic yards	No	—	—	6,705 tons or about 28,73 cubic yards	36,908 tons or about 58177 cubic yards	—	Barging 3/5 per ton or 9·33d. per cubic yard. Destructor 1/3·03 per ton or 3·59d. per cubic yard	*Not if a fixed dustbin is suitably placed and constructed. (*a*) By-law requires collection once a week, but we collect from some streets daily and from hospitals, hotels and flats two or three times a week.
Stoke Newington ...	50,669	863	Yes, as far as possible	Owners	Weekly. In summer poorer parts bi-weekly	Contract	House-to house	12 men and 8 vans	100 to 120 yards	No	—	—	—	—	—	-	
Twickenham	29,374	2,477	See remarks *	Owners	Weekly	Own staff	House-to house	12 men, 6 vans	51	No	—	—	—	15,375	—	For disposal 8½d. per cubic yard	* Galvanised iron receptacles are provided in the large majority of cases, about 85 per cent. of the whole; but the council possesses no power to enforce the provision of such receptacles.
Uxbridge (Rural) ...	9,400	12,625	In some instances	Owners	Fortnightly	Contract	House-to house	See remarks *	—	No	All collected	—	—	—	—	—	* Being a rural district, no hard and fast line is drawn; some houses in the country have no dustbins or ashpits and empty all on to garden.
Uxbridge (Urban) .	10,000	868	No, but generally used	Owners	Fortnightly, but weekly where desired	Council's staff	House-to house	6 men, 3 carts	9 cart loads equalling 18 cubic yards	No	5,000	—	—	—	—	2/- per cubic yard	
City of Westminster ..	160,277	2,503	Yes	Not provided by the City Council	Daily	Direct labour	House-to house	See remarks	303 tons	Yes (see remarks)	—	—	91,000 tons	—	—	Barging 3·3 per ton, collection and barging 5/3 per ton	(*d*) 58 dustmen, 103 half-time flushing dustmen, 76 carmen, 32 of which are half-timers and 17 motor drivers, 76 vans, 17 motors and 22 trailers. (*f*) Bins are required to be placed on the korbstone in front of the premises or in a conveniently accessible position to be agreed upon.
West Ham	289,102	4,706	Yes	Owners	Twice weekly	Own staff	House-to house	56 men, 36 carts and vans	147½ tons	See remarks	34 323 tons	—	17,621 tons	—	—	To tip average about £650 per annum. Barging average about £2,570 per ann * See remarks	(*f*) According to by-laws, the occupier of any house or premises shall place his movable receptacle outside the front of his house, in a position convenient for removal by the dustmen on such days as are specified for collection. * This is quite exclusive of wages, horse hire and other sundries.

(To be concluded.)

Assistants' and Students' Section.

Conducted by SYDNEY G. TURNER, Assoc.M.Inst.C.E.

All communications in regard to this page must be addressed to The Editor, St. Bride's House, 24 Bride-lane, Fleet-street, E.C. *Envelopes must be marked "Assistants' Section" in the top left-hand corner. Correspondents are invited to submit questions for consideration and answers to the questions which appear. For the contributions considered to be the most meritorious, one or more premiums in books will be awarded monthly. Diagrams must be drawn to scale on separate sheets, ready for reproduction.*

QUESTIONS.

This week answers are invited to the following questions:—

313. Mechanical Haulage.—What is the most suitable plant for hauling road metal over weak country roads by mechanical traction? How does the cost compare with horse haulage? ("Ehu.")

314. Concrete Roof.—It is desired to construct a semi-circular barrel roof in concrete of 50-ft. span, reinforced with expanded metal. Show the dimensions of the supporting walls, which are to be 15 ft. high from the top of the footings. The roof is to be ribbed with an extra thickness of concrete over the piers. (H. V. A., *Clapton.*)

315. Surveying: Theodolite.—If the graduated plate of a theodolite is not correctly centred, how may the error arising therefrom be eliminated? Prove that the method adopted does eliminate the error referred to. (T. W. P., *Bexhill-on-Sea.*)

316. Hydraulics. Describe a method of measuring the quantity of water flowing in a wide river. ("Enquirer.")

317. Strength of Beam.—A rolled steel I beam of British Standard Section, 12 in. by 6 in., and weighing 54 lb. per foot, is capable of sustaining a load of 15 tons uniformly distributed over a span of 20 ft. What would be the safe load uniformly distributed which could be placed on either half of the lower flange? ("Pupil.")

318. Chimney Design.—Design a chimney 120 ft. high above ground, internal diameter of flue at top 4 ft. 6 in. Also design for foundations. ("Enquirer.")

[The Editor is at all times glad to hear from readers who desire to submit questions regarding matters of general interest, points of daily practice, &c., for insertion in the "Assistants' and Students' Section." Questions which are published are taken into consideration, as well as other matter, in awarding the Monthly Premium.]

REPLIES TO QUESTIONS.

311. Surveying.—How would you draw a "give and take" line to an irregular boundary to facilitate taking out an area? (C. F. H., *Lincoln.*)

The determination of a give and take line for small irregularities in a boundary line is usually done by careful estimation with the eye, but for

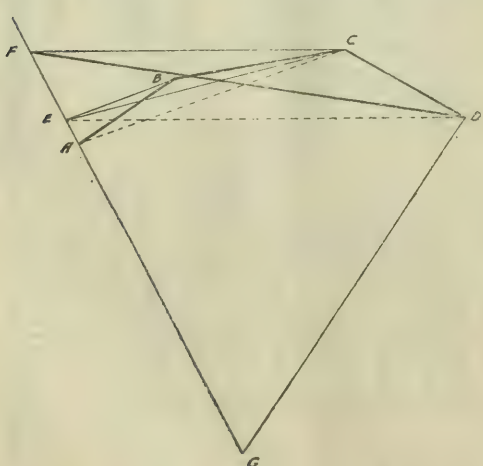


Fig. 1.

very irregular boundaries the simple geometric construction described below is far preferable. Absolute accuracy can be obtained by this method if the boundary consists of short straight lines, though in the case of a curving boundary personal judgment still plays a small part.

Example.—It is required to draw a give and take line to replace the irregular boundary A B C D, Fig. 1.

Join A C and draw E B parallel to A C, cutting G A in E. Join E C. Then, because the two triangles A B C, A E C are on the same base and between the same parallels, they are equal in area. Consequently the figure E C D G is equal in area to the figure A B C D G.

Proceeding in the same manner, draw F C parallel to E D, cutting G E in F. Join F D.

Then, similarly, the figure F D G is equal to the figure E C D G, and is therefore equal to the original figure A B C D G.

Q. E. F.

This method may be repeated for any number of points on a boundary. In practice a parallel ruler

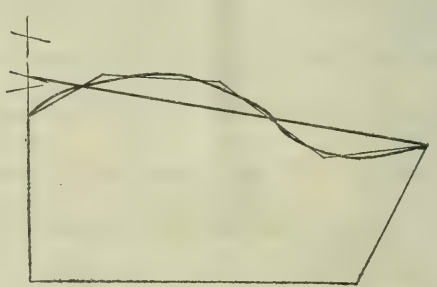


Fig. 2.

is used to determine the points E and F, obviating the necessity of drawing the lines A C, E D, &c.

In the case of a curving irregular boundary, as in Fig. 2, a series of short give and take lines should be drawn by careful estimation, and then the above geometric construction applied.

Great care must be exercised in drawing the parallel lines, particularly when there are a large number of points, as the errors are cumulative owing to the increasing length of the give and take line. (D. G. B., *Darlington.*)

When the area of a plot is to be ascertained, the plot having irregular boundaries, the simplest and most expeditious method, apart from the use of computing instruments, is probably arrived at by an application of Simpson's rule or formula for

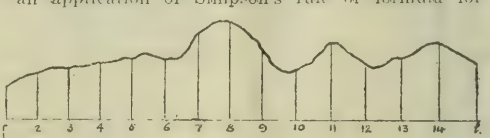


Fig. 1.

area computation, which is as follows: In Fig. 1 draw a base line to the irregular side or sides. Divide the base into any number of equal parts, and measure the length of perpendiculars (or ordi-

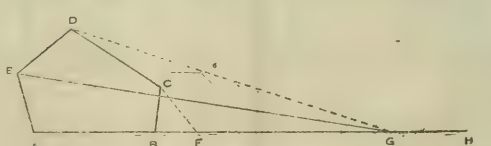


Fig. 2.

nates) through each division. If S = sum of lengths of first (*f*) and last (*l*) ordinates; E = sum of the lengths of intermediate *even* ordinates; N = sum of

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lengths of intermediate *odd* ordinates; d = common distance between ordinates, then

$$\text{Area} = \frac{S + 4E + 2N}{3} \times d$$

If the remainder of the plot is an area bounded by straight lines, as in Fig. 2, the following is often an accurate and expeditious method of arriving at the contents by reducing the irregular figure of any number of sides to a triangle.

Produce any side A B (preferably the longest side) to any distance H. Through point C draw a line parallel to B D, and cutting A H at F. Through D draw D G parallel to F E, cutting A H in G. Join G E. This gives the triangle A E G, which has an equal area to the irregular figure A B C D E, the area of which can be got in the usual manner. (D. H. S., *Dunfermline.*)

312. Design of Structures.—How can the weights of bridge members be allowed for when designing the structure? (H. V. O., *West Bromwich.*)

In designing girders it is necessary to take into consideration the weight of the girder itself as well as the superimposed load. Some convenient method must therefore be adopted for estimating the weight in relation to the load and span.

Now, the weight of any member is proportional to the sectional area, and the sectional area is determined by the total stress divided by the working stress. But the total stress depends upon the bending moment and the depth of the girder. Consequently a relation can be established between the weight of the girder and the safe load and the depth of the girder.

Prof. Henry Adams gives the following formulæ for the approximate weight of girders:—

W = safe distributed load in tons.
L = clear span in feet.
d = total depth in feet.
w = weight of girder.

Rolled steel joist—

$$w \text{ (in lbs.)} = \frac{2WL^2}{d}$$

Steel plate girder—

$$w \text{ (in tons)} = \frac{WL}{400} \times \sqrt{\frac{L}{d}}$$

Steel box girder—

$$w \text{ (in tons)} = \frac{WL}{375} \times \sqrt{\frac{L}{d}}$$

For parallel flange braced girders under 200 ft span Anglin gives the formula—

$$w \text{ (in tons)} = \frac{WL^2}{12fd - L^2}$$

f being the working stress in tons per square foot of gross section, and the other symbols as above.

As the reduction of section in the flange of a braced girder towards the supports is compensated for by the increase in the size of the bracings, it is sufficient for practical purposes to assume the weight as uniformly distributed.

For very large bridges the weight of the structure is the most important factor to be considered, as the moving load is small in proportion to it. Consequently the weight of the individual members of the bridge must be determined with some accuracy.

The treatment of this class of bridge is too complex to be considered within the space of this column, but readers will find a complete analysis of the subject in Fidler's "Bridge Construction," where also tables are given for various types of bridges. (D. G. B., *Darlington.*)

BAMPTON WATER SUPPLY.

ONE GALLON PER HEAD.

Both the medical officer of health, Dr. T. H. Bovey, and the surveyor, Mr. W. F. Siddalls, indulged in some plain speaking with respect to the question of the water supply at the last meeting of the Bampton Urban District Council. "Do you," said the medical officer of health, "think a tank holding 800 gallons or 750 gallons of water is sufficient for a town of this size, which has about 700 or 800 inhabitants? It only leaves 1 gallon per head of the population, whereas the higher authorities require that there should be from 15 to 20 gallons per head of the population, exclusive of wastage. I feel very strongly on the subject myself, as, being a ratepayer and paying for water, I think we should have water. It is a matter that should be looked into. If we have another summer like that of 1911, I don't know where we shall be in the matter of water. It will be time well spent and money well spent. But before any building can take place there must be an adequate supply of water." The surveyor (Mr. Siddalls) said that the question which had to be faced, and must be faced, was that regarding the size of the pipes, which were of 4-in. type. They were too small to meet requirements. If water was being drawn from the lower part of the town a vacuum was created in the mains, and no water could be obtained at the higher part of the town. Nobody was short of water downstairs; it was at the upper portions of houses, and under the roofs, where the tanks were situated, that the inconvenience of shortage was experienced. The officers were requested to mention the matter at the next meeting, after a new council had been elected.

Private Street Improvement Loans.—The correct procedure with respect to the borrowing of money for private street improvement was authoritatively expressed at the last meeting of the Chertsey Rural District Council, when the clerk read a letter from the Local Government Board stating, with reference to the proposed advance of money by a resident of Byfleet in connection with the making up of certain private streets in the parishes of Byfleet and Pyrford, that the board had no power to dispense with the provisions of the Public Health Act. He also read a letter from the gentleman in question pointing out that the only reason for not obtaining the loan from the Local Government Board was to save the proprietors expense. If that object could not be obtained, there was no reason for him to advance the money, and his offer must therefore lapse.—The chairman said he supposed the council must send up plans and then the Local Government Board would make all sorts of requisitions and spend about half as much again. The surveyor, Mr. H. Beeney, said he should like to take the draft plans to the Local Government Board before the applications for a loan were sent out. He would point out that it was a case where the majority of the owners were poor and would have some difficulty in raising the money.—This was agreed to.

Law Notes.

Edited by J. B. REIGNIER CONDER, 11 Old Jewry Chambers, E.C., Solicitor of the Supreme Court.

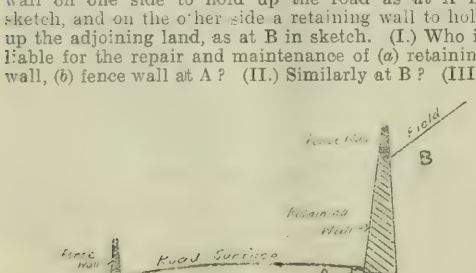
The Editor will be pleased to answer any questions affecting the practice of engineers and surveyors to local authorities. Queries (which should be written legibly on foolscap paper, one side only) should be addressed to "The Law Editor," at the office of The Surveyor, *accompanied by the writer's name and address, but correspondents who do not wish their names to be published should also furnish a "nom de plume." Where necessary, copies of local Acts or documents referred to should be enclosed.* **All explanatory diagrams must be drawn and lettered in BLACK ink only, and in such style as to be fit for direct reproduction**—*i.e.*, **without re-drawing or amendment.** *Unless these conditions are complied with we cannot undertake to reply to queries.*

Water Supply: Land left Vacant as a Gathering Ground for Water: Rateability.—The long-pending litigation in *Liverpool Corporation* v. *Chorley Union* has at length been brought to a close by the decision of the House of Lords (February 3rd). It may be remembered that the contest raged round a moorland area purchased by the corporation as a gathering ground for their water supply. About 300 acres were planted with trees, and 8½ acres were used as a nursery for young trees. The remainder was used for sporting purposes, the sporting rights being let to a tenant for a term of years at £300 a year. The King's Bench Divisional Court held that the corporation were rateable in respect of the whole of the land. A note of their decision will be found at p. 373 of Vol. xxxix. of The Surveyor. The Court of Appeal affirmed the King's Bench Division, and have now themselves in turn been affirmed by the House of Lords. Lord Atkinson, in delivering the judgment of the House, said that he thought none of the cases dealing with vacant houses were applicable to such property as a moor which, through the operations of Nature, unaided by man, produced each year products such as grass, heath and bracken, useful and valuable to man, and in the present case reared and harboured game in addition, thus differing in almost every respect from a vacant house which produced nothing, and was used for no purpose whatever. He was clearly of opinion that each of the uses to which the corporation devoted this moorland—*i.e.* (*a*) the commercial use of collecting water which they in their business vended, and (*b*) its use as a game preserve, and certainly these two uses combined—were sufficient to turn the corporation's admitted possession of the moor into their beneficial occupation of it, so as to render them rateable in respect of it.

QUERIES AND REPLIES.

In order to avoid confusion querists are requested to use distinctive words as noms de plume. *The letter* X. *combinations such as* X.Y.Z., *and words such as* "engineer" *and* "surveyor," *should never be used.*

Highway: Retaining Walls: Fences: Surface Water.—"West Riding" writes: In this urban district, which is a very hilly one, some of the highways have been constructed so that there is a retaining wall on one side to hold up the road as at A in sketch, and on the other side a retaining wall to hold up the adjoining land, as at B in sketch. (I.) Who is liable for the repair and maintenance of (*a*) retaining wall, (*b*) fence wall at A? (II.) Similarly at B? (III.)



If the road was originally constructed with a bank at B instead of a retaining wall, and it was afterwards found that a retaining wall was required owing to the instability of the bank, who would be liable to build the retaining wall? (IV.) Would this liability be affected by the lapse of time, supposing, for example, that the retaining wall was not found necessary until the lapse of thirty or forty years from the date of the construction of the road? (V.) If the road was originally constructed without a *fence* wall at A, and one was afterwards required, who would be liable to build it? Similarly for fence wall at B? (VI.) Is the practice in this neighbourhood to make a hole through the wall at intervals, as at D, to allow surface water to run through on to the land below; also to put in a drain from the other side to discharge on to the land, as D_2, no other provision being made for surface water. In other cases a considerable length of road may be entirely in cutting, and the surface water is allowed to run down the road until it comes to a place similar to AB, when it is discharged as D_1 and D_2. This has the effect of draining a considerable length of road, and concentrating the flow at one point. Are the highway authority within their rights in doing this (*a*) in case of a new road now being constructed, (*b*) or continuing this in case the surface water has thus been disposed of for a long period? (VII.) Will the highway authority be liable in case of damage to the adjoining land or property by surface water thus discharged from the highway or by debris carried on to the land by this surface water? (VIII.) What remedy have the highway authority in case of surface water or spring water discharged from the land at B on to the highway? Is this remedy, if any, affected by the lapse of time?

"In regard to disturnpiked roads, sec. 60 of the General Turnpike Act, 1823, required turnpike trustees to construct fences or build walls where roads were altered, widened and improved, and to keep such fences in repair for five years only. After this period the duty to repair fell on the owner, unless an agreement or other reason to the contrary could be shown." (Copnal's "Law Relating to Highways," 2nd Edition, p. 265.) With respect to other highways repairable by the inhabitants at large:—I. (*a*) The highway authority is liable if the retaining wall forms part of the highway. Whether or not it does form part of the highway is a question of fact (*Rex* v. *Whitney*, 5 Dowl, 728; *Reg* v. *Lordsmere Inhabitants*, 54 L.T. 766). The adjoining owner is not liable in the absence of a prescriptive obligation (*Stockport Highway Board* v. *Grant*, 46 L.T. 388). (*b*) There is no obligation on a highway authority to fence, or to repair the fences of an ordinary highway (*Rex* v. *Lund to Road Commissioners*, 2 T.R. 232). But where a fence protecting a highway against a precipice forms part of the highway, the highway authorities are liable for its repair (*Regina* v. *Ordsmere Inhabitants—supra*). Whether it forms part of the highway is (as in the case of a retaining wall) a question of fact. With respect to the liability of the adjoining owner, as a general rule he is not bound to erect fences next the highway. But if he does erect a fence he must keep it in repair (*Harrold* v. *Watney*, 46 W.R. 642). And in districts where sec. 31 of the Public Health, &c., Act, 1907, is in force the owner of land which is a source of danger to passengers may be compelled to fence it, or to repair the fences. II. (*a*) With respect to retaining walls made for the purpose of preventing the adjoining land from falling on the highway there is less author ty. In *Attorney-General* v. *Staffordshire County Council* (21 T.L.R. 139) the Court refused to order the County Council to repair such a wall on a main road, there being no evidence that the road itself was out of repair, or that the wall was in a dangerous state; but the question whether the council would have been liable had there been such evidence was left undecided. (*b*) As regards this fence, the same principles would apply as in the case of the fence A (III). The question assumes that some one would be liable, but this is not necessarily so; all that the highway authority are bound to do (assuming the highway to be repairable by them) is to keep the road reasonably passable for the ordinary traffic of the neighbourhood. (*Reg.* v. *High Halden Inhabitants* 1, F. and F., 678.) They are not bound to fence off dangerous places on or near the highway (*Morgan* v. *Leach*, 10 M. and W., 558; *Rex* v. *Whitney*, 7 C. and P., 208). In districts where sec. 30 or sec. 31 of the Public Health, &c., Act, 1907, is in force the landowner could probably be compelled to erect a wall in the event of the bank being a source of danger. IV. I do not think lapse of time would be a bar to proceedings under the Act of 1907. V. The answer to No. III. will apply. VI. (*a*) No such right exists in the case of a new road (*Croft* v. *Richmansworth Highway Board*, 39 Ch. D., 272; *Croysdale* v. *Sunbury Urban District Council*, 1898, 2 Ch., 515). (*b*) A highway authority may obtain an easement to discharge water on to adjoining lands, by continuing to do so for a long period (*Attorney-General* v. *Copeland*, 1902, 1 K.B., 690; *Kent County Council* v. *Kennedy*, 2 K.R., 544). VII. Yes, unless they have acquired an easement. VIII. Unless the highway was originally dedicated subject to the right of the landowner to discharge water on to it (which it is for him to prove if he can) the highway authority can—(*a*) repair the damage and recover the expense from the landowner, (*b*) indict the landowner for a nuisance, or (*c*) apply for an injunction. It is doubtful whether summary proceedings could be taken under sec. 72 of the Highway Act, 1835 (*Gully* v. *Smith*, 12 Q.B.D., 121).

Sewer Construction in Private Land.—"S. R. R." writes: A rural district council have given notice to the owners of certain lands of their intention to carry a sewer through private lands. The owners' agents have fixed the price for easements at so much per yard, &c., but they insist upon proper agreements being prepared, the cost of which has to be borne by the council. Are the council obliged to have this agreement? There does not appear to be any provision or requirement for it under the Public Health Acts.

The council are not bound to acquire or pay for an easement, or to enter into an agreement. They can exercise the statutory power given by sec. 16 of the Public Health Act, 1875, and in the event of the landowner sustaining any damage the compensation must be settled by arbitration under sec. 68 of that Act.

The Water Supply of Devonport.*

By F. W. LILLICRAP, Water Engineer.

The history of the present works dates as far back as 1793, when a Company of Promoters secured an Act to supply the town of Devonport (then known as Plymouth-Dock), Stonehouse, Stoke Damerel, and the parts adjacent with water. In this Act the company were empowered to make and complete a leat 10 ft. in breadth, extending from Dartmoor to the areas to be supplied, a distance of 35 miles; and were further invested with power to construct reservoirs, feeders, aqueducts, &c., for the proper maintenance of the supply, the proximate source of the water being the Blackabrook, Cowsic, and West Dart rivers.

These ambitious promoters having completed the works, with pardonable gusto gave notice to the public, in March, 1800, that "having, at great expense, nearly completed the laying down of elm pipes in most of the principal streets of the town of Plymouth-Dock and Stonehouse, as well as other considerable repairs and improvements of their works, they are now ready to deliver water for the use of the inhabitants. The size of the pipe not to exceed ¾-in. diameter, and ballcocks to be put to the cisterns. The company will lay on the water for two hours every second day at farthest."

It will already be seen that the methods of supply in those ancient days were of a very primitive character, and in striking contrast to those enjoyed by the public at the present time.

In the year 1806 the company displaced certain wooden trunk mains by iron pipes, the first of the kind introduced into this country; and from this date onwards alterations and additions have been made to the works on a liberal scale, till at the present time it is believed that Devonport possesses one of the finest water supplies in the kingdom.

The population of Devonport at the last Census was returned at 81,678, but the whole of this number does not come within the area of supply of the Devonport Corporation Waterworks, as a portion—viz., St. Budeaux—is supplied by the Plymouth Corporation; the number now, however, is approximately 75,800. The daily consumption, calculated on an average of twelve months, is 3,027,000 gallons per day, or an equivalent of 39·93 gallons per head per day; 23·63 gallons being for domestic purposes, and 16·30 for trade.

SOURCE OF SUPPLY.

The gathering grounds, situated on Dartmoor, near Princetown, have an area of 4,716 acres, made up as follows: The West Dart, 1,539 acres; Cowsic, 1,524 acres; and the Blackabrook, 1,653 acres.

The average annual rainfall over the whole of the gathering grounds during the last twenty years was 70 in. For the purpose of calculating the yield, allowing for consecutive years of drought, evaporation, and loss in floods, the available rainfall has been taken at 42 in. over an area, say, of 4,500 acres, which gives about 11,000,000 gallons per day. This figure cannot be taken as the average daily supply, because the available quantity will be limited by the flow from the rivers on the driest day of the driest year. The formation is granitic, but a large portion is very peaty and spongy, thus retaining the water to a great extent, and on only rare occasions has the yield fallen to less than 2,000,000 gallons per day.

LEAT.

The leat was cut about the year 1800, and was 35 miles in length; at the same time intakes were made on the rivers West Dart, Cowsic, and Blackabrook, and the water diverted from these rivers into the leat, which was an entirely open cutting, with the exception of a tunnel under Nuns Cross for a length of about 670 yds. This method of supplying Devonport was continued until about 1825-6, when a 9-in. pipe was laid from a small tank at Brooklands to Stoke, but this pipe was replaced by a 12-in. main in 1855. In the year 1876 another cast-iron main of 18 in. diameter was laid from Brooklands (hereinafter described under filters), and the leat, as a means of a supply, was abandoned from Crown Hill to Devonport. In 1894-5, a pipe line was laid from a reservoir at Roborough to Crown Hill, and a further portion of leat abandoned.

On the transfer of the waterworks in July, 1906, the corporation, in consequence of a report made by the writer, proceeded to Parliament, and in 1907 received Royal Assent for the expenditure of £80,000 for further improving the works. In these works it was provided that a pipe line be laid from Belliver reservoir, across the Roborough Down to Dousland, where it was intended to construct a small tank. This work was carried out, and the improvement effected enabled us to discard the leat between the two points for purposes of supply. The abandonment of this portion was purely from sanitary motives, for the corporation have always been keenly alive to the possibility of pollution, and their aims have been to protect the water from source to its final distribution to the consumers. The conveyance of water, by means of the leat, through the districts of Yelverton and Dousland was discontinued, as it was felt, from the condition of the leat and the number of visitors who frequent these places, that the risks of contamination from irresponsible individuals were great.

The portion now in use is 17 miles in length, and extends from the intakes to Dousland. Nearly the whole of the length passes through country which properly falls under the category of moorlands, free from cultivation.

STORAGE.

The amount of water stored at Devonport may not be considered excessive for a town supplying 75,800 persons, but in face of the excellent gathering grounds, and the infrequency of days upon which the yield is insufficient to meet the demand, the writer is of opinion that the existing storage is sufficient for a number of years.

The first reservoir, named Rowden's reservoir, was constructed at Stoke in 1825; it is circular in shape, and has a capacity of 2,071,000 gallons. A 9-in. pipe was laid to this reservoir from a tank at Brooklands. In 1875-6 the old Crown Hill reservoir was constructed, and had a capacity of 17,000,000 gallons; its banks were raised in 1892, and the extension thus made gave an increased storage of 500,000 gallons. Another reservoir was built at Roborough in 1896, and has a capacity of 2,049,000 gallons. The next reservoir was completed in 1900. It is situated at Beaconsfield, is covered, and holds 1,163,000 gallons.

These were the reservoirs which were constructed under the *régime* of the Devonport Water Company up to 1906, when the corporation took over the works. The storage to this date, including service reservoirs, was 22,779,000; this was considered inadequate, and in the Corporation Act, 1907, powers were obtained to construct a new reservoir at Crown Hill, having a capacity of 20,000,000 gallons. The work of constructing this reservoir was commenced in November, 1908, and completed in October, 1911. The capacity, when finished, was 21,000,000 gallons. Previous to this a small service tank was constructed at Dousland, which holds 180,000 gallons. The total storage of the Devonport Waterworks is, therefore, approximately 44,000,000 gallons.

DISTRIBUTION.

For the purpose of distribution the town is divided into three districts: the high, middle, and low levels. The different districts are subdivided into smaller districts for the purpose of detecting waste, and although the detection at present is not all that might be desired, good work is being done to keep the consumption within a reasonable figure.

FILTERS.

There are eight beds which are capable of filtering about 3,750,000 gallons per day.

The whole of the beds are somewhat similarly constructed; each is 115 ft. long and 80 ft. wide. The filtering medium is 4 ft. 6 in. in depth, and consists of 1 ft. of 3-in. granite spalls; 6 in. 1½-in. and 6 in. ¾-in. granite stone; 6 in. of pea gravel, and 18 in. fine sand.

The analytical examination is highly satisfactory, as it shows a total absence of saline or free ammonia and a very low proportion of albuminoid ammonia, which is evidence that the water is free from pollutive matter and products of organic decay. The results of bacteriological examination are also of a satisfactory nature, conforming to the characters of moorland water from an unpolluted water-shed.

* Extracted from paper read on Saturday last at a Sessional Meeting of the Royal Sanitary Institute held at Plymouth.

LOCAL GOVERNMENT BOARD INQUIRIES.

The Editor invites the co-operation of Surveyor *readers with a view to making the information given under this head as complete and accurate as possible.*

INQUIRIES HELD.

Bacup T.C. (March 4th. Mr. H. S. Stewart).—£565 for works of private street improvement.—The town clerk, Mr. J. Entwistle, stated that the period asked for repayment was ten years. The streets proposed to be dealt with were on the outskirts of the borough, and it was not proposed at the present to carry out works other than sewering. The population to be served was about 400.

Bradford T.C. (March 11th. Mr. W. H. Collin).—£6,500 for street improvements, town hall alterations, and a mortuary.—The scheme involved the taking of a strip off an ancient burial-ground at Chapeltown, known as the Old Chapel site. Mr. Harold Newell, barrister, stated that he had been instructed by the vicar, churchwardens, and certain parishioners to oppose the scheme. The town clerk stated this was an entirely new development, as the corporation were led to expect there would be no opposition. After consultation with his committee, Mr. Evans announced that the Old Chapel site proposals would be withdrawn. The details of the other parts of the council's proposals were then the subject of investigation.

Bungay U.D.C. (March 11th. Mr. H. A. Chapman).—£3,500 for the purposes of a scheme under Part III. of the Housing of the Working Classes Act, 1890, for the purchase of land and the erection of working-class dwellings.—Mr. P. J. Sprake, clerk to the council, stated that the money was required for the purpose of erecting twenty dwelling-houses on land opposite the old burial ground, adjoining the main road from Harleston to Beccles. It was estimated that the dwellings would bring in a rental of £208. From that they would have to allow for empties and losses £5, bringing the estimated yearly receipts to £203. If the loan was to be repaid in sixty years at 3½ per cent, the sum of £138 6s. 5d. would be necessary as an annual payment. The sites were estimated at 6s. 6d. in the £, £20 5s., insurance £2 5s., repairs and maintenance £15, supervision and collection of rents £10 10s., leaving a balance in hand estimated at £7 13s. 10d. The situation was an excellent one, the site stood high, had a southern aspect, was quite dry, and he did not think he would have any difficulty in satisfying the board as to the water supply.

Dursley (Glos.) R.D.C. (March 12th. Mr. R. G. Hetherington).—£10,000 for the purposes of sewerage and sewage disposal for the parish of Wotton-under-Edge.—Mr. F. Treasure (Gloucester) opposed the scheme on behalf of the local branch of the Farmers' Union.

Cosport U.D.C. (March 4th. Mr. F. H. Tulloch).—£250 for the erection of a ladies' chalet.—The surveyor, Mr. H. Frost, stated that there had been frequent requests for the provision of this accommodation, and the site was in a very busy locality, close to the ferries. The walls of the building would be of wood. The inspector, having suggested some alterations in respect to the drainage and examined the plans, invited comment. Mr. D. Fleming asked if a proper brick building could not be erected for about the same money. The surveyor replied that it would be possible, but it was thought that the building as suggested would be more in keeping with those in the vicinity.

Howden R.D.C. (March 11th. Mr. P. M. Crosthwaite).—£400 for the purpose of carrying out experimental boring for water.—It was stated that the council had engaged Mr. Percy Griffith, M.Inst.C.E., who went carefully over the whole district. A likely site was ultimately selected on land belonging to Mr. Harrison-Broadley, M.P., who gave them permission to make a trial boring without cost, beyond the compensation for cutting up the ground. The trial boring was carried down below the chalk, but the test pumping failed to find a sufficient supply of water. Mr. Griffith suggested the desirability of sinking the well deeper, and driving an adit with a view to tapping a sufficient supply. The council accepted that suggestion, and Mr. Griffith told them that if they could not find water at that spot, they might give up any idea of deep boring in that district. Evidence was given by Mr. Percy Griffith and Dr. Wilson, medical officer of health to the East Riding County Council.

Swansea T.C. (March 5th. Mr. R. H. Bicknell).—£2,454 for the purchase of land at Clase, Morriston, for the purposes of a cemetery, and £4,000 for paving works at Cwm-road.—The town clerk explained the nature of the cemetery proposal, the extent of the land acquired being 22¼ acres. The land was freehold, except a few leases which would fall in, and Sir Robert Morris, the freeholder, had offered no objection to the proposals of the corporation. In the second application it was stated that it was proposed to pave 600 yds. of the Cwm-road. The borough surveyor, Mr. G. Bell, stated that the traffic over the road was very heavy. At present the road was made of macadam.

APPLICATIONS FOR LOANS.

Abergavenny T.C.—£1,210 for the purchase of property for the widening of High-street.

Barrow-in-Furness T.C.—£3,500 for street improvements.

Blackburn T.C.—£2,330 for the purchase of property for street improvement purposes.

Bristol T.C.—£25,000 for the extension of electricity mains, sub-stations and services.

Ilkley U.D.C.—£9 500 for purchasing and developing "The Holmes" estate.

Lewisham B.C.—£7,767 for wood paving.

Maldens and Coombe U.D.C.—£3,100 for the provision of a three-cell refuse destructor, including chimney ventilation, building, approach road and drainage, estimated by the surveyor, Mr. R. H. Jeffes, to cost £3,068.—£6,897 for the extension of the sewage works.

Saltash T.C.—£200 for a wall and railings at the recreation field.

Stockton T.C.—£6,750 for converting house services to the water-carriage system.

Sutton-in-Ashfield U.D.C.—For the erection of a convenience and road work.

Walsall T.C.—£4,840 for machinery at the electricity works.

Westbury U.D.C.—£14,000 for a sewage disposal scheme.

Wilts C.C.—£13,500 for the erection of new county offices and alterations to existing offices.

Woodford U.D.C.—£850 for a new fire station.

LOANS SANCTIONED.

Castlebar U.D.C.—£4,000 for workmen's dwellings.

Darlington T.C.—£8,052 in connection with the water undertaking and £330 for meters.

Dartford U.D.C.—£1,700 for street improvements.

Devonport T.C.—£15,000 for gas stoves, autos and meters.

Harrow U.D.C.—£415 for improvements at the hospital.

Ipswich T.C.—£12,950 for the erection of a school.

Tiverton T.C.—£1,280 for the purchase of a site for working-class dwellings.

West Suffolk C.C.—£15,000 for main road reconstruction.

Yarmouth T.C.—£7,965 for granite-sett and wood-block paving.

FORTHCOMING INQUIRIES.

MARCH.	£
25.—**Middlesbrough.** For works of sewerage (Mr. F. O. Stanford)	33,850
25.—**Saffron Walden.** For water supply purposes (Mr. H. R. Hooper)...	150
26.—**Bedford.** For the electricity undertaking (Mr. T. C. Ekin)	11,590
26.—**Clacton.** For the electricity undertaking (Mr. H. R. Hooper)	—
26.—**Pontardawe.** For sewage disposal works (Mr. P. M. Crosthwaite)...	5,985
26.—**Reading.** For road widening purposes (Mr. Edgar Dudley)	670
26.—**Skipton.** For sewage purposes (Mr. F. H. Tulloch)	940
26.—**Stratton.** For road improvement and public convenience purposes (Mr. W. O. E. Meade-King)	1,700
27.—**Bingley.** For sewerage and bandstand purposes (Mr. F. H. Tulloch)	545
27.—**Pickering.** For water supply purposes (Mr. F. O. Stanford)	2,700
28.—**Devonport.** For gas supply and footpath purposes (Mr. W. O. E. Meade-King)...	5,859
28.—**Farnworth.** For the erection of a fire station (Mr. F. H. Tulloch)	2,200
29.—**Atherton.** For private street works (Mr. F. H. Tulloch)	1,510

Municipal Work in Progress and Projected.

The Editor invites the co-operation of Surveyor *readers with a view to making information given under this head as complete and accurate as possible.*

The following are among the more important projected works of which particulars appear below: Buildings—Dorchester, Dublin £23,000, Lynn, Maldens and Coombe, Paddington £80,000; housing and town planning—Merthyr; refuse collection and disposal—Melton Mowbray; roads and materials—Bexhill, Oldham, Swansea £20,000, Woolwich; sewerage and sewage disposal—Esher and the Dittons; water, gas and electricity—Bideford £20,000, West Ward.—Particulars of other works projected will be found on our "Local Government Board Inquiries" page.

BUILDINGS.

Ayr C.C.—It has been agreed to sanction an application by the Carrick District Committee for the erection of a new bridge over the river Stinchar at Hallowchapel, Pinwherry, at an estimated cost of £1,700.

Dalkeith T.C.—The new infectious diseases hospital and the Buccleuch Memorial Bridge were formally opened on Saturday last. The hospital has been erected at Whitehall at a cost of £5,000. It consists of five blocks fitted with appliances of the latest kind. The buildings are lighted throughout with electricity, and telephone communication connects each block. The drainage and plumber work of sanitary towers has been carried out in the most up-to-date manner. The new bridge, which was also opened, has been erected to connect the Public Park with its Eastbank entrance. It has been built from plans by Mr. C. H. Greig.

Dorchester T.C.—The borough and water engineer, Mr. H. D. Strange, has been instructed to prepare plans and estimates for the new municipal depot and stables.

Dublin T.C.—The widening of Butt Bridge is to be carried out at an estimated cost of £23,000.

Hornsey T.C.—The Education Committee propose to spend about £342 in providing additional fire precautions where required in the council schools. These safeguards include doors to open both ways, electric gongs, emergency staircases, and widening of gateways to playgrounds to admit fire escapes.

Leatherhead U.D.C.—The tenders of Mr. W. H. Impson of Leatherhead, have been accepted for the erection of a pavilion and lavatories at the new recreation ground, the former at £116 and the latter at £79.

Leigh-on-Sea U.D.C.—Work of piling is to be carried out at the Cliffs at the junction of Cliff-parade and Leigh-hill, at an estimated cost of £100.

Lynn T.C.—The question of the provision of public baths has been referred to the consideration of the whole council in committee.

Maldens and Coombe U.D.C.—Plans in sketch form submitted by Mr. Harold Bailey, F.R.I.B.A., hon. architect, have been adopted for the extension of the municipal offices, and Mr. Bailey has been authorised to retain the services of a quantity surveyor, so that specifications, &c., may be approved and forwarded to the Local Government Board for early sanction to a loan.

Mansfield T.C.—The question of the provision of a public abattoir has been referred to the Health Committee.

Paddington B.C.—It has been decided to erect at Porchester-road a swimming bath at a cost of £60,000, and two subsidiary establishments in different parts of the borough, including slipper baths and washhouses, at a further cost of £20,000.

Richmond (Surrey) T.C.—It has been decided to join in the request addressed by a recent public meeting at Twickenham to the county councils of Surrey and Middlesex to convene a joint meeting of the representatives of their respective bodies, the members of the Richmond Town Council, the Twickenham Urban District Council and the Richmond Bridge Commissioners, to consider the question of improving the bridge communication between Richmond and Twickenham.

Saltburn U.D.C.—The council have approved the scheme submitted by the surveyor, Mr. Joseph Draper for improvements on the sea banks, at an estimated cost of £250.

Seaton (Devon) U.D.C.—Negotiations have been opened for the purchase of a site near Hartley Station for the proposed new council offices.

Surrey C.C.—Mr. A. Dryland, the county surveyor, has prepared a definite scheme and estimate for the long-proposed widening of Winslow's Bridge, at present an eyesore and danger, on the Portsmouth road in the area of the Esher and the Dittons Urban District Council; and it has been decided to recommend the county council to effect the improvement if the district council will acquire the necessary land. The matter has been under discussion for seventeen years, so it may reasonably be hoped that it will not be very much longer before it passes into the stage of action.

Walton-on-the-Naze U.D.C.—Consideration is being given to a report of the Sanitary and General Purposes Committee dealing with plans, specifications and estimates for extensive repairs and additions to the sea defences at Burnt House breakwater. The proposed works include raising, casing and strengthening the existing Burnt House breakwater, £1,281; extension of shore end of the same breakwater to cliffs, £475; and extending breakwater at seaward end, £714.

Wigtown T.C.—The council have agreed to the erection of a bandstand in the Square, and will subscribe £15 towards the estimated cost of £75, the remainder being raised by public subscription.

Wilts C.C.—The tender of Messrs. Hayward & Wooster, of Bath, at £10,979, has been accepted for the erection of new county offices and alterations and additions to existing offices at Trowbridge.

Woolwich B.C.—It has been referred to the Baths Committee to take such steps as may be necessary for adapting the second-class swimming bath at Plumstead for cinematograph and other public entertainments, at an estimated cost of £650.

HOUSING AND TOWN PLANNING.

Bridlington T.C.—It has been decided to charge rents from 4s. 4d. to 5s. per week (inclusive of rates) for the twenty-five workmen's houses in course of erection in the Old Town.—It has also been agreed to purchase a piece of land on the east side of North Back-lane, in the Old Town, on which to erect twelve small cottages for "persons of the working class," and principally for aged couples and widows who are likely to be dishoused in consequence of street and other improvements.

Glasgow T.C.—The Executive Committee on Housing recommend the appointment of the following officers for duties exclusively devoted to the enforcement of the sanitary laws affecting house property—viz.: Junior medical officer, Dr. McLean; junior sanitary inspector, Mr. Henry Watt; junior master of works, Mr. Thomas Somers.

Holsworthy U.D.C.—It has been decided to build a certain number of working-class dwelling-houses "with all convenient speed."

Launceston T.C.—It has been agreed to build sixteen houses on the Race Hill site.

Market Bosworth R.D.C.—The Local Government Board has sanctioned a scheme for the erection of twelve dwellings in Markfield on the understanding that it is proceeded with immediately.

Merthyr T.C.—With respect to the application made to the Local Government Board to borrow £12,000 for the purchase of the Galon Uchaf estate, near Dowlais, for the erection of workmen's dwellings, and for small holdings and allotments, a letter has been received from the Local Government Board stating that the board understood that the estate comprised 92 acres, of which it was suggested 24 acres might be utilised for housing purposes, and the remaining 68 acres for purposes of small holdings and allotments. No evidence appeared to have been forthcoming at the inquiry of any demand for small holdings and allotments in the neighbourhood of the estate. As regards the part suggested for housing purposes, the board were advised that, owing to the contour of the land, the cost of building would be increased, and that it was not suitable for the erection of houses to be let at low rents. Further, it did not appear necessary for the council to acquire and develop so large

an area as 24 acres in the district for building purposes. The board, in view of the evidence submitted at the inquiry in regard to the existence of insanitary houses in the Dowlais district, were satisfied that a scheme for the erection of not less than 100 workmen's dwellings, suitable for persons earning from 15s. to 20s. a week, and containing a living room and scullery, and two or three bedrooms, was necessary.

Wharfedale R.D.C.—Negotiations are in progress for the provision of workmen's cottages at Odel.

PARKS AND OPEN SPACES.

Llandudno U.D.C.—Recently Lord Mostyn offered to grant to the council a lease for 999 years of the upper part of the Happy Valley at a nominal rent of £1 a year, and the lease has now been formally handed over by Lord Mostyn to the chairman of the council (Mr. Pierce Jones). It is stated that with the part of the valley leased by Lord Mostyn and the adjoining Wyddfyd estate, which the council have acquired, Llandudno will possess one of the finest seaside parks in the country.

REFUSE COLLECTION AND DISPOSAL.

Bridlington T.C.—For the disposal of refuse it has been agreed to purchase land near to Bempton-lane for £1,250.

Melton Mowbray U.D.C.—It has been agreed to provide a refuse destructor, at a cost not exceeding £2,000.

ROADS AND MATERIALS.

Bexhill T.C.—The council in committee have adopted a report giving details concerning the present position of affairs for the taking over by the council of the East-parade. The opinion is expressed that the management and control of the whole of the eastern front should be acquired by the council. Figures are given of the cost of making up the Marina roadway, which would fall upon the council. The capital cost to the council would also involve an expenditure of approximately £4,000 for sea-defence works.

Chelsea B.C.—King's-road is to be widened as a metropolitan improvement, at an estimated cost of £5,000.

Derby T.C.—A sum of £796 is to be paid for land for the purpose of widening London-road from 40 ft. to 50 ft.

Devon C.C.—The following works have been sanctioned: Widening Dawlish to Teignmouth road, near Oaklands (estimated cost £350, contribution £175); widening Salterton-road, Exmouth (£180, £50); replacing sett paving with macadam at Southmolton (£286, £143); widening Teignmouth to Bishopsteignton road (£1,630, £600); strengthening Witheridge-road, Tiverton (£1,340, £670).

Inverness-shire C.C.—The Badenoch District Committee have agreed to accept the grant offered by the Road Board. For the Perth-Inverness road the estimated cost of improvements is £2,990, and of this sum the Road Board will give a grant of £2153. The Kingussie-Fort William road improvements are to cost £1,170, towards which the Road Board will grant £843. The reconstruction of Laggan Bridge entails an expenditure of £1,700 the Road Board share amounting to £1,224. It has also been decided that the Laggan and Strathdearn divisions of roads, which have been worked by day labour for the past five years, should in future be let on contract. The distance is 89 miles.

Isle of Wight R.D.C.—The committee who were dealing with the claim of Mr. F. T. Mew, J.P., in the action for alleged damage to the fishery at Carisbrooke by washings from tar-sprayed roads, report that they have settled the action by agreeing to pay Mr. Mew £325, £200 of which was to be paid by Mr. Harvey, the contractor for the tar-spraying, who was joint defendant in the action, each party to pay their own costs.

Lancashire C.C.—In presenting the recommendations of the Main Roads and Bridges Committee on Monday last Alderman Aspell said in view of the increasing use of the main roads it would be no surprise to the members to see the greatly enlarged estimate for the coming year. The increase of £31,773 asked for, bringing the estimated expenditure to £211,552, showed that the expenditure had increased 50 per cent during the past fifteen years, and this was not the total of all that would be called for if the roads of the county were to be satisfactorily maintained.

Liberty of Peterborough C.C.—The Road Board has promised a grant of £7,185, spread over seven years, and a loan of £7,800, for strengthening the 5 miles of the Great North Road running through the county, the council to pay for surfacing out of maintenance. The Road Board has also given a grant of £800, and a loan of £3,000 for improving the main roads in Crowland, Market Deeping and Wansford districts. The loans are on condition that £4,600 is expended in the years 1913-14.

Loughborough T.C.—Negotiations are practically complete for an improvement scheme, involving an expenditure of £4,436. When this is effected a large area of slum property, called Steeple-row, will be cleared away, while a new street is to be made from Church-gate, where the corporation is to purchase property, into the Toothill-road.

Newquay U.D.C.—The surveyor, Mr. J. Ennor, reports that the amended scheme for the improvement of the main road between Narrowcliff and Bolowthas, could not be carried out for less than the original scheme—viz., £500. The council have approved of the scheme subject to the Local Government Board sanctioning a loan.

Oldham T.C.—The efforts of the borough surveyor's department are to be directed in the ensuing year to the main roads of the borough, and if money is available these are to be concreted.

Poole T.C.—Work under the Private Street Works Act is to be carried out in Alder-street and Parkside-road, and work to the value of £2,000 is to be done in Wallisdown-road.

Swansea T.C.—The borough surveyor, Mr. G. Bell, is engaged in the preparation of a scheme for the wood paving of the whole of the centre of the town, at an estimated cost of £20,000.

Wells (Somerset) U.D.C.—It has been agreed to purchase a road sweeping machine from Messrs. W. Smith & Son, at £22 10s.

West Suffolk C.C.—A letter has been received from Sir George Gibb, chairman of the Road Board, stating that if the county spend £29,569, including loan charges, in the year 1914, they could, if they choose, spend an additional £5,000, which would be provided by the board, either in the year 1914 or 1915, as they preferred, on any additional improvement work, but it would have to be such work. It could not, for example, be applied to reducing the expenditure in 1915, so as to bring it below the estimate of £29 569 for 1914, as that figure represented the amount which must be spent in order properly to maintain the roads.

Woolwich B.C.—It has been agreed to reconstruct the surface of the main road from Lee Green to New Eltham Station, at an estimated cost of £26 300. An amended application is to be made to the Road Board for a grant of £5,000, and a loan, without interest, of £7,000 for five years; and an application is also to be made to the London County Council for sanction to borrow the sum of £21,300, and to advance the sum of £14 300 for the wood-paving work and the kerbing channelling and drainage, repayable during the longest periods sanctioned for these purposes.

Worcester T.C.—The estimate of the city engineer, Mr. T. Caink, at £362, for making up Sydney-street, has been approved.

SEWERAGE AND SEWAGE DISPOSAL.

Auckland R.D.C.—The tender of Mr. Hetherington, of Coundon, at £1,546, has been accepted for the work in connection with the Hanwick sewage disposal scheme.

Esher and the Dittons U.D.C.—The tender of Messrs. James May & Son, of Ashtead, at £5,811, the lowest of three received, has been accepted for the extension of the sewage disposal works.

Hemel Hempstead R.D.C.—The council have approved the plans of the proposed scheme for treating the sewage of Kings Langley on the bacterial system, at an estimated cost of £1,500.

North Riding C.C.—An expenditure not exceeding £600 has been sanctioned for the construction of two additional filter beds in connection with the sewage scheme at the North Riding Pauper Lunatic Asylum.

Stroud U.D.C.—The tender of Mr. H. Smith, of Newport, at £1 030, has been accepted for the construction of an effluent drain in connection with the refuse destructor and sewage disposal works scheme.

Wirksworth U.D.C.—The tender of Messrs. Parker & Sharp, of York, at £9,276, has been accepted for laying

the main pipe line of the new sewerage scheme. For the ironwork for the outfall works the tender of Messrs. F. Bird & Co., London, at £647, has been accepted.

Worcester T.C.—The following works have been authorised at the sewage disposal works: Traveller along covered portion of carrier, including skip, £25; crane for lifting detritus to embankment, including foundation, £65; relaying rails along embankment, £3; total, £93.

WATER, GAS, AND ELECTRICITY.

Bideford T.C.—The Local Government Board have sanctioned the scheme for augmenting the water supply of the borough. The scheme includes the relaying of the mains, the construction of a service reservoir in Old Town, and of a storage reservoir at Bibery, the total cost being estimated at about £20,000.

Bristol T.C.—The city electrical engineer has proposed a series of alterations in the charges for electric lighting in the streets, which briefly amount to a reduction of the cost of the arc lamps by £2,000 per annum, and the conversion of some 700 gas lamps to electric lamps.

Chippenham R.D.C.—The surveyor, Mr. A. H. Lapham, has prepared two schemes of water supply for the district, with a view of being independent of the supply from the urban authority, whose charges amount to nearly £500 a year. One scheme, involving an annual estimated outlay of £494, provided for a supply from Allington, while the amended scheme, which was estimated to cost £300 a year, provided for a supply from an artesian well at Langley Burrell. The schemes have been referred to a special committee.

Dalkeith T.C.—The new waterworks at Ironmills were formally inaugurated on Saturday last. From the new bore, which has been sunk in the Public Park, 180,000 gallons of water per hour are obtained. The work was carried out by Messrs. T. Wilson & Son, of Edinburgh.

Dunoon T.C.—The tender of West's Gas Improvement Company, at £9,740, has been accepted for extensions at the gasworks.

Margate T.C.—The tender of Messrs. Hathorn, Davey & Co., at £11,710, has been accepted for an installation of pumping plant at Wingham, and tenders have been invited for carrying out the work of altering the existing buildings to provide for the new plant, the estimated cost being £5 000.

Marylebone B.C.—The Works Committee have considered as to the lighting of the new circus in Marylebone-road, and Mr. Seabrook has submitted a scheme which is considered suitable, and the committee have accepted it. The scheme provides for eight columns with one large lamp and four small ones on each being placed in the circus, one at each quadrant and one on each of the refuges to be placed in the roads leading into the circus. The approximate candle-power will be 4,800. The total cost of lighting and maintenance of the columns is estimated to be £150 per annum, but the committee have directed that the four small lamps on each column should be turned out at 1 a.m., reducing the cost to £101 per annum.

Neath R.D.C.—In connection with the new water supply works at Ystradfellte, Breconshire, a temporary supply was turned on last week. The work was commenced in 1909 by Messrs. Morrison & Mason, of Glasgow, with Mr. E. H. Hill as engineer and Mr. W. S. Beecher as resident engineer. It was found necessary to bore a tunnel under a portion of the mountain in order to divert the river, and the council went to Parliament again for further powers for an increased loan of £50,000 in order to meet the increased cost. These powers were secured, so that the cost of the works will be over £200,000. The supply will be available for a wide area.

Paignton U.D.C.—A 3-in. water main is to be laid from the main in Cockington-lane to join up the main in Sandringham-gardens.

Petersfield R.D.C.—The council have instructed Messrs. Taylor & Wallin (Mr. Harry W. Taylor, ASSOC.M.INST.C.E.), of Newcastle-upon-Tyne and Birmingham, to consider and report upon the waterworks for the parish of Liphook. Two proposals are under consideration, the first being a supply from the Wey Valley Water Company, and the second from a local scheme by means of which water would be obtained from a deep borehole in the green sands. The engineers are investigating both proposals fully, and will report upon the relative advantages and disadvantages of each for the council in due course.

Salcombe U.D.C.—The report of the Water Committee has been adopted recommending that the existing pumping and engine plant be replaced by two complete engines of uniform style and a suction gas engine. The estimated expenditure for this was £750, and this, with the necessary extension of the present buildings, &c., at Hanger, would necessitate a probable total outlay of £1,000. By obtaining this on loan, with repayment extending over a period of fifteen years and the adoption of a suction gas engine instead of oil, as at present used, such a saving would be effected as that a new and complete plant would be installed without any increasing expense.

Swansea T.C.—During the past year the electricity undertaking earned a profit of £3,600, and the market and slaughter-houses a nett surplus of £2,738.

Torquay T.C.—The electrical engineer (Mr. C. W. Salt) reported recently that, through the installation of the turbine, there had been effected in the year ended December 31, 1912, a saving of 1,200 tons of coal, and that, at the lowest figure of 13s. 10d. a ton, the saving in money was £830, while £206 had been saved in oil, waste and water. Councillor Langdon, chairman of the committee, calculated that the saving was nearer £1,200 than £1,000 a year. The reduction in the consumption of coal was about one-third.

Walsall T.C.—Upon the working of the electricity undertaking last year there was an adverse balance of £3,853, against a profit of £184 in the previous year.

West Ward (Westmorland) R.D.C.—The plans of a scheme have been completed for the supply of water from Blea Water Tarn, on the fells above Hawswater, for thirteen North Westmorland parishes, at a total cost of nearly £40 000. A Local Government Board inquiry was held in January, and at last week's meeting of the council a letter was read stating that the board "are advised that the scheme might be generally satisfactory," but they required information on certain points. One was the likelihood of Lord Lonsdale, the principal riparian owner, and owner of the lake, modifying his conditions as to the supply of water to the decoy pond in Lowther Park. It was reported that the special committee had waited upon Lord Lonsdale's agent who stated that Lord Lonsdale could not alter his terms. It was further reported that owing to the rapid rise of materials the cost of the original scheme would be much enhanced, but the engineer had made certain modifications which would bring the estimate down to £38,000.

MISCELLANEOUS.

Belfast T.C.—At a meeting of the council in committee a proposal that the minimum wage of all corporation labourers over twenty-one years of age should be 25s. weekly was rejected, but it was agreed to grant these labourers an advance of 1s. per week, and it is surmised that this increase, together with the other advances (about £2,000) approved of in salaries and wages, represents a total of over £7,000 a year.

Maidens and Coombe U.D.C.—Six tenders received for the supply of a first-aid motor fire appliance have been referred to the Fire Brigade Committee for report.

Troon T.C.—Mr. E. R. Matthews Bridlington, and Mr. John Eaglesham, Ayr, have prepared a report on the recent flooding of the town by sea water. They express the opinion that the two chief things required to ensure the prevention of the town flooding is to get as wide a strip of esplanade as possible between the town and the sea wall and to terrace this esplanade as high as is reasonably possible with an inclination towards the sea wall, so that any water from the sea which may be driven by heavy seas over the wall may gravitate quickly back again to the sea. The improvements which they propose meet those two requirements, and include the forming of a wider footpath than the present one, the building of a dwarf wall 2 ft. high along the upper side of the footpath, the forming of the upper part of the new wall next the sea in a curved projecting manner, and the placing of scupper holes through the parapet of the sea wall, at distances of 6 ft. apart, to allow of the speedy clearing of the water from the promenade. The estimated cost of carrying out the first scheme is £16 978. Scheme No. 2 is in all respects similar to scheme No. 1, except that the existing wall would be retained from opposite Bank-street westwards, and the cost is estimated at £15,400.

PERSONAL.

Mr. F. J. Harris, surveyor to the Holsworthy Rural District Council, has been granted an increase of salary.

Mr. J. M. Blizard, Assoc.M.Inst.C.E., Municipal Offices, Colombo, Ceylon, has been elected a member of the Royal Sanitary Institute.

Mr. E. J. Stead, deputy county surveyor of Somerset, has been appointed surveyor for No. 1 district under the Devon County Council.

Mr. W. A. Stenning, manager of the sewage disposal works of the Twickenham Urban District Council, has been voted an increase of salary.

Mr. William Wyllie, road surveyor, Lerwick, has been appointed road surveyor to the Easter Ross District Committee of Ross-shire, at a salary of £200 per annum.

Mr. Leslie Pardoe, son of Mr. J. C. Pardoe, surveyor to the Barry (Glamorgan) urban district, an assistant in his father's office, has obtained an important post as surveyor at Shanghai.

Mr. John Caffrey, who at present holds the post of principal of the Armagh Technical School, has been appointed by the Donegal County Council to the position of county surveyor for the southern division of the county.

Mr. Sidney T. Ford, assistant to Mr. E. Plummer Davies, engineer and surveyor to the Tisbury (Wilts) Rural District Council, was last week appointed highway surveyor (Northern District) to the St. Columb (Cornwall) Rural District Council.

Mr. R. H. Jenkins, surveyor to the Skegness Urban District Council, has had his salary increased by £20, instead of £10 as intended, on account of the efficient manner in which the work of his department has been carried out since he commenced his duties last October.

Major Henry Macaulay, formerly borough surveyor of Kingston, Surrey, has now recovered from the serious illness from which he was recently suffering. In a letter to a local contemporary he makes it clear that the description of "consulting surveyor" to the corporation, which has been applied to him—not in The Surveyor—is erroneous, this appointment ceasing automatically as long ago as June, 1911.

Mr. Alexander Glen, K.C., the well-known barrister, eldest son of the late William Cunningham Glen, principal legal adviser to the Local Government Board, died, we regret to state, on Monday. Mr. Glen, who was a distinguished specialist in municipal law, was the author of many works, including "The Law Relating to Highways," "The Law Relating to Public Health," and "The Law of County Government." He also edited "Penfold on Rating" and other local government works.

Mr. Ray R. Knight, A.M.Can.Soc.C.E., the newly-appointed city engineer of Fort William, Canada, previously held the post of chief designing engineer in the sewer department of the Department of Works, Toronto. Mr. Knight is an associate member of the Institution of Municipal and County Engineers, and before leaving England for Canada in 1910 he was for five years deputy engineer of Bromley, and had also been engaged in municipal work in Wood Green and Folkestone. He was articled to the engineer of Carnarvon.

Sir Richard Nicholson—who has just died at the age of eighty-eight, after having been blind for four years—is an unusual instance of an eminent solicitor who started professional life as a surveyor. He went to New Zealand at the age of sixteen as a cadet in the New Zealand Company, and, joining its surveying staff, was employed to lay out the town of Dunedin. He remained there but a few years, being recalled to England to become a solicitor when his eldest brother relinquished the practice of the law. He resigned the position of Clerk of the Peace of Middlesex three or four years ago, but retained until his death the appointment, of which he was the first holder, of Clerk of the Peace for the County of London.

To Manufacturers.—A correspondent is desirous of purchasing, for use in connection with a mortuary, two iron biers of the two-wheel type, fitted with covers. Makers of such vehicles are requested to communicate with "W. S.," *c/o* this Office.

PARAFFIN CARS OF THE LONDON FIRE BRIGADE.

MOTOR FUEL AT 7d.

Paraffin has been used for the past twelve months by the London Fire Brigade in three of their vehicles, one of which is an ordinary 20-horse power touring car used for the business of the office. In an interview by a *Daily Mail* representative on Monday an officer of the brigade said: "The special device we use enables us to run the engines on pure paraffin at 7d. a gallon. The power developed and the acceleration and general running are in every case quite equal to the results obtained with petrol. There is no noticeable smoke, except, as is usually the case with paraffin, immediately after the throttle has been suddenly closed. But it is very slight. The engines run very 'clean,' and 7,000 miles is the usual distance run before carbon deposit need be removed from the cylinders and pistons."

The device consists of a moderate-sized carburettor with the inlet pipe running through an exhaust-heated vaporiser. There is no float chamber, the fuel being fed direct to the jet under a constant pressure of 4 lb. Petrol is occasionally used for starting from cold. After standing in the cold outer air for a quarter of an hour the engine was easily started up on paraffin alone, and was at once throttled down and ran as silently and smoothly as it would have done on petrol. There was only a very slight smoke from the exhaust, and practically no smell. Twenty miles to the gallon is the average mileage obtained with this particular car.

Office Conversations.—The ninth of the series of articles under this heading is unavoidably held over until next week.

Institution of Civil Engineers.—At a meeting of the Institution to be held on Tuesday, the 1st prox., a paper entitled "The Yield of Various Catchment Areas in Scotland" will be read by Mr. Wm. Carstairs Reid, and one on "Measurement of the Flow on the River Derwent, Derbyshire," by Mr. Edward Sandeman, M.Inst.C.E.—A students' visit to the Kingston Bridge widening works has been arranged for the following day.

FOR OTHER ADVERTISEMENTS

See End of Paper.

LANCASHIRE COUNTY COUNCIL.
APPOINTMENT OF COUNTY SANITARY INSPECTOR.

The Lancashire County Council are prepared to receive applications for the post of County Sanitary Inspector, at a salary of £250 per annum. Applicants must be between 30 and 45 years of age, and must possess a Certificate of the Royal Sanitary Institute, or some other recognised body, and also hold a Certificate of Practical and Theoretical knowledge in Surveying.

Applications must be sent in on or before Saturday, April 5th, 1913.

Form of Application, terms of appointment and list of duties can be obtained from the

COUNTY MEDICAL OFFICER OF HEALTH.

County Offices,
Preston.
March, 1913. (293)

SURVEYOR, P.A.S.I. (24), seeks engagement with Progressive Firm of Surveyors, with a view to investing Capital in Partnership later. Excellent experience in Garden Suburb works, road making, sewering, levelling, general estate work. References.—R. J. Perkin, Tamworth.

ENGINEER, ARCHITECT and SURVEYOR (A.M.I.C.E.), in charge of a large Garden Suburb near London, has vacancy for a pupil. Moderate premium. Write Box 1225, office of The Surveyor, 24 Bride-lane, Fleet-street, E.C. (292)

WANTED, for a Waterworks Office, an Assistant experienced in the Distribution of Water. Salary, £156. Form of application may be had on application to Box 1,226, office of The Surveyor, 24 Bride-lane, Fleet-street, E.C. (294)

Some Municipal Works and Practice in Leeds.*

By W. T. LANCASHIRE, M.Inst.C.E., City Engineer.

One of the most important undertakings of the Leeds Corporation is the condemnation and reconstruction of a large area of the city under Part I. of the Housing of the Working Classes Act (1890).

It is probably one of the largest schemes of this description, the total area dealt with being 66¼ acres, all closely built up. The population when referenced was 13,642, and the disturbance of such a large number of people, equalling the population of many well-known towns, is a matter of great importance.

Fortunately, the demolition and clearance has so far taken place at a time when, for various reasons, Leeds has been much over-built, and it has been possible to urge the Local Government Board to relax the obligations laid upon the corporation in the matter of rehousing, until finally the board has decided that the corporation may be exempt from any more efforts in this direction in connection with this scheme.

The total requirements of the board in this respect were originally that rehousing accommodation should be provided for 8,000 persons, and it was only after three inquiries by the inspectors of the board, to whom statistics as to the number of unoccupied houses within half a mile and one mile radii were supplied, that the board were convinced that there was no further need to require the corporation to do any more rehousing. Provision has been made as follows: In tenement dwellings within the area built by private enterprise to approved plans, 198 persons; in cottages about a mile to the east of the area built by private enterprise to approved plans, 906 persons; in tenement dwellings within the area erected by the corporation, 108 persons; total, 1,212.

The rehousing effort cannot be said to have been very successful from a financial point of view. In those cases where the erection of tenements and cottages by private enterprise has been carried out the sale of land has been at a figure below the market value in order to make it a reasonable venture for the private parties concerned, and in the case of the tenement dwellings erected by the corporation the tenements have had to be let at such a rental that, when fully let, the total rentals (less rates) about equal the interest and sinking fund charges on buildings and paving, without any allowance for the price of land occupied. The actual income, of course, is less.

Tenements do not appear to meet with general approval in Leeds, and requests have been made for the erection of cottages if any further rehousing is made within the areas. At present this does not appear to be probable, and it is hoped that the surplus lands will be taken for business and manufacturing purposes.

The condemned area was acquired under two Provisional Orders: York-street area, 16¼ acres; Quarry-hill area, 50 acres; total, 66¼ acres.

It is now seventeen years since the first Provisional Order was obtained, and in the portion of the areas first dealt with an area of about 4½ acres, or about 27 per cent of the whole, has still to be disposed of by the corporation. It has not been possible to dispose of much of the land in the second portion obtained under Provisional Order, dated 1901, by reason of the difficulties arising from the housing question, and because of the laying out and construction of main arteries.

The work on the main thoroughfares has been executed to date as follows: New streets, 75 ft. wide 977 yds.; widened streets, 75 ft. wide, 921 yds.; new street, 60 ft. wide, 100 yds.; widened streets, 60 ft. wide, 973 yds.; total, 2 971 yds.

SUBWAYS.

Subways for pipes, cables, &c., have been constructed in them for a total length of 2,150 yds., varying from 5 ft. by 6 ft. 6 in., and 6 ft. 2 in high to 8 ft. by 7 ft. high. Gas, water, electric cables, and telephone pipes have been laid in them, but the different departments have not shown any great desire to avail themselves of the subways in lieu of the usual method of laying the pipes, &c., under carriageways or footpaths, and no charge has been made on any corporation department for the use of the subway.

The cost of these subways has amounted to £20,408, and this expenditure has caused, during recent years, a reaction in feeling as to the advisability of further construction in this direction; still, in years to come it is hoped that the saving of the breaking up of important thoroughfares, with its accompanying inconvenience and expense, will be looked upon as justifying the expense incurred in this generation.

Some of the main streets to be widened are crossed on the skew by the North-Eastern Railway, and girders of 105-ft. span will be necessary in some of these cases, payment for the work being a matter of arrangement between the corporation and the company, depending upon the circumstances in each case.

In connection with the development of this area and another it is noticeable that a total area of land of 5½ acres has been purchased by corporation departments—viz., the tramways, gas and markets. At the inception of the scheme they were not parties to the acquisition of the property, and apparently the committees responsible had no idea that they would so soon be in need of such large areas for the conduct of their growing municipal concerns.

The process of demolition, alteration and reconstruction of so large an area is somewhat depressing in its effect; but as time goes on and fine broad streets appear with good buildings in place of the wretched narrow dirty lanes and courts and miserable dwellings some satisfaction is experienced, and the boldness of the corporation is more and more appreciated.

Care is taken that restrictions are inserted in the conditions of sale of land fronting to important thoroughfares, as otherwise inferior buildings might be erected, and the appearance of the street spoiled for years to come.

Change in the centre of a large, growing city is always going on in the absorption of old house property for other requirements; in this case it is being done on good broad regulated lines, and probably succeeding generations will give full approval to the policy, especially when the sinking fund and interest charges have died out by lapse of time.

STREET WIDENINGS AND IMPROVEMENTS.

During the last forty years rather over 31 miles of streets and roads have been widened, exclusive of new roads made at the expense of the corporation, and the cost to the corporation on these widenings and new roads accounts for rather more than a 1s. rate; most of this has been done in the last twenty years.

Recently there has been less activity in this direction, but the necessity for more widenings is forced upon the responsible committee from time to time.

An example of considerable interest has been before the public quite recently in connection with the extension of the infirmary, and powers are being sought in the coming Session of Parliament for a new street which will form the eastern boundary of the extended infirmary site. This will be made 60 ft. wide for a length of about 390 lin. yds., and will provide a shorter route from Headingley, one of the principal residential suburbs to the Great Northern, Great Central, and Lancashire and Yorkshire railway stations. One of the chief arguments used by its promoters is that it will do away with the necessity for widening a narrow and crowded important main thoroughfare—Woodhouse-lane—at any rate for a long period, if not altogether. The scheme will also do away with a lot of poor property in a congested area.

One point in connection with road widenings is deserving of careful consideration—*viz.*, the widening of roads when property is being erected to country lanes, changing their nature into streets. At present doubt exists in many cases as to the financial obligations of owners and local authorities, and legislation determining this would be welcome by all who have to face the question in the gradual spread of towns.

A considerable sum of money has been spent upon street widenings which, in the opinion of many, ought, in part at any rate, to be charged to the tramway account, but up to the present time no amount has been so charged. It was proposed to take powers this session for widenings to be charged to the tramway account, but at the statutory meeting of the ratepayers

* Paper read on the 1st inst. at a North Eastern District meeting of the Institution of Municipal and County Engineers at Leeds.

an adverse vote on sections of the bill has postponed this matter for further consideration at another time.

TOWN PLANNING.

Up to the present time no large schemes of town planning under the new Act have proceeded beyond the preliminary stage of consultation with the landowners affected, but one case of a small area has been sent to the Local Government Board. The area is one of a few acres forming the grounds of an old residence round which smaller property has gradually sprung up, and the owner desired to lay it out under the by-laws for small terrace houses. The corporation propose to relax the by-law requirements as to width of streets in return for a widening along one frontage of the main road and the reduction of the number of houses per acre.

LAYING OUT OF NEW ESTATES.

Although the by-laws or regulations in Leeds as to the submission of plans by owners for the laying out of new streets, and as to the approval of such plans by the corporation, are no doubt much the same as those in general use in other towns, there is a distinctly unusual practice in this city with respect to the first construction of new streets.

In other towns a private owner can lay out his own estate by constructing sewers and laying kerbs, &c., subject to the by-laws or regulations, but such owner pays the full cost of the works. In Leeds, however, a Local Act was obtained in 1872 which prohibited the owners from doing this work, and provided that it should be done by the corporation, with power to recover one-half of the cost of the sewers and the full cost of the kerbs from the owners abutting, the cost being apportioned on frontage; and these special powers are now embodied in sec. 178, subsects. 1, 2 and 3, of the Leeds Consolidation Act (1905).

In Leeds streets are required to be laid out—*i.e.*, sewered and kerbed—before the corporation will approve any plans or proposals for buildings abutting thereon. The owner executes any necessary levelling, excavating or filling up that may be requisite before the corporation carry out the works of sewering and kerbing. When the work of forming has been completed the owners of not less than one-half of the frontage sign an application form requesting the corporation to do the work required. To this form a sketch plan is attached, showing the position of the street, and the corporation then instruct their contractor to proceed with the work.

If the corporation themselves desire to proceed with the kerbing and sewering of any approved street it is in their power to do so without any authority from the abutting owners; but this power has not yet been exercised. In order to have the work dealt with by a set of men who are accustomed to the work, a contract is let for a period of three years for all sewering and kerbing of estates, and this covers also any other sewer work, up to a certain size, required within the city. The practice works very well; the schedule is adaptable in that extra payments are made by a percentage on to the usual figures for any work in narrow streets and under other unusual circumstances, an extra also being allowed for tunnelling and "rock." The corporation supplies cement and ironwork for this contract, and thus ensures compliance with the specification as far as these materials are concerned.

The system of laying sewers for private owners at their request necessitates having a fund on which to draw, and from time to time application is made to the Local Government Board for a figure to cover the requirements for some years ahead. Since working plans and sections have to be given to the contractor with each order, a very complete record of all the sewerage of the city is secured.

There are distinct advantages attached to this system, among which the following may be noted: There is less risk of mistakes or bad work, as the men engaged by the corporation's contractors become specialists in the work, and there is better control over the men engaged and over the materials used. The levels throughout the street being fixed by the kerb before building is permitted, there is greater accuracy in the matter of lines and levels than when this system is not in operation. The order for a complete street is asked for, whereas if builders or owners did their own work at sewering or kerbing, they would often do it in very short lengths. In the areas recently added to the city where the ordinary methods of laying out estates have been in vogue, instances have already been noted where considerable errors both in line and levels have occurred. During the last ten years about 70 miles of streets have been laid out, at a cost to the corporation for their half of the sewers of rather over £50,000. A want of uniformity of practice in the laying of pipes and cables in streets by the different departments of the corporation was apparent some little time ago, and with a view to an improvement in this direction a consultation of all the chief officers of the corporation took place, with a result that definite positions have now been allotted to each type of service, and sections have been prepared to form a record for all parties, from which variation may be made only by permission.

AN AMERICAN VIEW OF THE ROYAL COMMISSION'S REPORT ON SEWAGE EFFLUENTS.

[An abstract of an article by W. L. Butcher in *Engineering News*.]

The proposed standards exhibit a rare use of practical "horse sense" reinforced by scientific facts. To American engineers they seem quite stringent, and to those German sanitarians who maintain that fresh swiftly moving sewage is inoffensive if confined within proper channels the standards must appear very rigid; but most German towns are near large streams, while in England large cities and enormous industries are crowded together on small watercourses. With regard to the "stringent standard" for complete treatment, American conditions are not yet such as to make this of much significance; but some large American sewage works of the English character would not come up to the British standard. In the year 1903 the chief engineer of the Massachusetts State Board of Health reported that he was of the opinion that, under the conditions examined a nuisance never existed from the discharge of untreated sewage when the flow was in excess of 6·5 cub. ft. per second per 1,000 persons. As these streams were receiving unsettled sewage, the requirement suggested by the Royal Commission—14 cub. ft. per second per 1,000 persons when reduced to the American equivalent—is a rigid one according to Massachusetts ideas. The "legal dilution" of the Chicago drainage canal is 3·3 cub. ft. per second per 1,000 persons, and reports show that nuisances arise, probably largely caused by putrefying sludge banks. This emphasises the value of the English standards for suspended matter in the effluent—6 parts and 15 parts per 100,000.

The commission's attempt to determine the standard for dissolved oxygen is somewhat unsatisfactory, because it is highly empirical; 4 cub. centimetres per litre would be about 60 per cent of saturation for fresh water at 65 deg. Fahr., or, in conditions such as those of New York Harbour, about 70 per cent, whereas 50 per cent has been regarded as sufficient in that case by the New York Sewerage Commission. (The editor of *Engineering News* here points out in a footnote that the standards under discussion apply to fresh waters, and remarks that the Royal Commission suggested that the principle might be applied to tidal waters where a standard is considered necessary, but still adheres to the conclusion of the fifth report—namely, that it is not practicable to lay down fixed rules as regards a standard effluent for tidal waters.)

The economic value of such standards as those proposed is exemplified by comparing the conditions at Chicago—far below the British standard—with those at Pittsburgh, where it is proposed to spend $37,000,000 on purification works, although under the present conditions the discharge of settled sewage would probably satisfy the standard.

Damages for Sewage Pollution.—At Staffordshire Assizes recently £341 damages were awarded against the Brownhills Urban District Council. The plaintiff was Samuel Brawn, farmer of Sheffield Farm, Walsall, who alleged that his farming stock had suffered deterioration and loss owing to the pollution of a stream running through the farm by sewage matter from defendants' sewage farm.

Insanitary Property in Liverpool.—The annual report of the medical officer of health (Dr. Hope) regarding insanitary property shows that during the past seven years 2,062 insanitary dwellings in Liverpool had been demolished, 456 had been closed and now awaited demolition or reconstruction, and 637 had been reconstructed and rendered sanitary, making a total of 3,095 for the seven years, excluding those in schemes but still occupied.

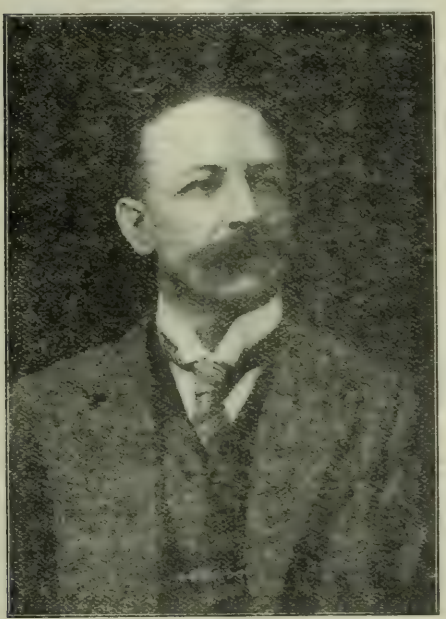
JOHN STUART ELLIS DE VESIAN.

A BIOGRAPHICAL SKETCH.

As the head and chief moving spirit of the Mouchel-Hennebique organisation, the subject of this sketch has been responsible for an enormous amount of ferro-concrete construction, and needs no introduction to our readers.

Continuing the work inaugurated in France by François Hennebique, and in Great Britain by the late Louis Gustave Mouchel, Mr. de Vesian possesses an unrivalled experience in the special and difficult branch of civil engineering with which he had been directly associated for the past decade.

Although bearing a French name, Mr. de Vesian may justly claim to be British in every other respect, his family having been domiciled in this country since 1690. He is descended from a French Huguenot



Mr. J. S. E. de Vesian.

family of Languedoc, whose full designation was de Vesian de Castelper, the head of the family being Seigneur de Moussac. On the revocation of the Edict of Nantes, in 1685, the de Vesians left their native land, some taking refuge in Switzerland, and others in Holland, whence one of the younger members came over to England in 1689 with William of Orange. In 1805, Mr. de Vesian's great-grandfather, Mr. Andrew Ellis de Vesian, one of the early underwriters at Lloyds, dropped his French name and adopted that of his godfather, John Ellis, one of the founders of Lloyds, being known thenceforward as Andrew Ellis Ellis. The English branch continued to be known under the name of Ellis from 1805 to 1889, the original patronymic having been resumed after the last-mentioned year. William Ellis, the son of Andrew, was well known at Lloyds, and was practically the founder of The Indemnity Marine Assurance Company. He was more widely known, however, as an untiring worker for the education of the masses and as the founder of schools, established and endowed by him, in different parts of London. In these schools he himself taught social economy and the philosophy of everyday life. This work brought many close friendships among the great thinkers of the day, among others being Bentham, James Mill, and his son John Stuart Mill. Edward Ellis, the father of John Stuart, was educated as an engineer, but owing to the early death of his elder brother he took his seat in the underwriters' room of The Indemnity Marine Assurance Company.

Mr. J. S. E. de Vesian was born in London in 1864. He was educated at University College School, and afterwards at University College under Prof. (now Sir Alexander) Kennedy. In the year 1885 he was articled to the late Mr. J. C. Park, M.Inst.C.E., locomotive engineer to the North London Railway Company, and served nearly four years in the locomotive works at Bow, having been in charge of a repair gang for the last nine months of his time. On leaving the Bow works, he joined the staff of Mr. Richard Price-Williams, M.Inst.C.E., and assisted in surveys and the preparation of the Parliamentary plans for two railways. On leaving Mr. Price-Williams, Mr. de Vesian commenced work on his own account, perfecting several inventions, among others a new type of railway crossing and an improved method of refrigeration for ice rinks. This system was successfully installed in the fine rink at Hengler's, now the Palladium, and in Glasgow and elsewhere. He subsequently carried out a number of cold storage and ice-making installations.

In 1904 Mr. de Vesian became associated with Mr. L. G. Mouchel, with whom he had been acquainted some years previously, joining his technical staff in the capacity of a superintending engineer. At that time Mr. Mouchel had established his headquarters in Westminster, and began to feel the need of an able and energetic colleague to assist him in supervising the operations of contractors engaged in the execution of works all over the United Kingdom. Mr. de Vesian thus became the right-hand man of the pioneer mentioned, and being possessed of an apparently unlimited capacity for hard work, and a gift for rapidly appreciating the best solution of any difficult problem encountered, either of administrative or of technical character, the scope of his duties was further increased until at the time when Mr. Mouchel's health began to fail he was virtually responsible for the entire control of the Mouchel-Hennebique organisation. In 1907, on the transfer of the undertaking to a company, under the style of L. G. Mouchel & Partners, Mr. de Vesian and Mr. T. J. Gueritte, who had for many years been the chief of the technical offices in Newcastle-upon-Tyne, were appointed managing directors and chief engineers to the firm.

It would be quite impossible within the limits of an article such as this to mention individually even the more important ferro-concrete works for the design and superintendence of which Mr. de Vesian has been jointly or entirely responsible to the engineers or architects acting on behalf of Government departments, county and municipal councils, dock and harbour authorities, railway companies, water authorities and companies, shipping companies, colliery proprietors, industrial firms and others. The aggregate value of the works so executed runs into several millions sterling, and they include many structures of great magnitude, including numerous important buildings, harbour works, railway and highway bridges, reservoirs, water towers, sewage tanks, wharves, jetties, and other structures. After the regrettable death of Mr. L. G. Mouchel in 1908 Mr. de Vesian acted as consulting engineer to H.M. Office of Works in respect of the new General Post Office buildings at St. Martin's-le-Grand, and since that date he has worthily sustained the great reputation established by his former chief and friend.

Although continuously working under high pressure, Mr. de Vesian is invariably cheerful and good-natured, being quite free from the irritability which is so frequently induced by overwork. He is extremely popular among the numerous clients of the company, and regarded with feelings of affectionate esteem by the various district engineers of the Mouchel-Hennebique organisation in London and the provinces, and by all members of the technical staff.

One of the most striking illustrations of the tact and perseverance possessed by Mr. de Vesian is the astonishing manner in which he succeeded in carrying through the project for a ferro-concrete bridge at Waterford, despite the powerful adverse influences brought to bear in favour of a steel structure by persons interested in that rival material. Having originally decided upon a ferro-concrete bridge as preferable to the steel bridge proposed by the Viceregal Commission, the Waterford Municipal Council suddenly changed their mind. About the same time rumours began to be spread in Waterford as to the risks supposed to attach to ferro-concrete, and it almost seemed as if the steel interests would carry all before them. Then it was that Mr. de Vesian began to shine. By public lectures at Waterford, by interviews with the several county authorities concerned, and by his able evidence before the Judicial Committee of the Privy Council in Ireland, he entirely turned the tables upon his opponents. The Privy Council not only decided that a ferro-concrete

bridge should be adopted, but ordered that the structure should be built in accordance with the plans and specifications prepared by Mr. de Vesian. Moreover, the Waterford Corporation were once more persuaded that ferro-concrete was perfectly safe and far preferable to steel—a view that has since been confirmed by the successful completion of the bridge and its undoubted claim to be regarded as an ornament to the city. How Mr. de Vesian managed to carry through so difficult an operation we do not quite know, but imagine it was due mainly to his personal magnetism, ready command of argument, and invincible persistence.

Of course, it goes without saying that ferro-concrete has claims over steel in respect of economy, endurance, and the elimination of maintenance charges, and particularly for the construction of bridges in tidal waters. Nevertheless, it appeared at one time that these manifest advantages had been entirely overlooked and would have gone for nothing in the absence of the able advocacy mentioned.

For several years Mr. de Vesian was a member of the London Division of the Royal Naval Volunteer Reserve, and was among the first to realise the importance of rifle practice on "miniature ranges." When residing in Hertfordshire he inaugurated the Stevenage Rifle Club in "Black" December, 1899, the first of such clubs to get into operation, and the forerunner of the present great movement for the creation of civilian riflemen. We may also mention that in the previous year, when living in Surrey, he acted as instructor to a flourishing school of arms and gymnasium, and while living at Stevenage he acted in a similar capacity for the local company of the Church Lads' Brigade.

Mr. de Vesian was admitted as an associate member of the Institution of Civil Engineers in 1891, and transferred to the class of full member in 1907; in 1889 he was elected as a graduate of the Institution of Mechanical Engineers and elected a full member in 1890, and is a member of council of the Concrete Institute. He has delivered numerous lectures on ferro-concrete design and construction to the students of technical colleges, and has contributed papers on the same subject to various engineering societies.

"THE SURVEYOR'S" COMING-OF-AGE.

Mr. S. A. Hill-Willis, engineer and surveyor, Tilbury Urban District Council writes: "May I be allowed to add my hearty congratulations to those you have already received from so many municipal engineers? I have been a subscriber to your valuable paper since 1895, and have referred to my bound copies so many times in the past that I know not what I should do without them. My last three appointments were obtained through noticing advertisements in the columns of The Surveyor, and my pupils inform me the Students' Section conducted by Mr. Sydney Turner is of great assistance to them. May The Surveyor continue to advance the interests of the profession in the future as it has done in the past!"

The Surveyor, of London, the excellent English technical municipal journal, has entered upon its twenty-first year. It has seemed to it interesting on this occasion to give a *résumé* of the progress accomplished during the past twenty years in the various departments of the art of the municipal engineer. The *résumé* is written from the English point of view, but, taken as a whole, it presents very well the forward march of sanitary engineering in all countries, as it may be said that thanks to rapid means of communication and the Press, all countries actually proceed with the same rapidity along the road of progress in sanitation and municipal works. The following are the principal subjects dealt with in the anniversary number of January 17, 1913: Electricity, roads, municipal buildings, sewerage and sewage disposal, street lighting, tramways, water supply, legal and administrative questions. Our contemporary may be proud of the importance which it has attained, and we offer it our congratulations and best wishes for future success.—*La Technique Sanitaire et Municipale.*

Daylight Saving.—The Surrey County Council have arranged for their offices to be opened and closed an hour earlier on Saturdays from March 29th to October 4th, and the alteration has also been adopted by the Maidenhead and Coombe Urban District Council.

THE CENTENARY OF GAS LIGHTING AND ITS HISTORICAL DEVELOPMENT.

By W. J. Liberty.

Inspector of Public Lighting in the City of London.

In a lecture on the above subject, at a meeting of the Illuminating Engineering Society, held at the Royal Society of Arts last week, Mr. W. J. Liberty sketched in an attractive manner the remarkable development of gas lighting from the commencement of the last century up to the present year. The subject was selected in view of 1913 being the centenary of gas supply.

The lecturer commenced by referring to the very earliest attempts to manufacture illuminating gas, and recalled how Sir Walter Scott, writing of the early lectures of Winsor in London exclaimed, "There is a madman proposing to light London with—what do you think?—why, with smoke!" Even the scientists of that day were sceptical, and, indeed, Winsor's lectures in London in the early part of the nineteenth century contained some fanciful suggestions. For some time after 1807 it was fashionable to go to see the gas at the Lyceum, but it was only after three years' perseverance that a charter was obtained from King George III., and on June 24 1812, the first meeting of the Incorporated Gas Light and Coke Company was held. Pall Mall was one of the first streets in London to be lighted. The company met with many early difficulties, but by 1816 no less than 16 miles of main were laid in London.

Among these early difficulties may be mentioned leakage and imperfect purification. We find that even in 1860 Dr. Letheby estimated that the amount of gas escaping into the earth of the metropolis was no less than 386,000,000 cub. ft. per annum!

Even after gas had established its position for public lighting it was long before it could be conveniently used for indoor illumination, and the room of the Royal Society of Arts (in which this lecture took place) was not so lighted until 1854.

A special tribute was paid by Mr. Liberty to the early work of Clegg a pupil of Murdoch, who devised the first gas meter, and did much to make gas lighting a practicable process.

After the initial difficulties had been overcome, gas lighting entered upon a stage of ruinous competition between the different companies, and it was only in the period 1868—83 that amalgamation began. Many of the companies at this time paid substantial dividends, and the price of gas was also high, in some cases as much as 6s. per 1,000 cub. ft. This favoured position of the gas industry eventually gave rise to a state of inertia and stagnation, and it was only in the early 'eighties, when the formidable competition of electric lighting made itself felt, that development began, and the great discovery of the incandescent mantle by Welsbach brought about an entirely changed state of things. From that day to the present steady progress has been made.

A great stimulus to the use of gas among poorer classes was the introduction of the penny-in-the-slot meter.

In the concluding section of this paper Mr. Liberty dealt more closely with gas as an illuminant, prefacing his remarks by a historical sketch of developments in public lighting. Opinion was divided as to the variety of public lighting provided in the streets of Rome; probably it was of a very primitive character. Even in the Middle Ages the lighting of the chief cities of Europe was only "modified darkness." In 1667 Paris was considered one of the best illuminated, but it was subsequently surpassed in this respect by London. For a long time lighting was carried out by oil lamps, and it was the duty of each householder to hang such a lamp outside his doorway, and to keep it lighted for stated periods.

In 1736 the Lord Mayor and Commonalty applied for powers to attend to the lighting of London, which thus passed from being a private duty to a public one. In 1774, owing to the large number of robberies, another Act of Parliament was necessary. It was said that at this time Oxford-street contained more lights than all Paris.

Mr. Liberty then passed on to the method of lighting early in the last century, dealing more particularly with the early forms of gas lamps that came into use. An interesting exhibit at the lecture took the form of a complete series of gas burners, ranging from the earliest iron rat-tail burners, and the "steatite" burner of 1868, up to the latest types of to-day. Much interesting information was given as

to the date at which changes were made in the lighting of various parts of London. A number of slides were shown illustrating how even to-day there are to be seen in London the old iron funnels or extinguishers beside the hall door into which torches were plunged and extinguished by parties returning home. Another slide showed one of the very earliest gas lamps ever put up in London, that is still to be seen hanging near Paternoster-square. Many early forms of lanterns using flat-flame burners, and photographs of streets so lighted in the past, were exhibited.

The lecturer also traced the rise of high-pressure gas within the last decade, mentioning that the Tower Bridge was among the very first lighted by this means. He also described various early forms of self-intensifying gas burners, such as those of the Scott-Snell type, which have given place to the high candle-power high and low pressure lamps of to-day.

As showing how there was still room for both illuminants, he referred to the combined lighting by gas and electricity in Holborn and in the City of London, by which vastly improved illumination had been obtained at a reduced cost. The whole question of street lighting was now receiving much more study, and suggestions were being made as to the best means of distributing the light and avoiding glare. It would be noted that in recent contracts the tendency had been made evident to specify the provision in the streets of a certain illumination. The study of such lighting problems had been greatly encouraged during the last few years by the formation of the Illuminating Engineering Society.

Business Announcement.—British Macadams, Ltd., the Road Maintenance and Stone Supply Company, Ltd., and Tarred Granites, Ltd., have opened offices at 123 Cannon-street, E.C. where Mr. Herbert Beadle will be in constant attendance. The telegraphic address is "Propatmac, Cannon, London," and the telephone number, 4097 City.

"THE SURVEYOR" EXHIBITION.

NOTICE TO INTENDING EXHIBITORS.

The Building Trades Exhibition at Olympia will be opened on Saturday, April 12th, by the Lord Mayor of London.

THE SURVEYOR Section, in the gallery, will, as usual, have a special attraction for municipal engineers and surveyors, the arrangement of this part of the exhibition being in the hands of Mr. C. S. Mason, 24 Bride-lane, Fleet-street, E.C.

Only a very limited number of spaces are now to let, and intending exhibitors are advised to make early application for particulars.

INSTITUTION OF MUNICIPAL AND COUNTY ENGINEERS.

President—Mr. R. J. THOMAS, M.INST.C.E., County Surveyor, Buckinghamshire.

NORTH-EASTERN DISTRICT.

A meeting of the institution will be held in the North-Eastern District at Newcastle-on-Tyne on May 2nd and 3rd next.

ANNUAL MEETING: ALTERATION OF DATE.

The date of the annual meeting of the institution has been altered from July 23rd-26th to July 16th-19th.

SCOTTISH MEETING.

A meeting of the institution will be held in the Scottish District at Dundee on June 6th and 7th.

By order of the Council,

THOMAS COLE,
92 Victoria-street, S.W. *Secretary.*

THE SURVEYORS' INSTITUTION.

The next ordinary general meeting will be held at the institution on Monday, April 7th, when a paper entitled "Reinforced-Concrete Construction" will be read by Mr. P. J. Waldram. The chair will be taken at 8 o'clock.

INSTITUTION OF MUNICIPAL ENGINEERS.

President—Mr. FRANK LATHAM, M.INST.C.E.I., F.S.E., Borough Engineer and Surveyor, Penzance.

COUNCIL MEETINGS.

The following council meetings have been arranged: March 26th, London; April 30th London; May 31st, Manchester; June 28th, London; July 30th, London.

GENERAL MEETING.

A visit will be paid to the Building Exhibition at Olympia on April 12th, by kind permission of the promoters. Full particulars will be issued later.

NORTHERN DISTRICT.

A district meeting will be held at Wallsend on March 29th, when a round of visits will be made to the municipal works and shipyards of the town. Full programme will be issued later.

EXAMINATIONS.

The next examination will be held in London and other centres during the week ending May 17th next. Copies of syllabus and forms of application to sit may be obtained from the secretary. Notice of intention to sit must reach the secretary not later than April 21st.

B. WYAND,
39 Victoria-street, S.W. *Secretary.*

APPOINTMENTS VACANT.

Official and similar advertisements received up to 4.30 p.m. on Thursdays will be inserted in the following day's issue, *but those responsible for their despatch are recommended to arrange that they shall reach* THE SURVEYOR *office by noon on* **Wednesdays** *to ensure their inclusion in the weekly list of vacancies. Such advertisements may, in cases of emergency only, be telephoned (No. 1339 Holborn), subject to later confirmation by letter.*

CLERK OF WORKS.—March 22nd.—Hinckley Urban District Council. £3 3s. per week.—Mr. E. H. Crump, engineer and surveyor.

ENGINEERING ASSISTANT.—March 22nd.—Corporation of Burnley.—Mr. Peregrine Thomas, town clerk.

CLERK OF WORKS.—March 24th.—Rivers Committee of the Manchester Corporation. £3 3s. per week.—Chairman of the Rivers Committee, Town Hall.

ENGINEERING ASSISTANT.—March 25th.—Corporation of Rotherham. £130—£150.—Mr. Chas. L. des Forges, town clerk.

JUNIOR ASSISTANT.—March 27th.—Friern Barnet Urban District Council. £50 per annum.—Mr. E. J. Reynolds, engineer and surveyor.

ROAD SURVEYOR.—March 29th.—Sutherland County Council. £350 per annum.—Mr. A. Argo, county clerk, Golspie.

TEMPORARY ASSISTANT.—March 29th.—Corporation of Truro.—Mr. F. A. Barnes, city engineer and surveyor.

HIGHWAYS AND GENERAL FOREMAN.—March 31st.—Hipperholme Urban District Council. 30s. per week.—Mr. G. Wharton Thompson, engineer and surveyor.

SEWAGE WORKS MANAGER.—March 31st.—Corporation of Faversham. 40s.—47s. 6d. per week.—Mr. Guy Tassell, town clerk.

COUNTY ROAD SURVEYOR.—March 31st.—Midlothian County Council. £450.—Mr. A. G. G. Asher, county clerk, County Rooms, Edinburgh.

ROAD FOREMAN.—April 8th.—Woking Urban District Council. £120—£140.—Mr. R. Mossop, clerk.

CHIEF ASSISTANT ENGINEER.—April 12th.—Port of London Authority. £1,200.—Mr. F. Ayliffe, secretary, 109 Leadenhall-street, E.C.

BOROUGH ENGINEER AND SURVEYOR.—April 12th.—Corporation of Ipswich. £350—£550.—Mr. W. Bantoft, town clerk.

STOKER AND DRIVER.—April 14th.—At pumping station of Borough of Dorchester Waterworks. 21s. per week, with house, coal and light.—Mr. A. G. Symonds, town clerk.

ASSISTANT ENGINEERS.—May 1st.—Indian Public Works and State Railway Departments.—Secretary, Public Works Department, India Office London, S.W.

ASSISTANT ENGINEER.—May 15th.—Board of Trustees for the Improvement of Calcutta. 500—700 rupees per mensem.—Mr. C. H. Bompas, chairman, 5 Clive-street, Calcutta.

MUNICIPAL COMPETITIONS OPEN.

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EXETER.—March 27th.—Designs for a hostel for male students, for the Exeter Corporation.—Mr. H. Lloyd Parry, town clerk.

IPSWICH.—March 31st.—Designs for laying out 26 acres as a working-class suburb on the lines of a modified garden city. Premiums of 50 guineas, 30 guineas, and 20 guineas are offered.—Mr. W. Bantoft, town clerk

ABERTILLERY.—April 9th.—Plans for an elementary school for 500 boys and girls and 300 infants, for the urban district council. The successful plans will be adopted, and the successful architect appointed.—Mr. N. J. Llewellyn, secretary, Education Committee, Council Offices.

DEVONPORT.—June 14th.—Designs for municipal buildings and a guildhall, for the Corporation of Devonport. Premiums of £350, £150, and £100 are offered. The assessor is Mr. Ernest Newton, A.R.A., F.R.I.B.A.—Mr. R. J. Fittall, town clerk.

MUNICIPAL CONTRACTS OPEN.

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Buildings.

BLAIRGOWRIE.—March 22nd.—For the erection of police buildings, for the county council.—Mr. D. Marshall, county clerk, County Buildings, Perth.

PEMBROKE.—March 22nd.—For rebuilding part of a bridge, for the county council.—Mr. A. Thomas, county surveyor, Haverfordwest.

SHEFFIELD.—March 25th.—For the erection of a light reinforced-concrete bridge, for the corporation.—Mr. S. E. Fedden, general manager and engineer, Electricity Department, Commercial-street.

SHOEBURYNESS.—March 25th.—For the erection of five wooden shelters, for the urban district council.—Mr. Frederic Gregson, clerk.

SOUTHEND-ON-SEA.—March 26th.—For the erection of a school, for the Education Committee.—Mr. J. W. Barrow, clerk to the committee, Municipal Buildings.

WEST RIDING.—March 28th.—For the erection of a school, for the Education Committee.—Education Architect, County Hall, Wakefield.

STAFFORD.—March 29th.—For the construction of ward block at isolation hospital, for the corporation.—Mr. W. Plant, borough engineer and surveyor.

FARNBOROUGH.—March 31st.—For the erection of a refuse destructor, with buildings and chimney stack, for the urban district council.—Mr. J. E. Hargreaves, surveyor.

EDMONTON.—March 31st.—For the erection of a public convenience, for the urban district council.—Mr. C. Brown, engineer.

DURHAM.—March 31st.—For the erection of a retaining wall, for the county council.—Mr. J. A. L. Robson, County Secretary for Higher Education, Shire Hall, Durham.

FROME.—March 31st.—For the construction of underground brick water-storage tank, for the rural district council.—Mr. J. A. Boynon, surveyor.

MANCHESTER.—March 31st.—For the erection of a school and caretaker's house, for the corporation.—Mr. Thomas Hudson, town clerk.

NORWICH.—April 1st.—For the erection of six cottages, for the corporation.—Mr. A. E. Collins, city engineer.

COLWYN BAY.—April 1st.—For the provision of labour and materials for erecting a sea wall, construction of slipway, and other works, for the urban district council.—Mr. James Amphlett, clerk.

SURBITON.—April 4th.—For the construction of two public conveniences, for the urban district council.—Mr. F. W. Wood, clerk.

READING.—April 7th.—For the erection of a shed and other works at the cattle market, for the corporation.—Borough Engineer.

CARNARVON.—April 16th.—For the erection of a police station and court room at Llandudno, for the Joint Committee.—Mr. A. Bodvel-Roberts, Clerk of the Peace, Carnarvon.

Iron and Steel.

BOMBAY.—March 25th.—For supplying and laying about 19 miles of 50-in. diameter steel main, for the municipality.—Mr. H. J. Trivess Smith, hydraulic engineer, Municipal Offices, Bombay.

YSTRADGYNLAIS.—March 26th.—For the supply of about 375 tons of 8-in. cast-iron pipes and laying same, together with sluice valves and fittings, for a new supplementary main, for the rural district council.—Mr. A. Jestyn Jeffreys, clerk.

HALSTEAD.—March 27th.—For laying and jointing about 7 miles of cast-iron water mains, from 5 in. to 3 in. in diameter, including the fixing of valves and hydrants, for the rural district council.—Mr. R. L. Hughes, clerk.

HALSTEAD.—March 27th.—For the supply of about 300 tons of cast-iron pipes, specials, and the supply and erection of cast-iron water tank to hold 40,000 gallons, for the rural district council.—Mr. R. L. Hughes, clerk.

WOLVERHAMPTON.—March 28th.—Tenders wanted for the purchase of second-hand 15-ton Aveling & Porter steam road roller.—Borough Engineer.

SOUTHEND-ON-SEA.—April 3rd.—For the supply and delivery of cast-iron special pipes required in connection with the sewage disposal works, for the corporation.—Mr. H. J. Worwood, town clerk.

SOUTHEND-ON-SEA.—April 3rd.—For the supply and delivery of sluice and other valves in connection with the sewage disposal works, for the corporation.—Mr. H. J. Worwood, town clerk.

TEDDINGTON.—April 5th.—For the supply and erection of two destructor furnaces, boiler settings, and flues, with two Lancashire boilers, for the urban district council.—Mr. G. H. Salmons, clerk.

Roads.

STEYNING, WEST.—March 22nd.—For the supply of broken granite, flints, and compo. sand, for the rural district council.—Mr. F. Slaughter, engineer and surveyor.

HAMBLEDON.—March 22nd.—For the supply of road materials, carting and team labour, for the rural district council.—Mr. S. B. Hasell, surveyor, Guildford.

ORMSKIRK.—March 24th.—For the supply of granite-macadam and chippings, limestone chippings, grit setts and kerbs, granite cubes, and flagging, for the urban district council.—Mr. H. W. Chadwick, surveyor.

NUNEATON.—March 25th.—For the supply of broken granite and haulage, for the rural district council.—Mr. C. Blakeway, clerk.

SOUTHGATE.—March 25th.—For works of street improvement, for the urban district council.—Mr. W. M. Ellenor, clerk.

SOUTHWELL.—March 25th.—For the supply of road material, for the rural district council.—Mr. John Ellis, clerk.

FARNHAM.—March 25th.—For tar-painting main and district roads, for the urban district council.—Mr. R. W. Cass, surveyor.

GOSFORTH.—March 25th.—For road widening, for the urban district council.—Mr. G. Nelson, engineer and surveyor.

GREAT OUSEBURN.—March 26th.—For the supply of whinstones, limestones, annealed slag, and furnace slag, for the rural district council.—Mr. H. S. Thompson, clerk.

WOODHALL SPA.—March 26th.—For the supply of granite, granite chippings, and slag, for the urban district council.—Mr. E. E. T. Bolton, surveyor.

CHIPPENHAM.—March 26th.—For the supply of granite, basalt, and limestone, for the rural district council.—Mr. A. H. Lapham, surveyor.

DEVON.—March 26th.—For strengthening, draining and resurfacing certain main roads, for the county council.—Mr. F. Bailey, clerk, Castle of Exeter.

CHATHAM.—March 27th.—For the supply of broken granite, granite chippings, surface-picked flints, broken Kentish ragstone, granite channel and granite setts, for the corporation.—Borough Surveyor.

HORSHAM.—March 27th.—For the supply of granite, team labour for haulage, hire of steam rollers, for the rural district council.—Mr. A. C. Coole, clerk.

EAST GRINSTEAD.—March 29th.—For the supply of 1¾-in. Quenast granite, Quenast granite screenings, tarred granite macadam, hand-picked broken surface flints, 2-in. Kentish ragstone, and brick rubble, for the urban district council.—Mr. E. P. Whitley Hughes, clerk.

LANCASHIRE.—March 29th.—For the hire of steam rollers, for the county council.—Mr. Harcourt E. Clare, clerk.

CARMARTHEN.—March 29th.—For work of road improvement and bridge widening, for the county council.—Mr. R. Williams Jones, county surveyor, County Offices, Carmarthen.

WANDSWORTH.—March 31st.—For making up and paving Genoa-avenue, Putney, for the borough council.—Mr. D. A. Nichol, town clerk.

YORK.—March 31st.—For work in connection with the construction of New-street, including the laying of a 21-in. pipe sewer along Piccadilly, for the corporation.—Mr. F. W. Spurr, city engineer.

WANDSWORTH.—March 31st.—For the repair of part of Welham-road, Streatham, for the borough council.—Mr. D. A. Nicholl, town clerk.

SOUTH STONEHAM.—March 31st.—For carting flint and granite, for the rural district council.—Mr. E. T. Westlake, clerk.

CLECKHEATON.—March 31st.—For granite paving works, for the urban district council.—Mr. John H. Linfield, clerk.

WANTAGE.—March 31st.—For the supply and delivery of 750 tons of broken and unbroken granite, basalt, and limestone, for the urban district council.—Mr. E. B. Ormond, clerk.

MALDON.—April 1st.—For the supply of broken granite, basalt, flints, gravel, picked stone, steam rolling, and cartage, for the rural district council.—Mr. Edgar J. Ennals, surveyor.

EASTBOURNE.—April 3rd.—For the supply of road materials, for the rural district council.—Mr. T. E. V. Kirtlan, clerk.

BULKINGTON.—April 7th.—For the supply of stone, for the urban district council.—Mr. H. W. Wilson, surveyor, Attleborough.

EAST PRESTON.—April 7th.—For work of steam rolling, for the rural district council. Mr. Arthur Shelley, clerk, Littlehampton.

TANGIER.—April 10th.—For the construction of a sewer and a road, for the Special Committee of Public Works.—Commercial Intelligence Branch of the Board of Trade, 73 Basinghall-street, E.C.

TANGIER.—April 12th.—For the construction of the second section of Casablanca-road, for the Special Committee of Public Works.—Commercial Intelligence Branch of the Board of Trade, 73 Basinghall-street, E.C.

HAVERHILL.—April 14th.—For the supply of broken granite or basalt and tar-macadam, for the urban district council.—Mr. John H. Clarke, surveyor.

FRINTON.—March 17th.—For work of tar paving, for the urban district council. Mr. E. M. Bate, surveyor.

Sanitary.

CHELTENHAM.—March 25th.—For the supply and delivery of 10,000 cub. yds. of material suitable for media in connection with sewage filters, for the corporation.—Mr. J. S. Pickering, borough engineer.

BRAINTREE.—March 25th.—For laying a sewer, for the rural district council. Mr. E. H. Bright, engineer, 17 Railway-street.

SEFTON.—March 25th.—For emptying ashpits, for the rural district council.—The Surveyor, 21 Evored-avenue, Walton.

BRIERFIELD.—March 26th.—For the construction of septic tanks and contact beds, for the urban district council.—Mr. B. Halstead, surveyor.

HULL.—March 26th.—For works of sewering and draining, for the corporation.—Mr. A. E. White, city engineer.

DORCHESTER.—March 27th.—For extensions to surface-water drainage, for the corporation.—Mr. A. G. Symonds, town clerk.

HINCKLEY.—March 29th.—For laying a new main outfall sewer, consisting of about 416 lin. yds. of 36 in. diameter cast-iron pipes, and 1,102 lin. yds. of egg-shaped concrete tubes, varying from 42 in. by 28 in. to 30 in. by 20 in., together with necessary manholes, for the urban district council.—Mr. E. H. Crump, engineer and surveyor.

SHIFNAL.—March 29th. For laying pipe sewers and manholes and construction of sewage disposal works, for the rural district council.—Messrs. Willcox & Raikes, 63 Temple-row, Birmingham.

ITCHEN.—March 31st.—For laying sewers and constructing manholes and storm-water tanks, for the urban district council.—Mr. T. A. Collingwood, surveyor, Council Offices, Portsmouth-road, Woolston, Southampton.

Stores.

GATESHEAD.—March 22nd.—For the supply of road materials, metal gullies, manhole covers, shoes, picks, scavenging brooms, lime, and cement, for the corporation.—Mr. W. Swinburne, town clerk.

LEEK.—March 24th.—For the supply of flags, kerbs, channels, setts, macadam stone and chippings, limestone and slag tar-macadam, Portland cement, sanitary pipes, pitch and oil, scavengers' bass brooms, cast-iron manhole and lamphole covers, galvanised malleable step-irons, and cast-iron gullies and frames, for the urban district council.—Mr. W. E. Beecham, surveyor and water engineer.

OGMORE.—March 24th.—For supplies of general stores, including road materials, for the urban district council.—Mr. W. T. Ollivant-Jones, engineer and surveyor, Council Offices, Brynmenyn, Glam.

ROTHERHAM.—March 25th.—For the supply of broken granite, broken slag, tarred slag, tarred limestone, concrete flags, Portland cement, timber, pitch, and creosote oil, gritstone setts and kerbs, granite setts and cast-iron pipes, for the corporation.—Mr. C. L. des Forges, town clerk.

WORSLEY.—March 26th.—For the supply of granite-macadam, tarred macadam, granite setts, Lonkey setts, grit setts, granite chippings, limestone chippings grit kerbs, Lonkey kerbs, stoneware pipes, pitch, and creosote oil, for the urban district council.—Mr. J. P. Monks, clerk.

ABERTILLERY.—March 28th.—For materials for the public works and water department, for the urban district council.—Mr. William Gait, clerk.

KENT.—March 29th.—For the supply of shovels, forks, scavenging brooms, scoops, scrapers, cart grease, tallow, oil, and other tools and materials, for the county council.—Mr. W. B. Prosser, clerk.

NUNEATON.—March 31st.—For the supply of blue bricks, kerbs, coal, slack, disinfectants and soap, earthenware pipes, granite kerbs and setts, iron castings, petroleum, and Portland cement, for the corporation.—Mr. F. C. Cook, borough surveyor.

TENDERS FOR MUNICIPAL WORKS OR SUPPLIES.

The Editor invites the co-operation of Surveyor *readers with a view to making the information given under this head as complete and accurate as possible.*

Accepted. † Recommended for acceptance.

ARDSLEY.—Scavenging tender, for the urban district council.—Mr. J. Morley, surveyor :—
E. Parkin & Sons, Ardsley, near Barnsley, £324.

BISHOP'S STORTFORD.—For the construction of a public convenience, for the urban district council.—Mr. R. S. Scott, engineer and surveyor :—

H. Champness, Bishop's Stortford	£485
Exors. C. Martin, Bishop's Stortford	430
Day & Son, Bishop's Stortford	392
D. Robinson, junr., Stansted, Essex	375
Successors Glasscock & Sons, Bishop's Stortford	365
Markwell & Son, Bishop's Stortford	361

DORCHESTER.—Accepted for the supply of materials for the year ending March, 1914.—Mr. H. D. Strange, borough and water engineer :—
Harness.—H. J. Greening, Dorchester.
Shoeing Horses.—Harrison & F. C. White, Dorchester.
Hauling Coal.—J. Willmott, Dorchester.
Horse Hire.—J. Willmott, Dorchester.
Bass Brooms.—Yates & Co., Halifax.
Ironmongery, Tools, Oils, &c.—Walley & Windows, Dorchester.
Tar-macadam.—Dalley & Co., Bath.
Broken Granite.—Fry Brothers, Greenwich.
Flints.—Lott & Walne, Dorchester.
Disinfectants.—Adcock, Easton & Co., London.
Painting Fire Manual.—Channon & Son, Dorchester.

EPSOM.—For the erection of the eleventh asylum, for the county council :—

Foster & Dicksee, Rugby	£398,933
F. & H. F. Higgs, London	385,443
Holland and Hannen and Cubitts, Limited, London	384,560
J. Carmichael, London	381,303
Godson & Sons, London	379,583
Rudd & Sons, Grantham	368,000
Higgs & Hill, Limited, London	367,773
C. Wall, Limited, London	367,000
Wallis & Sons, Limited, Maidstone	349,836
Holliday & Greenwood, London	347,509
Leslie & Co., Limited, London*	335,577

GOSFORTH.—For road improvement works, for the urban district council. Mr. G. Nelson, engineer and surveyor :—

G. E. Simpson, Newcastle-on-Tyne	£163
J. W. Henderson, Gosforth	147
W. Tulip, Gosforth	143
G. Revill, Gosforth	142
W. C. Flech, Gosforth	131

LISTOWEL.—Accepted provisionally for the construction of sewers, for the urban district council.—Mr. D. J. McMahon, surveyor :—

J. Hannon, Listowel (for 3 sewers)	£546
J. Cronin, Listowel (for 2 sewers)	137

NEW HUNSTANTON.—For the erection of boiler house, coal store, and other works, for the urban district council. —Mr. J. S. B. Glasier, clerk :—

F. Southgate, Hunstanton	£1,101
R. Shanks, Hunstanton and Chatteris*	1,056

PORTLAND.—For the supply of broken granite or basalt, for the urban district council.—Mr. R. S. Henshaw, engineer and surveyor :—

Guernsey Granite.—W. Griffiths, Bishopsgate-street Without, London, 12s. 10d. and 13s. 4d. per ton.
Welsh Granite. — United Stone Firms, Nicholas-street, Bristol, 12s. 9d. per ton.
Guernsey Granite.—Manuelle, Gracechurch-street, London, 12s. 4d. and 12s. 10d. per ton ; J. Mowlem, Grosvenor-wharf, Westminster, 12s. 1d. and 12s. 7d. per ton; Fry Brothers, Norman-road, Greenwich, 11s. 10d. and 12s. 4d. per ton.
Basalt.—Penlee and St. Ives Stone Company, Bristol, 11s. 8d. per ton.
Guernsey Granite.—Brookes, Limited, Westminster, 11s. 1d. and 11s. 8d. per ton.
Alderney Granite.—Rowe & Mitchell, London Bridge, 11s. 2d. and 10s. 10½ per ton.*
Basalt. — St. Keverne Stone Company, Helston, Cornwall, 10s. 6d. per ton; Roadstone Supply Company, Shepton Mallet, 9s. 8d. and 10s. 2d. per ton.

RICCALL.—For the supply of road materials, for the rural district council.—Mr. A. Douglas, surveyor :—

Whinstone.—Brookes, Limited, Halifax; Smith & Co., Leeds; Monkhouse & Peart, Wearehead.
Limestone and Tar-macadam.—J. Green & Son, Silsdon; Skinton Rock Company, Skipton; Broughton Quarries Company, Gargrave.
Slag.—Schofield & Son, Grosmont.

SURREY.—Accepted for the supply of high-class granites, basalts, limestone, slag, tar-macadam, bitumen, pitch, tar, and tar oils, for the county council. — Mr. A. Dryland, county surveyor :—

Basalt.—H. L. Cooper & Co., Mark-lane, London; Field & Mackay, Limited, Clee Hill, Ludlow.
Chippings. — Groby Granite Company, Limited, Groby, Leicester.
Flints and Gravel.—Farnham Flint, Gravel and Sand Company, Limited, Station-hill, Farnham.

TAR-MACADAMS.

Slag.—Constable, Hart & Co., Limited, Arthur-street, London.
Limestone.—C. Dalley & Co., Binegar, near Bath.
Granite.—Dosthill Granite Quarries, Limited, Dosthill, near Tamworth ; Northern Quarries, Company, Limited, Victoria-street, Westminster.
Tar, Tar-oils and Grout.—E. Catchpole & Sons, Ploughbridge, Rotherhithe.
Pitch.—Forbes, Abbott & Leonard, Limited, Gracechurch-street, London.

WING.—For the delivery of 1,500 tons of granite and 1,500 tons of slag, sand and gravel, for the rural district council :—

	Tons.
Groby Granite Company, Groby	500
Whitwick Granite Company, Whitwick	500
Exors P. Phipps, Northampton (slag)	1,500
C. Abett & Co., Atherstone	500
D. Cook & Sons, Leighton Buzzard (sand and gravel)	250

MEETINGS.

Secretaries and others will oblige by sending early notice of dates of forthcoming meetings.

MARCH.

29.—Institution of Municipal Engineers: Northern District Meeting at Wallsend.

APRIL.

2. Institute of Sanitary Engineers: Mr. Arthur H. Barker on "Heating and Ventilation." 8 p.m.
7. Surveyors' Institution: Mr. P. J. Waldram on "Reinforced Concrete Construction." 8 p.m.
12. Association of Engineers-in-Charge: Annual Dinner, Holborn Restaurant.
12.—Opening of Building Trades Exhibition, Olympia, by Lord Mayor of London.
15.—Joint Meeting of the Illuminating Engineering Society, the Institutions of Gas and Electrical Engineers, and the Institution of Municipal and County Engineers: Mr. A. P. Trotter, on "Standard Clauses for a Specification of Street Lighting."
17.—Roads Improvement Association: Annual General Meeting, 15 Dartmouth-street, S.W. 4.30 p.m.
21.—Institute of Sanitary Engineers: Mr. Frank R. Durham on "House Drainage on the Continent." 8 p.m.
21. Royal Institute of British Architects: Messrs. F. W. Jackson and Bernard Dicksee, on "Modern Steel Construction." 8 p.m.
23.—Royal Sanitary Institute: Ordinary General Meeting, 4 p.m.

MAY.

14-18.—Royal Institute of Public Health: Annual Congress in Paris.
19.—Institute of Sanitary Engineers: Dr. H. R. Kenwood on "Micro-Organisms and Public Health." 8 p.m.
23-24.—Surveyors' Institution: Meeting at Oxford.

JUNE.

6-7.—Institution of Municipal and County Engineers: Meeting at Dundee
23-28.—International Road Congress in London.

APPOINTMENTS OPEN.

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BOROUGH OF FAVERSHAM.

SEWAGE WORKS MANAGER.

The Corporation of Faversham requires a Sewage Works Manager to act under the directions of the Borough Surveyor.

The Works comprise (*a*) an Ejector Station, with electrically driven air compressors and Coomb's ejectors; (*b*) a Main Outfall Pumping Station with electrically driven screen-raking gear, centrifugal pumps, sludge elevator, &c.; (*c*) Disposal Works, comprising Slate Beds, Percolating Filters, Sedimentation Tanks, Sludge Beds, &c.

Full particulars of the duties may be had upon application to the undersigned. Only fully qualified men with the necessary experience need apply.

A house, with rent, rates, water and light free, in which the manager will have to reside, will be provided. The salary will commence at 40s. per week, rising by three annual increments of 2s. 6d. per week to a maximum of 47s. 6d. per week, subject to satisfactory service.

Applications, in the applicant's own handwriting, stating full particulars of qualifications and experience, age, family (if any), and all other details, must be sent to the undersigned not later than Monday, March 31st inst.

GUY TASSELL,
Town Clerk.

20 West-street,
Faversham.
March 17, 1913. (291)

URBAN DISTRICT COUNCIL OF HIPPERHOLME.

Wanted, Highways and General Foreman. Commencing wage, 30s. per week. Applications in candidate's own handwriting, on forms to be obtained from the undersigned, to be delivered not later than Monday, the 31st March, 1913.

Canvassing will disqualify.

G. WHARTON THOMPSON,
Engineer and Surveyor.

Council Offices,
Hipperholme.
March 20, 1913. (290)

COUNTY BOROUGH OF IPSWICH.

APPOINTMENT OF BOROUGH ENGINEER AND SURVEYOR.

The Town Council of Ipswich invite applications from duly qualified persons for the appointment of Borough Engineer and Surveyor. The person appointed must be capable of carrying out and performing all the duties of a Borough Engineer and Surveyor, under the Public Health Acts, the Municipal Corporations Act, 1882, and all other Acts incorporated therewith or amending the same respectively; but he will not be responsible for the waterworks, or the Electric Supply, or Tramway Undertakings of the Corporation. He must devote the whole of his time to the duties of the office, and take no private practice whatever. Age of applicants not to exceed 35. Salary £350 per annum, increasing by £50 every other year to £550.

The Council are retaining the services of the present Surveyor as Consulting Engineer and Surveyor.

Applications, stating qualifications, age and particulars of present appointment, accompanied by copies of three recent testimonials, to be sent to the undersigned, endorsed "Borough Surveyor," by four o'clock on Saturday, 12th April, 1913. Canvassing is strictly prohibited.

WILL. BANTOFT,
Town Clerk.

Town Hall,
Ipswich.
March 13, 1913. (282)

The Surveyor

And Municipal and County Engineer.

Vol. XLIII. MARCH 28, 1913. No. 1,106.

Minutes of Proceedings.

The Standpoint of the Motor User.

There are serious difficulties in the way of the critic who wishes to write about highway administration or road maintenance from the point of view of the user of motor vehicles. The chief difficulty lies in the fact that the value of a road cannot be measured, but can only be estimated by the exercise of judgment. No one can set a standard by which it can be discovered how much money may, with direct and indirect economy, be spent on the reconstruction or maintenance of a particular length of road. Another difficulty which faces the critic is the necessity for being explicit as to the extent to which he includes in the scope of his criticism the county authority as influencing the maintenance of district roads, the Road Board as influencing reconstruction and maintenance generally, and the nation as ultimately responsible for the administrative system and the financial provisions for road improvement and maintenance. There is also a subjective difficulty, a kind of "automobilism" orthodoxy, which is remarkable rather for its limitations than its distinctive features, and permeates most of the writings to which we are referring. There is, however, one underlying principle of real value which is to be found in many of the criticisms made from the standpoint of motor users—namely, that engineering skill of a high order ought somehow to be applied in a systematic way to road improvement. This idea, though not expressed in actual words, is strongly suggested by the general tenour of an article by Mr. Richard Twelvetrees, which will be found in another part of the present issue. Only a scientifically trained civil engineer, well versed in the practical applications of statics and dynamics, could successfully lay down the principles which should be followed in order to meet some of the typical cases put forward in this article as specially demanding attention; though in many specific instances local experience has found the particular solutions of the problems. These considerations apply, for instance, to the improvement of bends. It would take the whole of this issue of THE SURVEYOR to deal adequately with this one portion of Mr. Twelvetrees' article. Again, as regards super-elevation, so many considerations arise that it is almost impossible to comment usefully on this subject in a few words. Mr. Twelvetrees is right in condemning reverse super-elevation, and a small amount of super-elevation is desirable at most bends; but no attempt should be made to proportion it to the radius of the curve, its amount being properly determined on quite other data. With respect to roads which are liable to flooding, the development of motor traffic is a good reason for extending somewhat the mileage of roads fully protected and of roads protected from normal floods, as well as for the provision of bridges in places where fords have until recently been sufficient. But all roads liable to flooding cannot be protected; it is not worth while. Much temporary inconvenience is caused by snowdrifts on our northern railways; but the prevention of this inconvenience is not worth the cost of buying strips of land and planting them with trees in order to keep the snow out of the cuttings. The protection of roads from floods is, however, a matter which motor users may reasonably keep forward as worthy of special consideration when works of reconstruction and improvement are contemplated in the areas affected.

In the portion of the article dealing with unlevel road surfaces and dusty roads we find too much of the semi-official "motorism" view, and not enough of Mr. Twelvetrees' own observations and deductions; but the article as a whole is evidence that its author has a grasp of some of the important facts of the relations between motor traffic and road maintenance, and we are glad to find him following in the footsteps of his father, Mr. W. Noble Twelvetrees, whose solid literary work in engineering subjects is familiar to our readers.

* * *

Brick Pavements: Thermal Effects in American Cities.

The behaviour of pavements under the stresses imposed by traffic and by temperature changes provides a fascinating study, and one of the most interesting and important parts of such a study is that relating to the creep of pavements, and other disturbances which occur under repeated changes of temperature. With wood blocks and asphalt paving various favourable factors come into play, some abating temperature effects and others tending to restoration of form or of position, and, generally, the kinds of paving chiefly used in this country offer a much less favourable field for the study of temperature effects than do the brick pavements of American cities, especially pavements with cement joints. Further, the temperature conditions are much more severe in most of the States of the Union than they are in the United Kingdom, which fact, though it diminishes the applicability of American conclusions to our own cases, gives to the studies themselves a definiteness which makes them well worth our attention. None of the investigations so far undertaken or the reports made furnishes more useful data or provides a clearer picture of the conditions generally than does a valuable paper by Mr. J. E. Howard, engineer-physicist to the Bureau of Standards at Washington, a summary of which appears in another part of the present issue.

The conclusions at which Mr Howard arrives.

and the generalisations which he makes are based partly upon the physical properties of the materials and direct measurements, and partly upon careful observation. Certain cracks appear because a pavement moves in a certain way; and it moves in that way as a result of actual laws and the physical properties of the materials. Mr. Howard watches such movements, and explains them in a very convincing way in his paper, which is, moreover, a very suggestive one as regards a number of cognate matters. Of these one of the most important, perhaps, is the consideration that bituminous joints offer the great advantage that they are most compressible at high temperatures, when the bricks expand, and when the bricks contract the jointing material tends to keep the joint filled. As far as cracks in the joints themselves are concerned, the entrance of grit or fragments of hard material does not tend to accumulative strain and movement as much as in the case of cement joints, since the hard material is pressed into the bitumen when the bricks expand. Another point that is specially noteworthy is that if, as Mr. Howard suggests, the weaker brick, with a low modulus of elasticity, is sometimes better than the stronger brick with a high modulus of elasticity, the advantages of wood blocks, with a still lower modulus of elasticity, provided with air cells and capable of a certain amount of plastic adjustment, may be worth consideration where temperature effects cause serious damage to pavements. The accumulative action, due to the entrance of hard material into cracks, preventing them from closing, could perhaps be prevented by filling them with some fairly hard waxy substance, which would be squeezed out when the joint closed.

* * *

Dust Collection in London.

The proposal of the London County Council that the by-laws under section 16 of the Public Health (London) Act, 1891, relating to the removal of house refuse and providing for a collection not less than once a week, should be extended with the view of making a more frequent collection than once a week compulsory, has not met with the response which its authors anticipated, for in the majority of instances the borough councils to whom the recommendation was directed point to the absence of complaints on the part of citizens, and insist that the dust collection is a matter that may well be left to the discretion of the local authority. The Public Health Committee of the Greenwich Borough Council have gone a little beyond this in expressing the view that accumulations of refuse are a source of grave danger to public health, and they have induced the highways committee to agree to a scheme for a bi-weekly collection in one of the populous wards of the borough for a period of three months by way of experiment.

It is hard to resist the conclusion that if accumulations of refuse in hot weather are suspected to be a source of danger to health in Greenwich, they must be equally perilous in many other metropolitan areas that could be mentioned, and this being so it may be suggested that the action which it is proposed to take in the former borough might be very profitably adopted in others, especially in those where the population is densest. It would be regrettable if the financial factor is to be regarded as the only, or indeed an essential, consideration in such a matter as this. It would be none the less a matter to be deplored if the borough councils in considering the proposal of the London County Council had been guided to their conclusions by a super-sensitive objection to an increased stringency of their legal obligations. It is easy to make far too much of one or the other of these considerations, and it would certainly be a concession to the genius of well-ordered administration if this matter of dust collection in London were subjected to comprehensive and systematic investigation, with a view to the attainment of something like uniformity of practice. Considering how much is dependent upon it, it is hardly a satisfactory state of things to find that as a system it is subject to the caprice of a passing majority upon a borough council, and that, as has sometimes happened, the collection of refuse by the sanitary authority itself has been relinquished for collection by contract upon a fanciful plan of economy. How much remains to be done in improving the collection of London's refuse may be gathered from the fact that under existing circumstances the legal powers of the authorities over the dust receptacles is limited, and to meet this the Metropolitan Borough Councils Standing Joint Committee have adopted a suggestion that the councils should be empowered to require the refuse to be placed in proper receptacles and in convenient positions where there is a daily collection. This is only one of many points in which the dust collection of the Metropolis might be altered and improved.

* * *

The Roads Movement in Canada.

Our enterprising contemporary *Country Life* gives in a recent issue some most interesting particulars in regard to the movement for good roads, which is becoming one of the most prominent features of Canadian public spirit. About two years ago the interest in the roads question was signalised by the formation of the Canadian Highway Association, which has already become a great force throughout the whole of the country. It is stated that although the population of British Columbia is only about 500,000, no less than £1,000,000 was spent on roads during the course of 1912. Also progress in this direction is by no means confined to the less settled districts of Western Canada, for in the same year some £2,000,000 was spent on road work in the province of Quebec. The reason for the greatly increased interest taken in the formation and improvement of roads is, undoubtedly, the growing use of the motor-driven vehicle. In a new country, where money is more quickly made than in older districts, and where the whole outlook on life tends to be more progressive, it is only to be expected that the products of modern invention should receive a ready welcome, and this is illustrated by the estimate that one out of every 125 persons in the province of Alberta is the possessor of a motor-car. The field of action in Canada is so great that the railway companies, which at home are inclined to regard motor traction as a serious rival, are actually welcoming the development of the roads. Any competition of motor traction which will result from an improved road system will, presumably, be greatly outweighed by the value of the roads as feeders to the railways. It will be noted that throughout the greater part of Canada the railways consist almost entirely of main lines, and there is not that network of branch lines which exists in Europe. This, of course, is at present due to the fact that the development of the country has been of quite recent occurrence. But it is an open question whether in the future, not only in Canada, but in all new countries, it will not be found that motor transit on a well-planned roads system will render unnecessary any construction of branch railways. All circumstances point to the roads becoming more important than they have ever been since the days of the Romans. The middle of the nineteenth century saw the greatest enterprise on the part of the railway engineer, and may not the middle of the twentieth century be essentially the period of the highway engineer?

The Institution of Municipal and County Engineers.

The official report of the last meeting of the council of the Institution of Municipal and County Engineers, which was held at the new offices at 92 Victoria-street, will be found in another column. The scrutineers reported the election of Mr. J. W. Cockrill as president for 1913-14; while the yeoman service which has been rendered to the institution by Sir James Lemon and Mr. Charles Jones in the respective offices of hon. treasurer and hon. secretary was fully recognised by their re-election without opposition. There are two surprises in the election for members of council, Messrs. Campbell and Maybury failing to secure return. Mr. Cockrill is so well known that it is unnecessary to point out the services which he has already given to the institution, or the important works which he has carried out as a municipal engineer. We cordially wish him all success during his year's office as president.

The programme for the projected visit to Amsterdam at Whitsuntide, to which reference is made in the report, is also reproduced in this issue. It will be observed from this that the arrangements for the trip differ from those made in connection with the excursion to Paris last year in that rather more opportunities are provided for ordinary sightseeing, owing doubtless to the smaller number and greater accessibility of the works of engineering interest which it is proposed to inspect. The programme is certainly a most attractive one, and it is to be hoped that the number of those participating in the excursion will be such as to render it as successful as the president of the institution, Mr. Thomas, with characteristic keenness, is endeavouring to make it.

* * *

The Strength of Cement.

At the last meeting of the Concrete Institute a paper on the "Strength of Cement" was read by Mr. H. C. Johnson, the author's object being to demonstrate the wide range of the strengths of various kinds of Portland cement. In a very interesting communication Mr. Johnson (who is the demonstrator in engineering at University College, Cork) emphasised the importance of testing all the materials which enter into constructional works with a view to securing that they will be strong enough to fulfil their respective functions with a reasonable factor of safety. Among the most interesting conclusions which Mr. Johnson drew from the results of his experiments were the following: (1) That a good strength in paste is no proper indication of a good strength in concrete. (2) That the best test of a cement's value for reinforced concrete or similar work are (*a*) mortar compression cured in water, (*b*) mortar compression cured in air; and, in addition to having to show a certain strength, any cement having a higher value in air than in water is to be condemned. (3) That for a given expenditure on cement a first-class one will allow a saving, since there will be (*a*) less cement to pay carriage on, (*b*) less cement to handle, (*c*) less sacks to clean, tie up and return, (*d*) with at least as strong a concrete. Mr. Johnson also made an interesting suggestion that cement should be sold by volume instead of by weight, and that it should be delivered in paper bags containing one cubic foot.

* * *

Local Authorities and Post Office Wires.

The Association of Municipal Corporations, the *Yorkshire Post* states, have made little headway in their negotiations with the Postmaster-General on overhead telephone and telegraph wires in towns. Mr. Herbert Samuel has consistently refused to receive a deputation, and the latest decision of the Post Office is that an underground service, "where it is not warranted by engineering and financial considerations, is an amenity for which those only who enjoy it and desire it should be called upon to pay." If local authorities wish for underground work in streets and roads where it is not warranted, and are willing to pay the difference in cost between underground and overhead wires, the Postmaster-General will be ready to discuss details. Except under some such arrangement the Post Office is not prepared to do anything. In the same letter the Post Office points out that, in the absence of an understanding, there is no prospect of any reduction in the cost of the telephone service now that it has come into the hands of the State. In a report of a recent meeting of the council of the association, sent on Tuesday to the affiliated corporations, it is stated that the council are unable to recommend local authorities to agree to pay the additional cost of laying telephone wires underground, but again the need for conference is urged on the Postmaster-General.

* * *

Age Limits for Appointments.

The question of the age limit has been brought to our notice again in connection with one or two appointments which have recently been advertised. We are led, therefore, to reiterate the opinion which we have already expressed on more than one occasion in regard to this subject. The imposition of an age limit cannot be considered as an isolated question, but in discussing any given case regard must be had to the salary which is offered and the responsibilities which attach to the vacant appointment. It is a pity that some means cannot be adopted, in the first place, by which salaries and responsibilities may be made more commensurate than is the case at present. If this were done it would be possible to form some opinion as to what appointments required men of ripened experience to fill them adequately, and to distinguish these from others which might fairly be regarded as the younger man's opportunity for advancement. Things being as they are, however, we are unable to agree that the imposition of an age limit which is fairly proportioned to the salary and responsibilities of an office is in itself a bad thing, as the appointment of experienced and senior candidates to posts carrying inadequate salaries is not in the best interests of the profession generally, and tends to a general lowering of rates of remuneration.

* * *

Storm Water Discharge.

We are publishing this week the first of a series of articles on the subject of "Storm Water Discharge," by Mr. R. O. Wynne-Roberts, M.INST.C.E., and Mr. T. Brockmann, DIPL.ING. (BERLIN). In these papers the authors, who have made a special study of the matter on which they are well known as experts, deal in detail with the several factors involved. The first article is of a preliminary character, and leads up to a consideration of rainfall intensity. In subsequent papers the effect of impermeability of the surface of the drainage area is discussed, while the question of retardation, depending on the shape, extent, and configuration of the drainage area, and the velocity of flow in the sewers, is also fully dealt with. It is believed that the method of calculating storm water discharges, which is developed by the authors in these papers, is at once more comprehensive and more accurate than any which has been published in the English language. It is not claimed, however, that the method described is an original one, the principle involved having been first put forward by an eminent German engineer—the late Prof. Frühling, of Dresden; at the same time it is confidently anticipated that a presentation of the subject in English by writers of acknowledged authority and experience will prove both interesting and instructive to our readers.

Storm Water Discharge.

By R. O. WYNNE-ROBERTS, M.INST.C.E., F.R.SAN.I., Consulting Engineer, Regina, and T. BROCKMANN, DIPL.ING.(BERLIN), Civil Engineer, Regina.

The engineer who is called upon to design sewers has first of all to decide whether it is advisable to adopt the "combined" system or the "separate" system. In the former the ordinary sewage and rain water are conveyed by one common sewer, whereas in the latter case they are conveyed by separate conduits. Whichever system is adopted, if the sewers are constructed practically watertight it will not be a difficult matter to calculate the probable volume of ordinary sewage, for it must largely depend on the consumption of water for various purposes. In Europe this quantity averages about 30 gallons per head per day, but in Canada and the United States, for reasons which need not be gone into here, it ranges from about 40 gallons to over 200 gallons per head daily.

The quantity of ordinary sewage will necessarily vary during different hours of the day and in different seasons of the year. The range of fluctuation in volume of sewage to be dealt with will, approximately, be from about 40 per cent below to about 60 per cent above the mean daily flow. When, however, the engineer has to attack the problem of providing sewers to drain away storm water, he is confronted by many perplexing considerations. The quantity to be drained away per unit of time is generally vastly greater than the volume of sewage; so much so that the latter can oft-times be ignored when calculating the dimensions of combined sewers.

While ordinary sewage has to be disposed of in volumes ranging within more or less definite limits, the quantity of storm water varies so enormously, it is so erratic in its periodicity, and is dependent upon so many variable factors, that it is not surprising that some eminent authorities who have been extensively quoted have abandoned all attempts to establish a general formula for this purpose.

This subject has engaged the attention of many capable engineers in Europe and America, some of whom have deduced formulæ by which they considered it was possible to arrive at the probable volume of storm water to be provided for with sufficient accuracy.

The following are some of the formulæ which have been extensively quoted:—

BÜRKLI-ZIEGLER—

$$Q = R \times C \times \sqrt[4]{\frac{S}{A}}$$

McMATH—

$$Q = R \cdot C \cdot \sqrt[5]{\frac{S}{A}}$$

$$Q_1 = R \cdot C \cdot \sqrt[5]{S \times A^4}$$

Q = Cubic ft. per second per acre reaching sewers.
Q_1 = Cubic ft. per second from the whole area drained.
R = Average rain during heaviest rainfall, in cubic ft. per second per acre, varying from 1·75 to 2·75
C = Constant, 0·75 for paved streets, 0·31 for rural districts, average 0·625.
A = Area of district drained in acres.
S = General fall of area per thousand.

HAWKSLEY AND BAZALGETTE

$$\text{Log } D = \frac{3 \text{ Log } A + \text{Log } N + 6{\cdot}8}{10}$$

D = Diameter of circular sewer in inches, to carry off a rainfall of 1in. per hour.
A = Number of acres drained.
N = Length of sewer having a fall of 1ft.

KUICHLING—

$$Q = A \times a \times t \times (b - c \sqrt{t}).$$

Q = Discharge in cubic ft. per second.
A = Area drained in acres.
a, b, c = Empirical constants which vary for different localities.
t = Time required for the concentration of storm water at the outlet.

LLOYD-DAVIES—

$$Q = (60{\cdot}5 \times \frac{60}{Tc} \times R) \times Ap.$$

Q = Cubic ft. per minute.
Tc = Time of concentration *i.e.*, time of flow through longest line of sewers in district in minutes.
R = Rainfall in inches during Tc.
Ap = Percentage of impermeable area in acres.

If the reader cares to solve any problem concerning storm water by the foregoing formulæ he will find that the assumptions adopted by the different authorities are far from being uniform, and that the results obtained will be very dissimilar.

It is interesting as a matter of history to note how Bürkli-Ziegler's formula was established. About the year 1878 he was city engineer of Zurich, and during his term of office serious floods occurred causing destruction, which was followed by litigation for compensation. The information as to the intensity of rainfall and the quantity discharged into the sewers was at that time very meagre and unreliable, and this induced him to take up the matter to see if some formula could be found to suit his requirements. He found that Hawksley had assumed a rainfall of 1 in. per hour, which is equivalent to 70 litres per second per hectare, and had constructed a formula which in metric terms had the following expression:—

$$D = 0{\cdot}32 \times \sqrt[10]{\frac{A^3}{S}}$$

D = Diameter of pipe in metres.
A = Area in hectares.
S = Slope of area in 1,000.

Etylwein also had brought out his formula for ascertaining the size of pipes, which was:—

$$D = 1{\cdot}2 \times \sqrt[10]{\frac{A^4 \times q^4}{S^2}}$$

q = Volume of discharge per second per hectare in cubic metres.
A and S were the same as above.

By combining the two formulæ Bürkli-Ziegler obtained the value of q corresponding to the rainfall assumed by Hawksley. Thus:—

$$D = 0{\cdot}32 \times \sqrt[10]{\frac{A^3}{S}} \quad \text{equal } 1{\cdot}2 \times \sqrt[10]{\frac{A^4 \times q^4}{S^2}}$$

$$q = 0{\cdot}037 \times \sqrt[4]{\frac{S}{A}}$$

Reducing this to litres per second per hectare, he got

$$q = 37 \times \sqrt[4]{\frac{S}{A}}$$

The ratio between the discharge and the quantity of rain fallen, which was sought for by Bürkli-Ziegler, was found thus:—

$$\frac{\text{Volume of discharge}}{\text{Rainfall}} = \frac{Di}{Rn} = \frac{37}{70} \times \sqrt[4]{\frac{S}{A}} \quad \text{say } 0{\cdot}5 \times \sqrt[4]{\frac{S}{A}}$$

$$Di = 0{\cdot}5\ Rn \times \sqrt[4]{\frac{S}{A}}$$

This is the classic formula deduced by Burkli-Ziegler. Considering 0·5 as the factor of impermeability denoted by P, it then takes the form in which it has been so extensively published in America, &c.:—

$$Di = P \times Rn \times \sqrt[4]{\frac{S}{A}}$$

Of the foregoing formulæ the last (Lloyd-Davies) is the most advanced, but it does not satisfy all the conditions, as will be shown later on. With regard to the others, it can be stated that they are inadequate and no longer up-to-date.

These formulæ (excepting Lloyd-Davies') are unsatisfactory inasmuch as it is assumed that the discharge is constant, regardless of the shape and configuration of the drainage area and the velocity of the flow in the sewers. Lloyd-Davies' formula is an advance on the others, for it takes into consideration the above-mentioned factors, which are ignored by the others, but which, nevertheless, are important, as they actually influence the discharge of the storm water. But he and Mr. Wallington Butt, who have read interesting papers on this subject, assumed that the entire area must be contributory to the flow in the sewers before the maximum discharge is attained. This assumption, however, must be controverted, as it does not suit all conditions.

The principal factors which influence the discharge of storm water are:—

(1) Rainfall intensity.

(2) Impermeability of the surface of the drainage area.

(3) Retardation, which depends on the shape, extent and configuration of the drainage area, and also on the velocity of flow in the sewers.

RAINFALL INTENSITY.

The annual rainfall in different parts of any country varies considerably. The mean annual precipitation over a long period—in parts of prairie provinces, for instance—is about 18 in., but in other parts it is much less. In the semi-arid parts of the United States it is under 10 in., while in the Canadian Rockies it must be many times as much. On Table Mountain, Cape Town, the average yearly rainfall over a certain area is nearly 70 in., but in the city, which is only 4 miles distant, it is about 30 in. The mean rainfall in Germany is about 26½ in., although near Berlin it is 24 in., and near Basel 33½ in. The rain, moreover, does not fall in convenient uniform showers, but often in erratic torrential downpours, with very great intensity, during more or less short periods. In New England a rate of 3·6 in. an hour, continuing for five minutes, may be expected every year or so, a rate of 2 in. continuing for twenty minutes, 1½ in. for thirty minutes, and 1 in. in one hour (Folwell).

(To be continued.)

THE STRENGTH OF CEMENT.

MR. H. C. JOHNSON AT THE CONCRETE INSTITUTE.

A meeting of the Concrete Institute took place on Thursday evening, March 13th, when a paper, entitled "The Strength of Cement: Results of Tests on Fifteen Different Brands used in Paste, Mortar and Concrete," was read by Mr. H. C. Johnson, demonstrator in Engineering at the University College, Cork. Mr. E. Fiander Etchells, F.PHYS.SOC., M.MATH.A., A.M.I.MECH.E., M. COUNCIL C.I., was in the chair. The reading of the paper was succeeded by a discussion in which Messrs. D. B. Butler, ASSOC.M.INST.C.E., F.C.S., H. J. Harding, H. Kempton Dyson (secretary of the institute), W. Cyril Cocking, Noel Ridley, M.INST.C.E., Herbert Shepherd, A.R.I.B.A., M.C.I., and E. Fiander Etchells, F.PHYS.SOC., M.MATH.A., F.C.S., took part.

The main object the author had in writing his paper was to show the wide range of strengths as indicated by the tests. To many people it was, undoubtedly, a fact that any bag marked "Portland Cement" was just as good value as any other bag so marked, and also that (*a*) the cheapest cement was the most economical to use; (*b*) testing a cement with a "name" was unnecessary; (*c*) the value of fine grinding was not considered, even if its advantages were known; (*d*) the paste tensile seven days' test was quite sufficient guide to a cement's value as a binding material.

The author remarked that he would not be the first to point out that these conclusions were erroneous.

The results of these tests were therefore put forward with the object of calling further attention to the importance of testing all materials entering into constructional works in which they would be called upon to do their duty, with a predetermined factor of safety. This factor, if due attention were paid to excellence of materials in every particular, might reasonably be reduced from the customary 4 or 6 to 3 or 4½.

The term "paste" used in the paper meant neat cement and water; the term "mortar" meant 1 part cement to 3 parts standard sand and water.

From the detailed results of his experiments Mr. Johnson drew the following conclusions:—

(1) That a good strength in paste is no proper indication of a good strength in concrete.

(2) That the best tests of a cement's value for reinforced concrete or similar work are (*a*) mortar compression cured in water, (*b*) mortar compression cured in air; and, in addition to having to show a certain strength, any cement having a higher value in air than in water is to be condemned.

(3) That not less than 22 per cent of water be allowed in gauging paste, and not less than 3 per cent plus ¼ the percentage as used in the paste in gauging mortar.

(4) That the standard of values for cement to be used in reinforced-concrete work be raised by 25 per cent—not that a cement only just passing the British Standard Specification is to be condemned for average work, but in order that first-class cements only shall enter into reinforced-concrete structures—engineers may then reasonably expect to be able, in the near future, to use 1,000 lb. per square inch on concrete instead of 600 lb.

(5) That for a given expenditure on cement a first-class one will allow a saving, since there will be (*a*) less cement to pay carriage on, (*b*) less cement to handle, (*c*) less sacks to clean, tie up and return, (*d*) with at least as strong a concrete.

(6) That a given strength of cement should be specified instead of a given mix—which does not take into account the proper proportioning of aggregate—even if a cement of first quality is used.

(7) That cement should be sold by volume instead of by weight, and in bags containing 1 cub. ft., to allow of quicker and easier handling. These bags should be made of paper for preference, this being the common practice in the United States. Among the advantages the author noted that paper bags have over canvas ones are: (*a*) No time is lost in shaking out the cement; (*b*) no cement is retained by the sacks; (*c*) there is no return freight on empties; (*d*) the packages are better looked after in storage, and (*e*) cement is kept in better condition.

The members of the Concrete Institute have been invited to visit the International Building Trades Exhibition at Olympia, on Thursday afternoon, April 24th. The members of the institute will assemble in the vestibule of the Addison-road entrance at 2.45 for 3 p.m. sharp, at which time groups of the members will be conducted round the exhibition, special attention being accorded to the numerous concrete exhibits which will be on view.

Members will be furnished with tickets of admission on application to the secretary of the institute, Mr. H. Kempton Dyson.

ROAD BOARD FUNDS.

QUESTIONS IN THE HOUSE.

On Monday, in the House of Commons, the Secretary of the Treasury was asked what were the present amounts standing to the credit of the Development Fund and Road Improvement Fund respectively; and whether and to what extent additions would be made to either during the coming financial year.

Mr. Wedgwood Benn, who replied, said the total sum paid into the Road Improvement Fund in respect of carriage licences and motor-spirit duties up to February 28th was £2,998,343. Grants and loans to an aggregate amount of £2,687,000 had been indicated (including £997,191 formally made) by the Road Board to highway authorities, and £521,871 has been actually paid out under grants. With regard to the Development Fund, the cash balance was £296,743, and in addition there were invested funds amounting to £2,500,000. He was unable to anticipate the intentions with regard to the coming financial year, but under the existing law the Road Improvement Fund would receive the proceeds of the petrol duty and also the revenue from carriage licence duties over and above the receipts in the standard year 1909.

Mr. C. Bathurst asked for a statement as to the amount standing to the credit of the Road Improvement Fund, and why so large a sum as £2,000,000 had been invested out of the Development Fund and not expended on many of the urgent improvements which are being asked for?

Mr. Wedgwood Benn suggested that the hon. member would put down a request for information on that point. One of the duties laid upon the commissioners however, was to have regard to the state of the labour market.

Harrogate Baths and Pump Rooms.—The Lord Mayor of the City of London has accepted an invitation from the Mayor (Mr. Joseph S. Rowntree) and the Town Council of Harrogate to visit that town on June 7th, in civic state, in order to inaugurate the extensive additions and improvements to the Mineral Water Bathing Establishments and Pump Rooms, which are at present under construction at a cost of £14,000. The Royal Baths were opened by the late Duke of Cambridge in 1897, and upwards of £360,000 has already been spent by the corporation in the erection of pump rooms and bathing establishments, the purchase of mineral water springs, and the laying out of pleasure grounds for the use and enjoyment of visitors resorting to Harrogate for the cure.

Thermal Effects on Brick Pavements.

MR. J. E. HOWARD'S STUDIES AND MEASUREMENTS.*

[A summary of the main points of a paper read before the American Society of Municipal Improvements, by J. E. Howard, engineer-physicist, Bureau of Standards, Washington.]

After pointing out that a vitrified brick pavement of monolithic construction with cement joints usually meets requirements as regards low tractive effort, foot and wheel hold, resistance to abrasion, and compressive strength, and is practically non-absorbent and impervious to moisture, Mr. Howard concludes that:—

"An inquiry into the effects of changes in temperature on cement-filled brick pavements is an inquiry of a refined order, taking up the subject at an advanced stage from a constructional point of view, but nevertheless involving questions of vital importance, the solution or adjustment of which will promote the success of this type of pavement, and contribute toward securing that permanency which is desired."

PHYSICAL PROPERTIES OF PAVING BRICK.

"The crushing strength of vitrified paving brick commonly ranges from 10,000 lb. to 15,000 lb. per square inch, not infrequently reaching and exceeding 20,000 lb. per square inch. The compressive modulus of elasticity is found to range ordinarily from 2,500,000 lb. to 8,000,000 lb. per square inch, with a value as high as 10,000,000 lb. per square inch, occasionally observed."

Mr. Howard points out that the compressive strength and modulus of elasticity increase with an increase in specific gravity, and that while the apparent modulus of elasticity is modified by the conditions of burning the brick, the crushing strength and density certainly can be controlled within limits. In considering some of the phenomena of expansion a coefficient of 0·0000040 was adopted for the time being, while it was observed that a coefficient of 0·0000060 is sometimes found for brick.

Four mud bricks were taken from different parts of a kiln—top, a quarter way down, two-thirds down, and the bottom—and gave, in that order, a moduli of elasticity ranging from 10,000,000 to about 4,500,000, crushing strengths from 19,000 lb. to about 11,000 lb. per square inch, weights per cubic foot decreasing from 144 lb. to 125 lb., and confined stresses from 4,000 lb. to 1,818 lb. per square inch for a rise of 100 deg. Fahr. in temperature. The highest stresses will occur in pavements made of heavy bricks with a high modulus of elasticity. "It would, in some cases, relieve the magnitude and severity of thermal effects to restrict the brick to a grade sufficient to provide adequate abrasive resistance for traffic conditions of a particular street. The endurance of brick pavements against abrasive wear has been found from experience to be so great that no trouble is ordinarily apprehended in that direction. The observed expansion of cement-filled pavements, in a direction crosswise of the roadway, has corresponded closely to a coefficient of expansion of 0·0000040 per degree Fahrenheit."

For 100 deg. rise of temperature this gives an expansion of 0·12 in. for a 25-ft. roadway; 0·19 in. for a 40-ft. roadway, and 0·24 in. for 50-ft. The maximum stresses in individual blocks would range from 25,000 lb. to 50,000 lb. per square inch; but the street kerbing would not ordinarily afford any such reaction.

"Kerbing which is backed up by earth filling yields to moderate pressures when they are long sustained, and in a crosswise direction pavements would not be expected to develop forces of very great magnitude in the absence of substantial buttresses. The fact that the middle of a roadway rises during the period when the bricks reach a high summer temperature is occasioned and facilitated by the crowning of the roadway. The usual pavement is, in transverse section, a bent column of very slender proportions, which easily deflects, increasing the crowning of the arch; this action may result in the formation of longitudinal cracks."

Observations made at Cleveland, Ohio, over a period of one year included measurements of changes in length along and across the roadway. Reference lengths of 20 in., marked by small bronze plugs, were established, the plugs being sunk about ⅛ in. below the surface and protected by paper washers and putty. A small conical hole in each plug provided the reference point. It is believed that the changes measured in these reference lengths were accurate within two ten-thousandths of an inch.

A number of measurements of the elastic deformation of pavements and tram-rails were made by means of a levelling beam, one end of which rested on the track, the other end 4 ft. or 5 ft away upon the pavement. The beam is provided with a sensitive level and a micrometer elevating screw.

"There is a general depression of the pavement and road bed in the vicinity of a car, but slight in amount when compared with the depression of ordinary trolley track. Depression of trolley track usually takes place to such an extent as to make it undesirable to bond the pavement to the track. When a very sensitive level bubble was used the depression of the pavement could be detected some 10 ft. from a trolley car in the direction of the kerbstone; this was found on a tar-filled pavement. At an intersection the approach of a man when 12 ft. distant was indicated by this sensitive level.

"Monolithic brick pavements are very elastic. They depress locally under loads and spring back when released."

A freshly laid cement-jointed pavement can hardly sustain a drop of 30 deg. in temperature from day to night without starting incipient cracks, and it is probably impracticable to use a layer of sand thick enough to afford adequate protection. Thermal effects may, therefore, originate before the street is opened to traffic. Cracks due to early temperature changes are of common occurrence, and Mr. Howard points out that it must not be thought that streets with expansion joints are exempt from transverse cracks due to early changes in temperature.

THE GROWTH OF CRACKS.

The presence of a large number of transverse cracks leads to a lengthening of the pavement as a whole, and a case is cited in which, after ten months, a pavement had thus crept in one direction, had crowded over a marginal kerb at a railway crossing about ⅝ in., and in the other direction had crowded an asphalt pavement, "carrying with it and deflecting the trolley tracks."

By spanning transverse cracks with reference lengths between plugs it was possible to measure their growth. In one case such measurements were begun in September, when the temperature of the pavement was about 90 deg. Fahr., and concluded in November, when it was about 32 deg. Fahr. The crack had grown 0·008 in. in eight days, 0·017 in. in thirty-one days, 0·025 in. in forty-eight days, and 0·038 in. after fifty-two days; all reckoned from the date of the first measurement, and covering the period from September 22nd to November 13th. In the following August, when the temperature of the pavement was about 82 deg. Fahr., the crack was much reduced in width.

Fine particles of sand or abraded material may prevent a crack from closing completely when the pavement again reaches a high temperature, and the process will be repeated until the pavement reaches a state of considerable longitudinal compression.

"The middle portion of the length of the street would then remain in a state of more or less initial compression over certain ranges in temperature, while the ends, if unresisted, would extend measurably in each direction longitudinally. The part of the street which is under initial compression longitudinally is, for the time being, in a firm condition and capable of sustaining traffic satisfactorily.

"If the cracks are numerous and near together, and not under sufficient longitudinal compression, the sections then act independently. When depressed by the load of a vehicle, an abrasive action will take place between the cracks and tend to enlarge them.

"The pavement is believed to be in a favourable condition when under initial longitudinal compression, and the same would be true of lateral compression if the pavement was flat or had very little crowning. Initial compression as such seems advantageous, or a certain amount is advantageous. This state of compression may be reached and maintained along the middle part of a straight roadway, but difficulties

* We are indebted to *Engineering News* for the text of the passages quoted and for the illustrations.

are encountered at open ends in providing an adequate marginal kerb to resist the thrust."

One street which was under observation was paved in three sections, the middle one with tar-filled joints, the others with cement-filled joints. There was a creeping of these two sections towards the middle section.

"The lower cement-filled section is travelling upgrade toward the tar-filled section and carrying with it a part of the pavement of a driveway entrance leading off one side of the street. The upper cement-filled section is compressing the intermediate section in a down-grade direction. This compressive force is felt at the ends of the tar-filled section, but not at the middle of its length. Along the centre line of the roadway the 20-in. reference lengths in the tar-filled section were shortened 0·1155 in. and 0·1968 in.

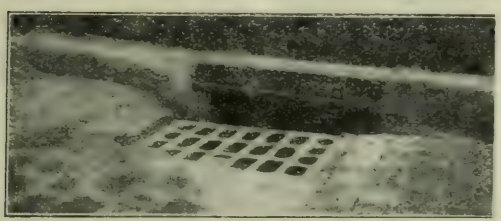


Fig. 1. Catchbasin Grating Sheared by Creep of Pavement.

respectively, for the upper and lower ends of the section, between the dates of September 29, 1911, and August 25, 1912."

In one case the creep of a brick pavement raised a ridge in an abutting asphalt pavement, near which the brick pavement was more or less cracked as it would have been at a free end. In another case a movement about equal to the width of a brick was clearly shown by the shifting of a catch basin grating. (Fig. 1.)

"Obviously, a section where no movement of the pavement occurs marks a place of great durability. Without the disturbing factor of changes of temperature the construction and maintenance intact of a monolithic pavement would be much simplified."

Effects at Curves.

Serious effects are observed at curves. A pavement may leave the kerb at the inside of a bend, leaving a gap, the maximum movement observed being about 2½ in. to 2 in., except in cases complicated by the

Fig. 2. Shearing Fractures at Reverse Curves.

effects of traffic. In the case of a pavement which was under initial strain when repairs were made, the pressure on the outer kerb, resisted by the flagging, caused the fracture of the concrete combined gutter and kerbing. In another case, at a bend of about 50 deg., the pavement left the inside kerbing for a length of about 160 ft., crowding against the outer kerbing; and there are tension cracks where the longer tangent of the street has acted upon the shorter one. "The conditions in streets with short reverse curves are rather more severe than in single bends. The long tangents set up shearing stresses which fracture the pavement at the reverse curve." (Fig. 2.) The pavement was forced in close contact with the outside kerbs of the bends, while at the inside kerbs the openings were 1½ in. and 2 in. respectively. At a turning near the reverse curve there were two openings of 2½ in. each between the pavement and the kerbstone.

"These several openings are believed to have been the result of the gradual lengthening of the pavements by alternate expansion and contraction. When cold, gritty material would sift into open cracks and

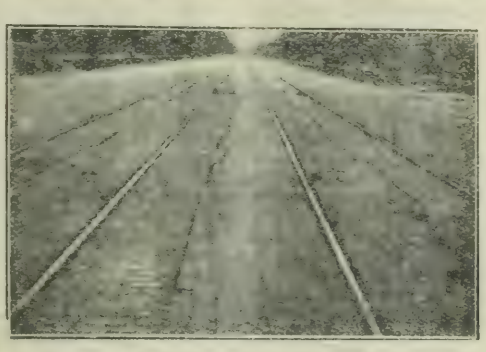


Fig. 3. Cracks Between Rails and Between Tracks.

prevent them closing subsequently when the pavement was next heated, this process being repeated, gradually causing a pronounced lengthening of the entire surface."

Effects of thermal changes are in part accumulative.

"Predictions based upon the relations existing between the coefficients of expansion, the moduli of elasticity, and the crushing strengths of the bricks lead to the inference that when thermal effects are considered the behaviour of these earlier paved

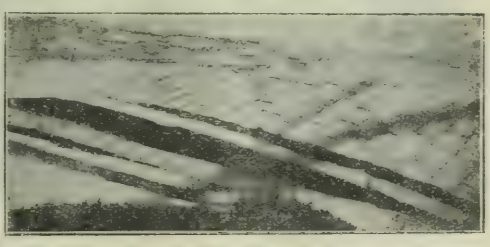


Fig. 4. Upheaval of Brick Pavement at Elevated Crossing.

streets may be taken as examples of what should eventually be found in current construction.

"Greater strength may reside in recently constructed pavements, but it may also follow that greater internal strains may be introduced by reason of the higher physical properties of the materials used. Internal generated forces depend for their magnitude upon the physical properties of the materials themselves. It is believed that thermal effects will be similarly displayed in pavements both of medium and of maximum strength."

Some Other Points.

References are made, with illustrations, to features connected with the general subject of brick pavements. Fig. 3 shows lengthwise cracks attributed to

Fig. 5. Micrometer Strain Gauge.

crosswise bending of paved strips between tram-rails.

"The expansion of such narrow strips as these would be only a few hundredths of an inch for a range of 100 deg. Fahr., and compression forces due to changes in temperature would not account for the formation of these cracks. These cracks appear to be due to crosswise bending of the pavement, in reaching which result the depression of the tracks and possibly the yielding of the ties on which the track rests are important factors."

Fig. 4 shows a pavement which heaved up owing

to expansion in a situation where high temperatures are reached.

In one brick-paved street, single courses of creosoted wood blocks were placed at intervals of about 150 ft., and the bricks next to these blocks were spalled in a number of places.

"The middle of the length of a straight street is believed to need no expansion joint; as for the ends, they would be benefited by being confined by rigid marginal kerbs rather than by the use of joints of a yielding character."

CONCLUSIONS.

"In conclusion, it is believed that:—

"(1) The integrity of cement-filled brick pavements can best be maintained by adopting such details of design and construction as will enable the pavements to resist forces of compression which are incident to alternate changes of temperature.

"(2) Provision to resist such compressive forces apply to the pavement in both longitudinal and crosswise directions.

"(3) Initial compression, within limits, is a desirable feature to have in a pavement; it seldom happens that the maximum compressive stresses occasioned by rise of temperature are sufficient to cause injury to the bricks by approach to their crushing strength.

"(4) The middle parts of the lengths of straight streets are from positions best located to maintain the continuity of the pavements intact.

"(5) Open ends of paved streets may be expected to display creeping tendencies.

"(6) End-creeping is a consequence of a permanent lengthening of the pavement, and, while individual bricks of the pavement will successfully resist compression stresses incident to rise of temperature, still the total force thus generated is too great to admit of being entirely resisted by marginal kerbs or other means available.

"(7) Streets having others enter from one side only are unfavourably situated in respect to being exposed to overstraining forces.

"(8) Curved roadways have a tendency to leave the inside kerbing and crowd against the outside.

"(9) Continuous pavements will not be expected to remain intact at short reversed curves in roadways, at least in the case of streets having long tangent ends.

"(10) To successfully resist the compressive stresses caused by variations in temperature, pavements should be laid as nearly flat as feasible—*i.e.*, with minimum permissible crowning.

"(11) Compression stresses in pavements in directions in which the elements are straight lines are advantageous rather than detrimental, and assist in keeping the pavements intact. Conversely, compression stresses acting in directions in which the elements are curved are menacing to the integrity of the pavements. The compressive stresses referred to are those caused by thermal changes, which act in the plane of the pavement, and do not refer to loads or stresses normal to the surface of pavements, such as wheel pressures of loaded vehicles."

MANCHESTER'S NEW LAKE.

The accompanying photographic view depicts a new lake at Heaton Park, Manchester, which was formally opened last week by Alderman Harrop, chairman of the Parks Committee of the corporation.

The lake owes its existence to the prevalence of unemployment during the winter of 1910, for at that time the Distress Committee was at its wits' end to find work for unemployed people. The idea of constructing the lake was raised, and, with the co-operation of the Parks Committee, the undertaking was started. Through the winter of 1911 the work continued, and though, in accordance with the provisions of the Unemployment Act, under which the matter was commenced, a stop had to be called during the summer months, the lake was completed last September.

The water has been obtained from neighbouring springs, and it covers in extent about 13 acres. The total cost amounts to about £21,000, and a sum of £1,500 has been incurred for boats, 83 of these being for rowing, and two being motor driven. The lake is 3 ft. 6 in. deep, but this can be increased to 4 ft. It has a solid brick bottom, and so is eminently suitable for bathing.

Heaton Park Lake, Manchester.

Being prettily situated, and having ample accommodation for boating and swimming, it is expected that the lake will prove a source of considerable revenue to the corporation, especially during the summer months.

Alderman Harrop in performing the opening ceremony, said that anyone looking at the place now would not believe that three years ago it consisted of undulating ground and a steep sloping hillside. The city surveyor, Mr. de Courcy Meade, was to be complimented on the way in which he had engineered a lake on such a difficult site. The level banks on which they were now standing was, a short time ago, a steep declivity. The earth that was taken out of the hillsides was placed in the valleys, and the surplus used to form the ornamental islands in the middle of the lake. By this means the work was done at a minimum cost, and chiefly by unskilled labour.

Cremation in Great Britain.—There were 1,134 cremations in Great Britain last year, an increase of 111 over the previous year.

Wood Paving Orders.—During the last week the Improved Wood Pavement Company have booked up 54,350 yds. of creosoted wood paving in Bradford, Brighton, Woolwich, Epsom, Finchley, and Westminster.

The Slate Bed Treatment of Sewage.—The paper on this subject which Mr. W. J. Dibdin, F.I.C., presented at a meeting of the Society of Chemical Industry on December 2nd last has been reprinted in pamphlet form, together with a report of the discussion which followed its reading. The proceedings at the meeting in question were fully reported in our issue of December 6th last.

New York's Water Supply.

CREATING A SUBTERRANEAN RIVER 90 MILES IN LENGTH.

[The following is extracted from a comprehensive and fully illustrated account of New York's great water supply scheme that appeared in "Scientific American," which acknowledges facilities given for its compilation by Mr. Alfred D. Flinn, department engineer of the Board of Water Supply.]

On May 14, 1906, the State Water Supply Commission approved of the application of the Board of Water Supply of New York for obtaining a daily supply of 500,000,000 gallons of water from the Esopus, Rondout, Schoharie and Catskill creeks in the Catskill Mountains, at an estimated cost of £32,373,300. In 1910 a plan for the distribution of the water throughout Manhattan, Queens and the Bronx by a deep pressure tunnel was approved by the Board of Estimate and Apportionment. The additional cost of this scheme is £3,000,000.

THE NEW SCHEME OF WATER SUPPLY.

The new supply of water, of the finest mountain quality, is to be taken from four watersheds, having a total area of nearly 900 square miles. The total estimated capacity of these four gathering grounds is, even in a series of unusually dry years, equal to supplying 770,000,000 gallons daily. Reservoirs will be built, as they are required, in each of these basins, and they will be connected by aqueducts. For the present the Esopus watershed only is being developed. In a series of dry years this watershed can furnish a daily supply of only 250,000,000 gallons; but the aqueduct leading to the city is being built of double that capacity, or 500,000,000 gallons daily. The first contract for construction was let at the close of 1906. In 1907 to 1908 about 5 per cent of the work was completed from Ashokan reservoir in the Esopus watershed to Croton Lake. By the end of 1909 22 per cent was done, 60 per cent at the close of 1910, 78 per cent by 1911, and at the present time about 95 per cent of the work is done. The delivery of water into the Croton reservoir, which will be possible this year, will prevent any possibility of water famine during the completion of the new aqueduct to New York.

The system under construction and now nearing completion consists of a large reservoir in the Esopus basin, an underground aqueduct, 17 ft. in diameter, by which the water is led for 64 miles to another large basin, the Kensico reservoir, which will serve for emergency storage; a third reservoir, situated about 15 miles south of Kensico, and just over the New York City line, known as the Hill View reservoir, which will equalise the difference between the use of water in the city—which, of course, varies from hour to hour and from day to day—and the steady flow coming in from the aqueduct. Between Hill View and the city the system consists of a deep, circular, high-pressure tunnel, through which the water will be led beneath Manhattan to be distributed by surface mains throughout that city, and also throughout the other districts of Greater New York.

THE ASHOKAN RESERVOIR.

The great Ashokan reservoir is situated about 14 miles west of Kingston, on the Hudson River. Its cost is £3,600,000, and it will hold sufficient water to cover the whole of Manhattan Island to a depth of 28 ft. The water is impounded by the Olive Bridge dam, which is built across Esopus Creek, and also by the Beaver Kill and the Hurley dykes, which have been built across streams and gaps lying between the hills which surround the reservoir. By the 1st of January this year 73 per cent of this work was done. The dam is a masonry structure, 190 ft. in thickness at the base, and 23 ft. thick at the top. The surface of the water when the reservoir is full is 590 ft. above tide level. The total length of the main dam is 4,650 ft., and the maximum depth of the water is 190 ft. The area of the water surface is 12·8 square miles, and in preparing the bottom it was necessary to remove seven villages, with a total population of 2 000. Forty miles of highway and ten bridges had to be built. In the construction of the dam and dykes it was necessary to excavate nearly 3,000,000 cub. yds. of material, and 8,000,000 cub. yds. of embankment, and nearly 1,000,000 cub. yds. of masonry had to be put in place. The maximum number of men employed on the job was 3,000.

THE 92-MILE AQUEDUCT.

The water is conducted from Ashokan reservoir as a huge underground, artificial river. The aqueduct is 92 miles in length from Ashokan to the northern city line, and it should be explained that it is built on a gentle grade, and that the water flows through this at a slow and fairly constant speed. The aqueduct contains four distinct types: The cut-and-cover, the grade tunnel, the pressure tunnel and the steel pipe syphon. The cut-and-cover type, which is used on 55 miles of the aqueduct, is of a horseshoe shape, and measures 17 ft. high by 17 ft. 6 in. wide, inside measurements. It is built of concrete, and on completion it is covered in with an earth embankment. This type is used wherever the nature of the ground and the elevation allow. Where the aqueduct intersects hills or mountains, it is driven through them in tunnel at the standard grade. There are twenty-four of these tunnels, aggregating 14 miles in length. They are horseshoe in shape, 17 ft. high by 13 ft. 4 in. wide, and they are lined with concrete. When the line of the aqueduct encountered deep and broad valleys they were crossed by two methods: If suitable rock were present, circular tunnels were driven deep within this rock and lined with concrete. There are seven of these pressure tunnels of a total length of 17 miles. Their internal diameter is 14 ft., and at each end of each tunnel a vertical shaft connects the tunnel with the grade tunnel above. If the bottom of the valley did not offer suitable rock for a rock tunnel, or if there were other prohibitive reasons, steel syphons were used. These are 9 ft. and 11 ft. in diameter. They are lined with 2 in. of cement mortar, and are embedded in concrete and covered with an earth embankment. There are fourteen of these pipe syphons in a total length of 6 miles. At present one pipe suffices to carry the water. Ultimately three will be required for each syphon.

Of the many syphons constructed by far the most interesting and difficult is that which has been completed beneath the Hudson River. The preliminary borings made from scows in the river showed that great depths would have to be reached before rock sufficiently solid and free from seams was encountered to withstand the enormous hydraulic pressure of the water in the tunnel. After failing to reach rock by the scow drills, two series of inclined borings were made from each shore, one pair intercepting at about 900 ft. depth and the other at about 1,500 ft. Both showed satisfactory rock, and accordingly a shaft was sunk on each shore to a depth of approximately 1,100 ft., and then a horizontal tunnel was driven connecting the two. It is of interest to note that because of the enormous head, which must be measured from the flow line far above the river surface, the pressure in the horizontal tunnel reaches over 40 tons per square foot.

KENSICO RESERVOIR.

Next to Ashokan the most important basin is the Kensico reservoir, which lies east of the Hudson, and is situated 30 miles north of the city hall. It will hold sufficient of the Catskill water to supply the city for several months. Its purpose is to act as an emergency storage reservoir, so that if it is necessary, on account of accident, to interrupt the flow in the 77 miles of aqueduct between Kensico and Ashokan, this can be done without interrupting the city supply. The cost of this work is £1,700,000.

The reservoir will be formed by a huge masonry dam across the valley of the Bronx River. The surface of the water will be at an elevation of 355 ft. above mean sea level, and will cover 2 218 acres. It will contain, when full, about 40,000 million gallons, of which 29,000 million gallons, or sixty days' continuous supply at 500,000,000 gallons daily, will be available. The main dam will be 1,843 ft. long, the total height will be 300 ft.; it will be 230 ft. thick at the base, and 28 ft. thick at the top. The average depth of the reservoir will be 100 ft., and its maximum depth at the wall of the dam will be 155 ft. An interesting feature of the construction is that the entire dam will be divided into sections by transverse expansion joints, which will be placed about 80 ft. apart longitudinally. On one side they will be faced with concrete blocks, forming a series of vertical tongues and grooves, against which the masonry of the other side will be built. Near the upstream face will be a

copper strip which will cover the expansion joints and act as a water stop, the strips continuing from the bottom to the top of the dam. In order to catch any water that may seep through from the upstream side diagonal wells will be built 15 ft. apart, measured longitudinally. They will be formed of porous-concrete blocks. They will reach from the top of the dam to a longitudinal inspection gallery at about the level of the reservoir bottom, which will, in its turn, be connected with a transverse drainage gallery, which will lead to the downstream base of the dam. This will prevent any seepage entirely through the wall, and will avoid that discolouration which is liable to mar the architectural beauty of structures of this kind.

AËRATION AND FILTRATION.

Both at the Ashokan and Kensico reservoirs will be built aërators, each of which will be capable of passing and treating all the water which will flow in the aqueduct. The aërator is a large rectangular basin, 500 ft. by 250 ft., containing about 1,800 nozzles, through which jets of water will be thrown into the air. The nozzles will be of such form that the water will be divided into a fine spray, and this will permit of a thorough admixture of the oxygen of the air and the removal of gases and matters which would cause taste and odours. For the present no provision will be made for filtrating the Catskill water, but provision has been made for a filtration plant by the purchase of 315 acres of land near Tarrytown, adjacent to the aqueduct.

HILL VIEW RESERVOIR.

From Kensico the water will flow to the Hill View reservoir, which will serve to equalise the difference between the amount of water used in the city and the amount of water flowing in the aqueduct. Also it will furnish a great quantity of water should there be an immediate demand, such as occurs during a great conflagration. Its capacity will be 900,000,000 gallons. The reservoir is divided into two basins, so that one may be used while the other is being inspected for repairs. The aqueduct is carried within the wall which divides the two basins, and the aqueduct water can be passed through the reservoir and delivered directly into the city tunnel.

The preceding notes tell how the new aqueduct is being constructed from the Catskill Mountains down to the New York city line, where, at the Hill View reservoir, the waters will pause before taking their plunge into the heart of the city.

The problem of admitting so large a flood into the metropolis is no small one, particularly when the chief demand for the water will come from those sections of Greater New York which lie many miles away. For the present, at least, little if any of the Catskill water will be used in Manhattan and the Bronx, but most of it will be consumed by the boroughs of Brooklyn, Queens and Richmond. The water-waste campaign which has been carried on for the past few years has so far reduced the consumption of water that the Croton system, which can furnish steadily 350 000,000 gallons of water per day, can easily take care of the immediate wants of Manhattan and the Bronx as well as the demand from these two boroughs for many years to come.

To conduct the Catskill water into Brooklyn and Queens it was decided to build a trunk line, so far beneath the surface that there would always be 150 ft. of good solid rock for the roof of the tunnel, and provide a course for a subterranean river which could be tapped as needed for the city's supply, and which, at the same time, would be so completely buried that it would never menace the safety of structures above it. When this tunnel is completed it will be one of the most durable pieces of work ever constructed by man, for practically nothing but an earthquake can destroy it; and even this possibility is very remote, for the rock underlying New York is of very early formation, and not at all liable to seismic disturbance. And so the city tunnel of the Catskill aqueduct is being bored through the rock on the average of 200 ft. to 250 ft. below the surface except in places where the nature of the rock is of such a character as to call for a much greater depth.

The first dip takes place just above the Harlem River, where the tunnel drops down 362 ft. below the ground level. Then it runs practically horizontally until it passes the dip in the rock under 125th-street. Thence it rises again and maintains a practically constant level of 200 ft. under the city until it arrives at the ancient bed of the East River. The large deposits of earth and rock carried by the glaciers caused the river to be pushed eastward out of its normal channel and over the solid rock beyond. When borings were made for the aqueduct through this section of the city it was found necessary to lay it at a depth of about 750 ft. below the surface. Much of the rock through this section is decayed and unfit to form the walls of a high-pressure aqueduct which is being built to last for all time. The present channel of the East River, on the other hand, passes over solid rock, and is comparatively very shallow. Seven hundred and fifty feet is an enormous depth, second only to the great syphon under the Hudson River, which is 1,114 ft. below the river surface. It so happens that the deepest shaft ever sunk in New York City equals the height of the tallest building in the world.

Arrived in Brooklyn, the aqueduct rises again to within 200 ft. or 300 ft. of the surface, and is pushed as far as it is possible to carry it in solid rock and yet communicate it with the surface. This limit was found to be at the junction of Flatbush and Third Avenues. Here it was necessary to go through 215 ft. of overlying earth before coming to the rock. The caisson method had to be resorted to, and the caisson was sunk over 100 ft. below the water line before rock was reached. Considerable difficulty was here experienced in sinking the shaft to the rock, because it called for the use of pneumatic pressure that taxed the endurance of the workmen to the limit. From here on the water will be conducted through pipes laid in a trench of a moderate depth below the surface. From the foot of Seventy-ninth-street, Bay Ridge, the conduit will be run across the Narrows to Staten Island, through a pipe 36 in. in diameter, provided with flexible joints, and laid in a submarine trench. The details of this section of the work have not yet been given out. However, tests have been made to discover at what depth the pipe line under the water must be buried. It is evident that it must lie far enough below ground to prevent its being entangled with anchors from large vessels that may have to anchor in the Narrows. The matter has been thoroughly investigated, and practical tests have been made by dragging anchors of large size along the bottom. It has been determined that if the pipe line is buried at least 8 ft. under the bed it will be entirely safe. On the Staten Island side a 48-in. pipe will carry the water on up the hill and through a tunnel into Silver Lake reservoir, 120 miles from the source in the Catskills.

The greatest interest in this city section of the aqueduct attaches naturally to that part which is being excavated through solid rock under the busy city. It is a surprising fact that a work of such magnitude can be carried on without inconveniencing people in the least. The only surface evidence of the deep rock tunnelling is to be found at the various shafts which are located in parks or public squares.

The work through the rock is being pushed very rapidly; at some of the shafts between 800 lb. and 1,000 lb. of dynamite have been used daily. Within the last year millions of pounds of dynamite have been exploded under the city, while most of New York was totally oblivious to the fact. Already a number of the tunnel sections have been "holed" through. To expedite the work one contractor is using an interesting form of shovelling machine, built especially for this work, so that it may be taken down the comparatively narrow shaft and be assembled to work within the small diameter of 11 ft., which is the size of the tunnel at the particular point where this machine is now being used.

It is probable that no immediate changes will be made in the water supply of Manhattan and Bronx, except that pipe lines will be run from the shafts to help out the existing supply in case of emergency. In Brooklyn and Queens, where thirty-five pumping stations are now required, most of the stations will be discontinued for the reason that the water will be delivered through the aqueduct at sufficient pressure to reach practically all parts. Only in one or two sections will pumping be necessary.

From Hill View reservoir the water will flow through a tunnel, 15 ft. in diameter. This will be narrowed to 14 ft., 13 ft., 12 ft. and 11 ft., which is the diameter of the rock tunnel at Fort Greene Park, Brooklyn, and at the intersection of Flatbush and Third Avenues. From there on steel pipes, 5½ ft. in diameter, and running down to 4 ft. in diameter, will carry the water to the Narrows, and under New York Bay, at the Narrows the line will be only 3 ft. in diameter.

Office Conversations.—The ninth of the series of articles under this heading is again unavoidably held over, but will appear next week.

Comparative Reports of General Practice.—LXXX.

DUST COLLECTION IN AND AROUND THE METROPOLIS.—(*Conclusion.*)

The present comparative report of general practice—the first portion of which appeared in our issue of February 21st—deals with dust collection in and around the Metropolis, and is reproduced by the courtesy of Mr. Reginald Brown, M.INST.C.E., F.S.I., engineer and surveyor to the Southall-Norwood Urban District Council. Mr. Brown has collected information on the subject from no fewer than sixty-one districts.

District.	Population.	Area in acres.	Storage.		Collection.						Disposal How is your Refuse disposed of (in cubic yards) per annum?						Remarks
			Do you insist upon the provision of galvanised iron sanitary dustbins?	Do the owners or council provide same?	(a) How often is the refuse collected?	(b) Do you collect by contract or by your own staff?	(c) Is there a "house-to-house" collection, or is the "D" Card System adopted?	(d) What is the average number of men and carts employed daily?	(e) No. of cubic yards collected daily.	(f) Have you made any regulations as to assistance to be given by occupiers? If so, what?	Tip.	Brickfields	Barging	Destructor.	Other means	Cost.	
Woolwich	121,000	8,986	Yes	Owners	Once each week, except in cases of large business premises	See remarks	House-to-house	10 in Woolwich, 14 in Plumstead, 4 in Eltham	Varies	No	—	—	—	—	—	No available information	(b) Collection in Woolwich district by own staff, but by contract in the districts of Plumstead and Eltham.
Wood Green	50,000	1,625	Yes	Owners	Once per week. Shops every day	Horse & man by contract. Cart and dustmen by council	House-to-house	8	30 tons	No	—	—	—	By destructor	—	—	
Willesden	154,214	4,382	Yes, when new bins are provided	Owners	Weekly	Contract	House-to-house	39 men and 21 carts	275·7	No	84,367	–	—	—	—	18·6d.	
Wealdstone	12,250	1,066	Yes	Owners	Weekly	See remarks	House-to-house	See remarks	6 loads equal to 15 cubic yards per day	No	1,300	—	—	2,990	—	To tip nil. By destructor 6d	(b) Council contract for horses and men only. Carts supplied by council, and council's own men act over the carters as dust foremen. (d) Three men, 2 horses and carts, for 3 days in each week, 4 men and 3 horses and carts for 3 days each week so as to get through the district in 6 days. The council have built a small experimental destructor which destroys all garbage; the cinders falling through the forks, which have 1 in. spaces between the tangs, are afterwards sifted through ¾-in. riddle. The coke is sold for greenhouse fires, and to burn ballast at 2s. per yard at destructor; the finer siftings are used for laying artificial stone paving on in lieu of sand. Value reckoned at 1s. per yard cubic. Not been in operation long enough to ascertain credit for 12 months. The council also receive £18 a year for the pickings out of the refuse by a contractor.
Wandsworth	311,402	9,199	Yes	Owners or occupiers	Weekly	Contract	House-to-house	42 vans and 84 horses	—	No	8,684 tons (outside boro')	—	44,216 tons	20,562 tons	—	Total cost of collection and disposal, £16,378 5s. 8d.	

Road Construction and Maintenance.

FROM THE STANDPOINT OF THE MOTOR USER.

By RICHARD W. R. TWELVETREES.

At the present time, when the question of roads improvement is being considered by highway authorities throughout the country, it seems opportune that some notes should be published in The Surveyor and Municipal and County Engineer dealing with the subject from the point of view of those concerned in the construction and use of mechanically propelled vehicles.

Having been occupied for nearly fifteen years in the design, construction and testing of motor vehicles of various kinds, the writer has had fairly extensive opportunities for observing defective and inconvenient features characterising main highways and subsidiary roads in many urban and rural districts, and hopes that the subjoined brief comments may be found of practical service to authorities responsible for the maintenance and improvement of roads in general.

As a matter of convenience, and to facilitate the consideration of each point, the comments are arranged in the form of notes under separate headings.

APPROACHES TO TOWNS AND VILLAGES.

The arrangement of the streets on the outskirts of many important cities and towns is such that the main roads do not form suitable or convenient approaches. It often happens that the outlying areas are thickly populated and that motor traffic has to

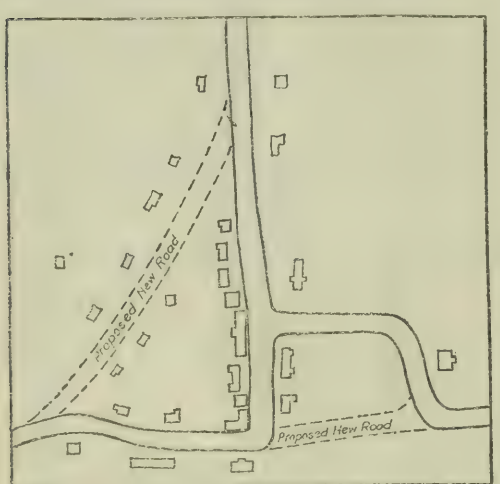


Fig. 1. Bad Entry to Village.

pass through comparatively narrow streets occupied by people engaged in marketing or sauntering about for the enjoyment of fresh air and friendly intercourse. These conditions are sometimes made more unfavourable by the addition of more or less congested tramway traffic augmenting the risks to motor users and the public alike, not only because tramway cars obstruct the look-out of motor drivers, but also for the reason that they generally run on tracks laid out so as to disorganise ordinary traffic, and to prevent accepted rules of the road from being followed rigidly.

In wide avenues, properly designed with ample space for street railways as well as ordinary traffic, tramways would constitute no menace to the safety of motorists; but in ordinary approaches to a city they are out of place, and particularly so where passing along narrow thoroughfares, such, for example, as High-street, Brentford, on the Bath road, and the principal street in Croydon on the Brighton road. All concerned in motor traffic would gladly welcome the advent of railless traction as a substitute for the public services now conducted on tram lines.

In the case of numerous small towns and villages the main entrance is in the form of a right angle, as illustrated in Fig. 1, offering the best possible means of encouraging collisions and other accidents. It should not be very costly to remove death traps of the kind, as the value of land in such places is relatively small, and could often be carried out in the manner indicated in Fig. 1.

SHARP BENDS AND CONCEALED TURNINGS.

Apart from right-angled turns at the entrance of towns, British highways are unnecessarily endowed with many sharp bends, generally bordered by tall hedges, and making it impossible for the driver of a

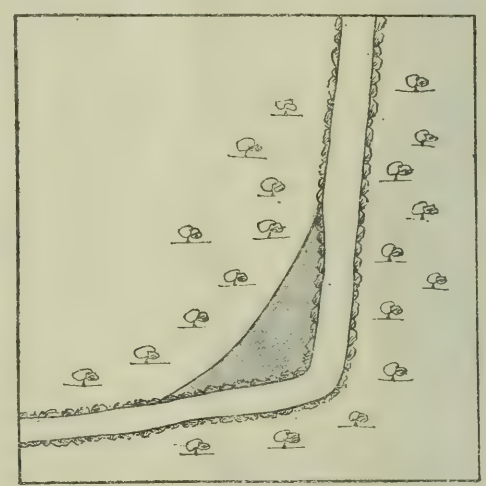


Fig. 2. Sharp Bend.

motor vehicle to see what may be round the corner. Fig. 2 shows a typical bend in a main highway, the stippled area indicating suggested widening. Sometimes the bends are so sharp that the driver of a car has to reverse direction in order to get round the angle.

This defect in road lay-out is not merely an inconvenience to motor traffic and a source of danger to pedestrians, but it involves needless wear and tear of the road surface owing to the rapid retardation

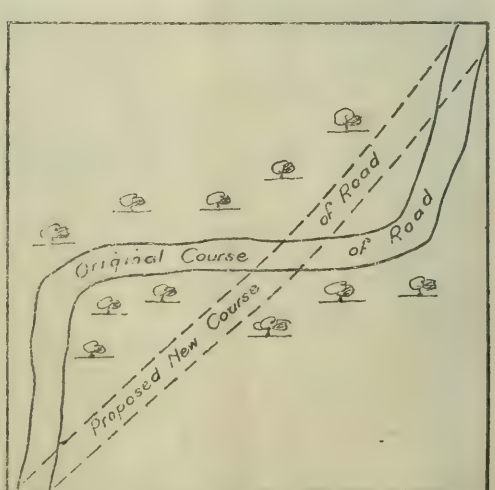


Fig. 3. Winding Road.

and acceleration of motor cars. As a matter of fact, a heavy car fitted with steel-studded tyres travelling at high speed and then suddenly slowed down or stopped has an effect upon the road surface somewhat like that of a scarifier. Hence the fewer curves in a highway the lower will be the cost of maintenance.

Numerous country roads could be greatly improved

by the simple expedient of widening them somewhat at places where there are awkward curves. This would often only necessitate the inclusion in the roadway of the space usually occupied by grass bordering or unused footpaths in rural districts.

Similar improvements could be readily made in the case of cross roads by widening the openings (Fig. 3), thereby affording greater safety to motorists and others.

It may be interesting to mention here how very deceptive some curves are in appearance when viewed from the driver's seat of a vehicle. One may approach a curve of apparently wide radius, and find on arriving there that it more nearly resembles a sharp bend than an easy curve—an optical illusion which has on occasions been attended with very unpleasant results.

When travelling at ordinary touring speeds upon zig-zag roads, touring cars, especially if carrying a fair amount of baggage, develop a swaying movement, which has the effect of rendering steering a most difficult and often a dangerous operation. This steering difficulty is noticeable even in vehicles possessing quite a satisfactory degree of stability, and it may be imagined how much greater is the trouble to be contended with by the drivers of vehicles carrying heavy loads of great bulk. Fig. 4 shows a winding road and proposed new direct road.

Side turnings are often concealed by trees and lofty hedgerows. Many unfortunate accidents have occurred from time to time that would have been

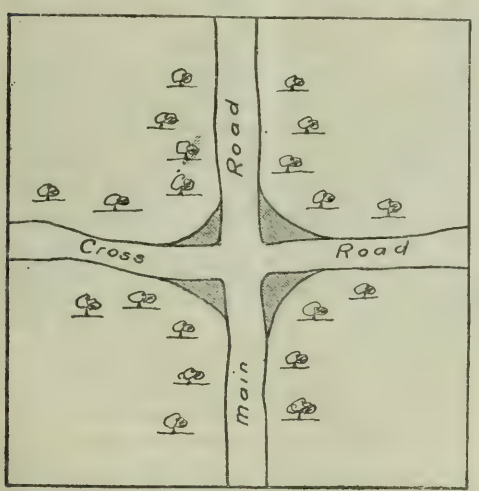


Fig. 4. Cross Roads.

averted if the hedges had been kept down to a reasonable height. The cost of clipping is very small, and country road surveyors ought certainly to be authorised to undertake the supervision of such operations. An additional safeguard already adopted is the provision of mirrors at specially dangerous corners. This has been found of much practical value in places where it has been tried, and the more extensive use of this simple device would find favour with all responsible for driving motor vehicles.

SUPER-ELEVATION AT CURVES.

Even when travelling at ordinary touring speeds motor vehicles have a decided tendency to fly outwards from their course when rounding curves in the road. To counteract this tendency, and to enable curves to be negotiated with safety, all roads should be constructed so as to provide an amount of super-elevation proportionate to the radius of the curve. All roads not so constructed originally should be banked up as required in order to afford safety for motor vehicles travelling at reasonable speeds. It is not recommended that the super-elevation or banking up should be in any way excessive, nor that it should be sufficient to encourage the speed maniac; but, on the other hand, it is most important that it should be regarded as an essential feature of road construction, and be properly maintained as such.

Fig. 5 illustrates an important road near London where the super-elevation is actually on the wrong side, and instead of making the turning of vehicles easy and safe it has a pronounced tendency to divert them from their proper course into the footpath. The practical result of this defective construction is that at the outer radius of the curve the road is carefully avoided, and the whole of the traffic in both directions passes as far as possible along the inner radius. The cost of repairs in such a case is obviously very high, while even under the most favourable circumstances the curve is extremely dangerous to motorists and the public. The example below indicates the importance of the point under discussion, and emphasises the fact that roads designed without regard to super-

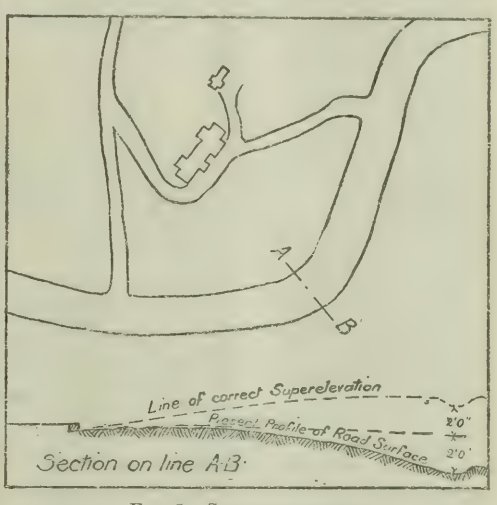


Fig. 5. Super-elevation.

elevation encourage continued neglect of ordinary traffic rules on the part of drivers, who, while endeavouring to select the safest portion of the road to travel upon, often run risks of collision with traffic coming in the opposite direction.

Additional convexity at curves gives a certain amount of super-elevation to the inner radius, but aggravate the adverse conditions at the outer radius. At cross roads the contour should be of slightly domed form, thus assisting the passage of vehicles in all directions.

CULVERTS AND SMALL BRIDGES UNDER ROADS.

Another serious trouble experienced by motorists is the improper way in which culverts and small bridges frequently are constructed so as to cause a sharply-

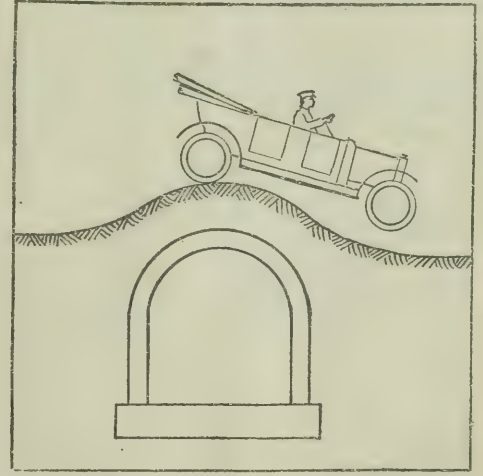


Fig. 6. Car Crossing Culvert.

defined hump in the roadway. As a rule, the road surface rises very rapidly at the centre of the culvert or arch, and as quickly falls again. Motor cars cannot follow such extremely sharp contours even when running at moderate speeds. Consequently there is a tendency for the front wheels to leave the ground, as illustrated in Fig. 6, and as they come down again the whole part of the axle load falls suddenly upon the springs. At extremely high speeds, which are not to be countenanced on public highways, cars

actually fly off such contours at a tangent, all four wheels leaving the ground at once.

Sudden rises and falls of the kind could very easily be abolished by grading up the road surface. Their effect upon vehicles travelling at ordinary speeds is most unpleasant for the occupants, and chassis are constantly being severely strained by the sudden shocks caused.

EXCESSIVE CONVEXITY.

Numerous suburban and country roads, as made up at present, are characterised by excessive convexity, the idea presumably being to insure rapid drainage, and it may possibly be intended to provide for gradual settlement of the roadway to a flatter cross-section.

Whatever its object may be, undue convexity naturally causes drivers to prefer the middle of the road, where vehicles can keep upright, to the sides, where they perforce lean to the right or left, as the case may be. One result is that rapid wear of the road surface occurs along the middle, another being that in wet weather water is retained by depressions and ruts instead of running into the side channels.

INADEQUATE DRAINAGE.

The rapid deterioration of road surfaces owing to the percolation of water through the outer crust, and subsequent loosening of the subsoil is well known to road surveyors. The continued presence of water upon the surface, whether arising from ruts, depressions, impaired contour, or the choking of side channels and drains, is most objectionable to motorists as well as other users of public highways, and also conduces to deterioration in the manner stated above.

FLOODED AND SUBMERGED ROADS.

Motor vehicles ought never to be required to pass through water, whether due to floods or to the small fords such as still remain in numerous country districts. A few years ago it was impossible for any internal-combustion motor vehicle to cross even a shallow piece of flooded roadway because the water splashed up at once cooled down the ignition tube. Nowadays, however, although complete stoppage seldom occurs under similar conditions, the water sprayed into the working parts of a motor engine always gives rise to much inconvenience, especially by interfering with the proper action of the carburetor and magneto. Small fords should certainly be bridged over or replaced by culverts in order to comply with the requirements of mechanical traction.

Roads liable to flooding in low-lying and swampy land should be more effectively protected than they are at present. In many places the old Roman method of building the road upon a causeway could be adopted with much advantage.

RAILWAY LEVEL CROSSINGS.

As a general rule railway crossings only justify the use of the adjective "level" in a very limited sense. The lines usually stand up prominently above the roadway, and unless great care is exercised by drivers the springs of motor vehicles crossing the lines are very apt to be broken or damaged by the severe shocks experienced. The frequently adopted expedient of depositing loose stones between the rails merely aggravates the unfavourable conditions by the addition of material likely to injure pneumatic tyres. The proper method of treatment is to form a solid foundation of concrete between and on either side of the rails, and upon this to form a surface capable of withstanding heavy traffic without appreciable wear and without being unduly compressed. The best surface, and one that will prove most economical in the long run, is granite paving firmly set and well grouted.

UNLEVEL ROAD SURFACES.

Even in the case of roads repaired on the most approved principles, with steam-rolled macadam or tar-macadam, the surface does not always remain in a satisfactory condition for any length of time.

The essential condition laid down by Macadam—that a road surface should be absolutely watertight—is now generally disregarded. Binding material capable of absorbing water is largely used, one result being that it is washed away in parts and so gives rise to a corrugated surface which causes the progression of motor vehicles to be accompanied by a succession of bumps, trying to the mechanism and injurious to the roadway. Another result following the use of ordinary binding material is the formation of "potholes," due to hydraulic action.

While genuine tar-macadam is free from such disadvantages, it is unfortunately a somewhat prevalent idea that any road can be satisfactorily converted for use by mechanically-propelled vehicles simply by raking up the old surface, pouring on tar, and rolling down. This sort of treatment certainly does some good by restoring the surface temporarily and by abating the dust nuisance, but it is not sufficient for turning a bad road into a good one.

Many highway authorities seem to think that mere surface treatment is the only thing for attention, cheerfully oblivious of the facts that the foundation is the real road, that the stones forming the crust are simply intended to protect the foundation, and that foundations unable to withstand traffic when covered with flint will still suffer when covered with harder stone.

For a striking illustration of the total unsuitability of ordinary country roads for heavy traffic one has only to observe the condition of things after a country fair of any importance. It may be argued that the traction engines and other heavy vehicles employed in connection with such gatherings constitute abnormally heavy traffic. While admitting this, it is still the fact that the disintegration of road surfaces thereby caused is far greater than it ought to be. Moreover, as the roads are supposed to be made for traffic and not the traffic for roads it is obviously the duty of highway authorities to keep abreast of the times, and to increase the strength of road foundations and surfaces, just as railway companies have to strengthen their permanent way and bridges to render them suitable for modern rolling stock.

SLIPPERY SURFACES.

Almost every kind of paving and surface material is apt to become greasy or slippery in damp weather, making excessive convexity and sharp curves particularly dangerous for motor traffic. It is at corners and crossings where most accidents occur, and while a moderately slippery surface may not occasion trouble on a straight road, even a small amount of slipperiness at a bend is always dangerous. The slightest application of the brakes on a slippery road may cause the wheels to lock, with the result that the car may skid in any direction and be practically out of control. The sudden application of brakes on a greasy surface almost invariably causes skidding, thus defeating the very object for which such apparatus is provided.

An improvement in road construction that would be welcomed by motorists generally would be the formation of surfaces affording a good grip for motor vehicle wheels at road junctions and curves.

INCONSIDERATE REPAIR PROCEDURE.

On some main highways the practice is for half the width of the road to be repaired at a time, thus providing for the unobstructed conduct of regular traffic. On other highways of the same class the whole width is repaired simultaneously, making it necessary for cars to negotiate rough material or wet tar. In the latter case the wheels throw up a mixture of small stones and tar which adheres to the body work, and generally necessitates a visit to the coach painters for removal and a new coat of varnish.

On many country roads the whole width is generally repaired in a single operation, with the result that motor vehicles have to plough through loose road metal, much to the injury of tyres and to the discomfort of passengers. The inconvenience of this procedure is greatly aggravated in places where the primitive method of allowing new metal to be consolidated by traffic is still in force. Contractors frequently show much indifference to the convenience of road users by leaving traps of broken stone in the highway, appearing to think that while they are at work all traffic must stop or else travel by lengthy detours. That this is by no means a fanciful complaint is shown by the reports published in various motor journals where lists of roads that are virtually impassable are printed every week.

DUSTY ROADS.

Probably no question has exercised the public mind in connection with motor traffic and road surfaces more than that of dust prevention. Motor engineers have from time to time modified the design of vehicles with the express object of reducing the raising of dust upon the surface of the road. Experiments upon specially prepared surfaces have proved that certain vehicles raise less dust than others, but where roads rapidly disintegrate through the use of unsuit-

able materials dust is certain to be thrown up by vehicles of every kind. The pneumatic tyre is generally supposed to exert great suction, and so to raise dust in excessive quantities. In practice, however, pneumatic tyres are inflated to a degree of hardness which renders such action next to impossible, and, as a matter of fact, the disintegration of road surfaces is considerably reduced by the use of such tyres.

In wet weather the mud thrown up from a macadam road is due to hydraulic and not to pneumatic action. Thus, water in the road crust is put under pressure by the advancing wheels, and the material is then loosened by internal pressure. As the water is unable to escape with sufficient rapidity through the interstices, it is forced up to the surface, carrying with it some of the binding material, which eventually forms dust.

The various bituminous preparations for dust prevention are, generally speaking, satisfactory; but those which exude tarry substances under certain conditions should be avoided, as the mixture of these loose materials results in the formation of greasy surfaces. It is fortunate that the blinding dust storms raised by motor cars upon the highways are now far less frequent than formerly, thanks to the introduction of tar-macadam and tar-spraying; but legislative action with the object of enforcing a minimum ground clearance for all motor vehicles would be highly desirable, for a regulation to this effect would considerably reduce the motor-dust nuisance.

WATER SUPPLY FOR STEAM VEHICLES.

The use of steam vehicles for heavy traction is frequently attended by the drawback of scarcity of available water supply in certain districts. Where water could be obtained permission to take supplies from that particular source is often refused, and the range of steam vehicles considerably reduced by such refusals. Municipal and rural authorities would render a great service to users of such vehicles, and would create a source of income for themselves by providing suitable standpipes at fixed distances along important highways, as was formerly done on the Bath road, for watering purposes. The standpipes here proposed should be arranged with automatic meters operated by penny-in-the-slot mechanism, so that steam-tractor drivers could at all times obtain supplies of water with which to fill their boilers and tanks.

The same standpipes might be very convenient to the local authorities for the purpose of filling water carts and vans.

ROUTE IDENTIFICATION.

The present system of signposts and milestones for the direction of travellers stands in need of improvement.

The posts often indicate the direction to small villages, while large and important towns are not mentioned. In France the Government have recently introduced a system of route identification under which a number is given to every main highway or "route nationale." This number is plainly marked upon each kilometre stone along the route, and travellers can readily ascertain what road they are upon, and can follow their way without misdirection from incorrect or insufficiently marked signposts. Road authorities in this country might do well to copy this innovation, and thus assist travellers in unfamiliar districts.

The Specification of Street Lighting.—As announced in our issue of the 14th inst., a paper by Mr. A. P. Trotter, giving an account of the work of the Joint Committee of the Institution of Electrical Engineers the Institution of Gas Engineers and the Institution of Municipal and County Engineers and the Illuminating Engineering Society, will be presented at a meeting of the Illuminating Engineering Society at the Royal Society of Arts, 18 John-street, Adelphi, London, on Tuesday, April 15th, at 8 p.m. The paper will not be read. The discussion will be opened after some introductory remarks by the author. Members of the Institution of Electrical Engineers, the Institution of Gas Engineers, and the Institution of Municipal and County Engineers are invited to attend, and they may obtain copies of the paper on application to Mr. L. Gaster, the hon. secretary of the Illuminating Engineering Society, 32 Victoria-street, London, S.W. The council of the Institution of Municipal and County Engineers trust that members will make every endeavour to attend this meeting.

CORRESPONDENCE.

For every ill beneath the sun
There is some remedy or none;
If there be one, resolve to find it;
If not, submit, and never mind it.
— Anon., *circa* 1843.

LAND VALUATION BOARD APPOINTMENTS.

To the Editor of The Surveyor.

Sir,—As another valuation assistant, I have been very interested in the correspondence under this heading which has appeared in your paper. I, like "Valuation Assistant," was originally appointed as draughtsman, and in that capacity executed a good deal of important surveying work for the revision of maps, and so forth. After about seven months a vacancy as assistant valuer occurred, and I was promoted to that office.

I should just like to relieve "Property Owner's" mind on the subject of "Valuation Assistant's" remarks. I am afraid the latter's enthusiasm has carried him away somewhat, as my experience is that fully fledged valuers are not created from assistants of six months' standing who have previously been draughtsmen. I think, if the facts were known, "Valuation Assistant" is really working under the supervision of some superior officer. In any case, the district valuer, who has full control of the whole of the staff in his district, is responsible for, and signs the whole of, the provisional valuations sent out, and no doubt he would be consulted on matters of importance.

I cannot agree with "Site Value" when he intimates that the department is in a state of chaos and unrest. Speaking for our own districts, the staff make quite a happy family, working expeditiously and in unison. Each member is given to understand when appointed that his future depends a good deal upon himself, and consequently each one is putting his best into the work to justify that future being a bright one. The district valuers and valuers I have always found very kind and ever ready to help and instruct the younger members.

Has "Site Value" ever attended a staff dinner? If so he must have noticed that enthusiasm in the work is a prevailing feature.

In view of these facts, I think "Site Value" might conveniently limit his remarks to his own district, and not embrace the whole department, as I can quite believe that if there are malcontents among the staff of which he is a member all will not be smooth sailing. I should also have thought that anyone would have ascertained the nature of valuation work before joining a valuation staff, instead of taking office and then expecting to get experience in civil engineering and the like.

Finally, I agree that many of the valuers had not seen a provisional valuation before appointment, for the simple reason that provisional valuations, as now understood, were only inaugurated with the working of the Act.—Yours, &c.,

"Mancunian."

March 22, 1913.

Town Planning for Richmond (Surrey).—Mr. Thomas Adams, an inspector of the Local Government Board, held an enquiry on Wednesday of last week into the council's application for authority to prepare a town-planning scheme. Mr. Brierley, the borough surveyor, gave evidence at considerable length, explaining the scheme in detail.

Bournemouth's New Library.—The new central library which has been erected by the Public Libraries Committee at Bournemouth was on Wednesday formally opened by the mayor, Alderman H. S. McCalmont Hill. The library is a handsome and commodious building, and adjoins the new Municipal College at Lansdown, which is to be opened in May next by the president of the Board of Education.

London Water Contaminated.—In the Hampstead district uneasiness was created last week when it was discovered that the public water supply had become in some way contaminated. The taste and smell were such that the water became undrinkable. The Metropolitan Water Board on Wednesday issued a statement explaining that the disagreeable taste was due to the sudden development of algæ, which was traced to a few filter beds, and is attributed to the unusual weather. It is hoped that the trouble has now been entirely overcome.

Law Notes.

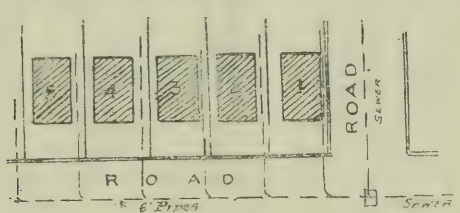
Edited by J. B. REIGNIER CONDER, 11 Old Jewry Chambers, E.C., Solicitor of the Supreme Court.

The Editor will be pleased to answer any questions affecting the practice of engineers and surveyors to local authorities. Queries (which should be written legibly on foolscap paper, one side only) should be addressed to "The Law Editor," at the office of The Surveyor, *accompanied by the writer's name and address, but correspondents who do not wish their names to be published should also furnish a "nom de plume." Where necessary, copies of local Acts or documents referred to should be enclosed.* **All explanatory diagrams must be drawn and lettered in BLACK ink only, and in such style as to be fit for direct reproduction—i.e., without re-drawing or amendment.** *Unless these conditions are complied with we cannot undertake to reply to queries.*

QUERIES AND REPLIES.

In order to avoid confusion querists are requested to use distinctive words as noms de plume. *The letter* X, *combinations such as* X.Y.Z., *and words such as* "engineer" *and* "surveyor," *should never be used.*

Combined Drainage.—"S. A. R." writes: The drainage of a row of houses is as shown on the accompanying sketch, the pipe in the road having been extended gradually by the builder as each house was built. This pipe is now broken, having been laid too near the surface of the road. (*a*) Is this pipe now a public sewer, and must it therefore be repaired by the council? (*b*) If the Private Street Works Act, 1892, is put into force in this road can a new line of pipes to replace the broken ones be



included, seeing that the street is not "sewered to the satisfaction of the urban authority"? (*c*) Had the council power to require that the drain to the first house should be properly protected so as to avoid being broken by traffic? (*d*) Assuming that the pipes are now a sewer, could the council have prevented the drain of house No. 2 being connected to the drain of house No. 1 on the grounds that these pipes would then become a sewer and probably collapse through being insufficiently protected?

(*a*) Yes. If, however, Part III. of the Public Health Acts Amendment Act, 1890, has been adopted, and the houses belong to different owners, and an actual nuisance occurs the council can recover the cost of the necessary works from the owners under sec. 19 of that Act. (*b*) Yes, unless a sufficient time has elapsed since the construction of the "sewer" to raise a presumption that the council were satisfied with it when constructed. What is a sufficient time depends upon circumstances, and may vary in different cases. See *Walthamstow Local Board* v. *Staines* (L.R. 1891, 2 ch., 606). (*c*) Under sec. 25 of the Public Health Act, 1875, the council could have required the builder to construct a separate drain for each house at such level as on the report of their surveyor appeared necessary for the effectual drainage of such house. See *Woodford U.D.C.* v. *Stark* (18 T.L.R., 439). The council could not, however, have compelled him to construct a sewer or pipe in the street to connect with the house drains unless there was any by-law in force giving them power to do so. See *Regina* v. *Tynemouth R.D.C.* (1896, 2 Q.B., 451). But they might have sewered the street at the expense of the frontagers under sec. 150 of the Act of 1875 or under the Private Street Works Act, 1892, if in force. (*d*) Under sec. 25 of the Act of 1875, the council could have required him to provide a separate drain for house No. 2 emptying direct into any sewer with which the council were entitled to use within 100ft., or, failing a sewer within that distance, into such cesspool or other place as they directed. This would have enabled them to prevent his connecting the drain of No. 2 with the drain of No. 1.

Conversion of Privies into Water-closets.—"T. P." writes: In May, 1909, my council adopted Parts 2, 3, 4, 5 and 6 of the Public Health Act Amendment Act, 1907, and shortly afterwards obtained the Local Government Board's sanction to a loan to be applied in part payment of the cost of conversion of privy midden closets to water-closets. Since then my council have been proceeding quietly with these conversions by arrangement with the owners, the council generally defraying the cost of the necessary draining to connect the water-closets with the main sewer. But up to the present time the council have not done the whole work of draining and conversion. Recently my council requested an owner of a row of cottages to convert his privy midden closets (of which there was one closet to every two houses, with a common open yard) into water closets, the council, as usual, offering to defray the cost of the draining. This the owner refused to do, contending that he was entitled to one half of the total cost of conversions and draining. My council thereupon ordered their inspector to serve notice for conversion under sec. 36 of the Public Health Act, 1875, alleging that inasmuch as sec. 36 of the Public Health Act, 1875, is not repealed, they had a right to proceed under the Acts of either 1875 or 1907. Of course, I expressed my opinion that, having adopted Part 3 of the 1907 Act, sec. 36 of the 1875 Act was practically repealed as far as my council were concerned, and they have instructed me to obtain your opinion on the following points: (1) Have my council the option of proceeding under sec. 36 of the Public Health Act, 1875, for the conversion of existing closets into water-closets, and charging the owners with the whole cost, after having adopted Part 3 of the 1907 Act? (2) Does the one half of the expenses to be borne by the local authority under the 1907 Act include both the cost of conversion and draining and connecting with the authority's main sewer? (3) Does sec. 39 of the Public Health Act Amendment Act, 1907, override sec. 36 of the Public Health Act, 1875, in districts where the local authority have adopted the 1907 Act? (4) Can the council compel the provision of one water-closet for each house?

(1 and 3) It would appear that the council have this option. Sec. 11 of the Act of 1907 provides that all powers given to a local authority under that Act shall be deemed to be in addition to and not in derogation of any other powers conferred upon such local authority by any Act of Parliament. And sec. 2 provides that the Act of 1907 shall be construed as one with the Public Health Acts. (2) Subsection (4) of sec. 39 of the Act of 1907 refers to the "work of alteration" only—*i.e.*, presumably the conversion of the closet accommodation itself. Apparently the construction of the necessary drain could be enforced under sec. 23 of the Act of 1875. (4) Yes, I think so.

By-laws: Drains under Buildings.—"Hotel de Ville" writes: I forward an extract from the by-laws of the Manchester Corporation, and shall be pleased if you will give me your opinion on the following points: (1) Can the local authority insist on cast-iron drains being laid on a bed of concrete where such drains are inside a building, and where the ground upon which they are laid is solid? (2) If they cannot, and where the owner has written on the approved plans, at their request, that such drains will be laid on concrete, can they insist upon it in face of the by-law? (3) Does not the last paragraph mean that suitable support shall be given to cast-iron drains where the ground is not solid?

[Extract from by-laws.]

Drains under Buildings.—He shall not construct any such drain so as to pass under any building, except in any case where any other mode of construction may be impracticable, and in that case he shall cause such drain, if constructed otherwise than of iron pipes, to be so laid in the ground that there shall be a distance of at least 12-in between the top of such drain at its highest point and the surface of the ground under such building. He shall also cause such drain to be laid in a direct line for the whole distance beneath such building, and, if constructed otherwise than of iron pipes, to be completely embedded in and covered with good concrete, at least 6 in. thick, all round.

Drains to be laid in Concrete.—If he shall construct such drain of iron pipe, he shall cause such drain to be properly supported on suitable and sufficient piers or other suitable and sufficient supports, or to be laid in a bed of good concrete.

1. Under the last clause of the by-law an iron main must be either (*a*) supported on suitable and sufficient piers or other supports, or (*b*) laid in concrete. I do not think the authority can insist, under this clause, on an iron drain being laid in concrete provided it is supported on suitable and sufficient piers or other supports. 2. In my opinion they cannot. 3. There is no mention of the ground being solid, and the clause means, I think, that unless the drain is laid in concrete it must be supported on piers or other suitable and sufficient supports whether the ground is solid or not

House Drainage: Premises without the District: Subsequent Inclusion in District.—"Veras" writes: A few years ago the drainage of several houses outside the borough boundary was taken into the borough sewers. A 6-in. connecting pipe was laid by the builder, and he entered into an agreement to keep the pipe in order and pay a drainage rate. The boundary having been extended, those houses are now within the urban district area. They belong to several owners, and the connecting pipe before mentioned being very flat, is frequently choked, causing a nuisance. (*a*) Is the agreement still in force so far as it applies to keeping the pipe in order, or did it

The Surveyor
And Municipal and County Engineer.

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lapse when the houses came into the borough eight years ago? The special drainage rate has not since been collected, the property now paying full rates. (*b*) If the council cannot require the builder to clear the obstruction under the agreement, can the pipe be termed a combined drain and the owners required to do what is necessary to abate the nuisance? (*c*) Can the provisions of the Private Street Works Act be put into force with respect to a new sewer to replace this choked 6-in. pipe?

(*a*) This is rather a difficult question, and I can find no direct authority on the point. I do not think the agreement *necessarily* lapsed as against the builder on the extension of the borough boundary. See *Butt v. Snow* (89 L. T., 302). But it may have become void or voidable by the action of the council in discontinuing the special drainage rate which I gather was less than the "full rates" since charged), or by other circumstances. (*b*) If Part III. of the Public Health Acts Amendment Act, 1890, has been adopted, then, in the event of an actual nuisance arising, the council could recover the expense of the necessary works from the owners. (*c*) Inasmuch as the "sewer" came into the borough 8 years ago, I think it would be presumed that the council were satisfied with it at that time, in the absence of special circumstances, and in that case they could not charge the frontagers with the cost of a new sewer.

Nuisance: Privy.—"W. H. R." writes: I shall be glad if you will please answer the following queries: (1) In the case of a privy being a nuisance (leaking walls, &c.), under which section and Act should the council serve notice to enforce the conversion or provision of a water-closet in the existing building, if—(*a*) The building is of a reasonable size (say 5 ft. by 2 ft. 6 in.), and is in a good structural condition; (*b*) the building is dilapidated, but can be rebuilt, and is large enough; (*c*) the privy is dilapidated and too small. (2) If a notice under sec. 94 of the Public Health Act, 1875, is suitable in any of the above cases, will you please indicate on enclosed form how the requirements should be specified? (3) What is meant by the word "alteration" in sec. 39, sub-section (3) of the Public Health Act Amendment Act, 1907?

(1) Under sec. 94 of the Public Health Act, 1875, the local authority can require the execution of such works only as are necessary to abate the nuisance. It would appear therefore that under this section they cannot enforce the conversion of a privy into a water-closet if the nuisance can be otherwise abated. If, however, the surveyor reports that a given house is "without a sufficient water-closet, earth-closet, or privy," the authority can, under sec. 36 (whether a nuisance exists or not), require the substitution of a water-closet in place of an existing privy (*Nicholl v. Epping Urban District Council*, 1899, 1 Ch., 843). They cannot, however, specify any particular kind of water-closet (*Robinson v. Sunderland Corporation*, 62 J. P., 216). (2) If notice is given under sec. 94 it should specify the works necessary for the abatement of the nuisance in each case. What these works are is a question for the surveyor. A notice under sec. 36 should require the provision of a "sufficient water-closet." (3) The expression in the sub-section is "the alteration of any existing closet accommodation *in pursuance of this section*." This evidently refers to the alteration provided for by sub-section (4) *viz.*: the alteration of any existing closet accommodation (other than a water-closet or a slop-closet) so as to be converted into a water-closet or slop-closet.

Private Streets: Different Levels.—"F. H." writes: I should be pleased to have your observation on the following matter. Park-avenue is a private street recently made up by the council under sec. 150 of the Public Health Act, 1875. The carriageway is made up in tar-macadam, the finished height of which is about 4 in. above the carriageway level of Church-avenue, another private street which crosses it at right angles, and in which the foundation only to carriageway has been laid. Under these circumstances it has been found advisable to prepare an approach in Church-avenue to the carriageway of Park-avenue. Who will be responsible for the payment of the expense incurred in the preparation of the approach?

It has been decided that under the Act of 1875 the authority cannot charge frontagers with the expense of altering the level of a street, where such alteration is made merely for the purpose of bringing it into conformity with another street (*Carey v. Kingston-upon-Hull Local Board*, 29 J.P., 116). It would appear therefore that it is (to say the least) doubtful whether the cost of the proposed approaches could be recovered from the frontagers in this case. I assume that the Private Street Works Act, 1892, has not been adopted. Sec. 9 of that Act expressly empowers the authority (in districts where it has been adopted) to include any works necessary for bringing a street, as regards level, into conformity with any other streets.

Appointment of Health Visitors.—"Ynys" writes: A letter has been received by my council from the secretary of the local nursing association asking if their nurses can be appointed lady health visitors, and suggesting that an annual sum be paid to the said association for such services. Will you kindly advise (*a*) whether my council (urban), having a population of about 4,800, can appoint such health visitors and give grants to the nursing association? (*b*) If so, whether the Local Government Board have to sanction such appointment, and (*c*) under what section of the Public Health Acts or otherwise can such grants be made?

I cannot find that there is any power under the Public Health Acts or otherwise to appoint "Health Visitors" *eo nomine*. If and when the Local Government Board make regulations with respect to a district (or a part thereof) under sec. 134 of the Public Health Act, 1875, the local authority of the district are required by sec. 136 to appoint and pay "medical or other officers or persons" for superintending, executing, or aiding the execution of such regulations. Possibly "health visitors" might be appointed under the latter section if and when any regulations under sec. 131 are in force in a district. But such regulations can only be made when there is a formidable epidemic, endemic or infectious disease, or the threat thereof.

Highway Ditches.—"C. D. E." writes: A and B are the occupiers of land through which passes a ditch or watercourse into which the water from the public highway discharges. This ditch has got partially blocked or silted up, and prevents the water freely flowing away. Can the district council compel the owner or occupier to cleanse out the ditch?

If the ditch is in such a state as to be a nuisance or injurious to health, the owner can be proceeded against under secs. 91 *et seq.* of the Public Health Act, 1875. If it causes an obstruction or nuisance to passengers on the highway the owner can be indicted at common law. Even if the circumstances are not such as to warrant proceedings, the council could themselves cleanse the ditch under sec. 67 of the Highway Act, 1835, compensating the owner or occupier for any damage. But, before doing so, they should give notice to the occupier to cleanse, and only exercise their powers on his failing to comply with the notice. (See Pratt & Mackenzie's "Law of Highways," 15th Edition, p. 239.)

Public Baths.—"H. W." writes: I shall be glad if you will kindly inform me if it is competent for a local authority in connection with public baths provided out of the rates—(1) To fix certain times for ladies and girls from schools to bathe, to the exclusion of other females in the town during such hours as may be fixed for scholars, &c.? (2) To fix certain times for boys from schools to bathe, to the exclusion of other males in the town during such hours as may be fixed for the said boys.

Under sec. 33 of the Baths and Washhouses Act, 1846, the management and control of public baths are in the hands of the local authority. It would appear therefore that it is competent for them to fix hours as stated.

We have to draw the attention of querists to the directions laid down for their guidance in regard to the preparation of diagrams. Rough sketches obviously cannot be made use of, and we should be obliged if correspondents would therefore send only carefully-prepared drawings, preferably about 6 in. in width, and without colouring or wash of any description. Failure to observe these rules will involve the risk of queries remaining unanswered.

Assistants' and Students' Section.

Conducted by SYDNEY G. TURNER, assoc.m.inst.c.e.

All communications in regard to this page must be addressed to The Editor, St. Bride's House, 24 Bride-lane, Fleet-street, E.C. *Envelopes must be marked "Assistants' Section" in the top left-hand corner. Correspondents are invited to submit questions for consideration and answers to the questions which appear. For the contributions considered to be the most meritorious, one or more premiums in books will be awarded monthly. Diagrams must be drawn to scale on separate sheets, ready for reproduction.*

QUESTIONS.

This week answers are invited to the following questions:—

314. Concrete Roof.—It is desired to construct a semi-circular barrel roof in concrete of 50-ft. span, reinforced with expanded metal. Show the dimensions of the supporting walls, which are to be 15 ft. high from the top of the footings. The roof is to be ribbed with an extra thickness of concrete over the piers. (H. V. A., *Clapton.*)

315. Surveying: Theodolite.—If the graduated plate of a theodolite is not correctly centred, how may the error arising therefrom be eliminated? Prove that the method adopted does eliminate the error referred to. (T. W. P. *Bexhill-on-Sea.*)

317. Strength of Beam.—A rolled steel I beam of British Standard Section, 12 in. by 6 in., and weighing 54 lb. per foot, is capable of sustaining a load of 15 tons uniformly distributed over a span of 20 ft. What would be the safe load uniformly distributed which could be placed on either half of the lower flange? ("Pupil.")

318. Chimney Design.—Design a chimney 120 ft. high above ground, internal diameter of flue at top 4 ft. 6 in. Also design for foundations. ("Enquirer.")

319. Hydraulics.—Fig. 1 illustrates a cast-iron pipe line leading from a reservoir.

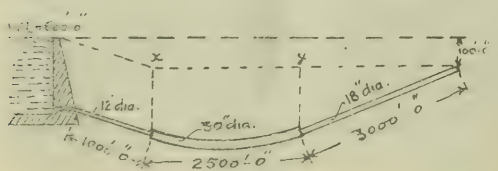


Fig. 1.

With the data given (1) calculate the discharge at the extremity of the pipe: (2) find the diameter of a single line to displace the system shown; (3) find the piezometric heights *x* and *y* at the junctions of the pipes. (E. A. B., *Leicester.*)

320. Water Tower Design.—Design a small water tower to hold 8,000 gallons, top water level being 30 ft. above ground level, tank of cast-iron, framework of tower of steel. Show full calculations, including wind pressure allowances. (W. H. B. *Bocking.*)

[The Editor is at all times glad to hear from readers who desire to submit questions regarding matters of general interest, points of daily practice, &c., for insertion in the "Assistants' and Students' Section." Questions which are published are taken into consideration, as well as other matter, in awarding the Monthly Premium.]

REPLIES TO QUESTIONS.

311. Surveying.—How would you draw a "give and take" line to an irregular boundary to facilitate taking out an area? (C. F. H., *Lincoln.*)

The following additional reply has been received since our last issue:—

A simple method of constructing a "give and take" line for irregular boundaries when calculating areas, &c., is as follows:—

The curved line (1, 2, 3, 4, 5, 6, 7) is the boundary. Divide this into any number of parts (not necessarily equal), and number them consecutively as 1 to 7. Set up a base AB through point 1, and approximately at right angles to the boundary line. Set the parallel rule through 1 and 3, and run back to 2, giving 2' on the base line, then 2' and 4 and run back to 3, giving 3' on base line. Continue this until the last point but one is reached, in this case 5' and 7, run back to 6 giving 6' on base line. Join 6' and 7 and this will give the "give and take" line required.

In adopting this method the greater number of

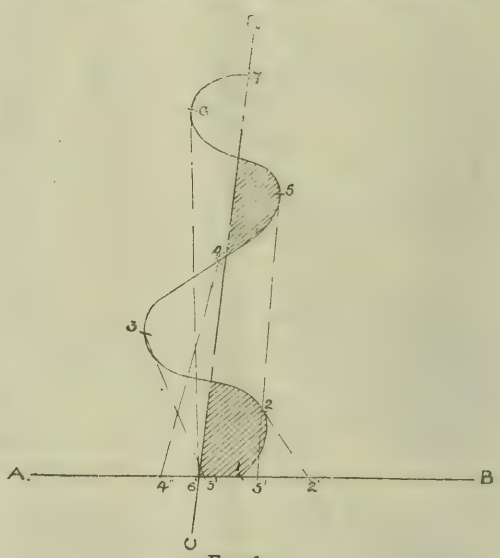


Fig. 1.

points taken the more accurate will be the result; and points should always be fixed at all extremities of curves or angles. (E. S. M., *Luton.*)

313. Mechanical Haulage.—What is the most suitable plant for hauling road metal over weak country roads by mechanical traction? How does the cost compare with horse haulage? ("Ehu.")

Mechanical traction, generally, for use by municipal and road authorities, has, in recent years, been the subject of considerable discussion, and the experiences of surveyors and others in various parts of the country can be taken as forming the only reliable basis on which the subject can be reasonably considered.

From the results of the practical workings of various types of plant some of the details for consideration are so influenced by the "local conditions" of the particular district that the conclusions to be derived must of necessity be somewhat conflicting; but the opinion is so uniformly expressed that comparatively long distances, full loads, and easy loading and tipping are essential to financial success, that these conditions at once become indispensable, and may therefore be assumed in the consideration of the present question.

The type of vehicle or other plant now becomes the chief consideration, and the following comparative figures taken from a recent report upon the question may with advantage be quoted:—

	s.	d.	
The heavy traction engine and wagon showed a saving over horse haulage of ...	1	11	per ton.
The steam motor wagon showed a saving over horse haulage of	0	6	,, ,,
The steam traction and trailer showed a saving over horse haulage of	1	7	,, ,,
The rubber tyred petrol wagon showed a saving over horse haulage of	1	3	,, ,,

In all these cases the figures include the total working costs as well as a liberal allowance for depreciation, varying with the type of plant considered, and as the material was quickly loaded and tipped, and the distances traversed by each vehicle similar—viz., an average of 5 miles—these figures are of considerable comparative value.

In considering the type of plant best adapted

for use over soft country roads, at the same time having regard to the financial aspect, a 3-ton rubber-tyred petrol wagon will probably prove to be most advantageous. The resilience of the rubber tyres reduces the impact due to a heavy load moving rapidly over an uneven surface and the rubber tyres also enable the motor to travel during weather conditions in which the iron-shod wheels would seriously damage the road surface.

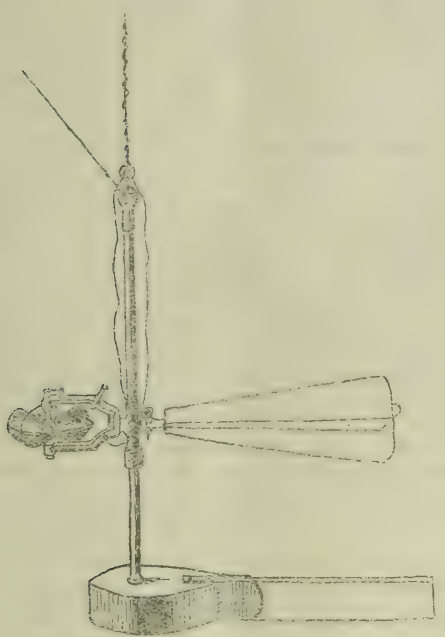
The cost of a motor of this description will be about £750, and it will travel from 50 miles to 60 miles per day; the working expenses amount to £1 per day, which, with an allowance of 20 per cent for depreciation makes a total daily cost of £1 10s. 9d. Assuming the distance of a single journey to be 4 miles and the load 3 tons, the total weight of material hauled will be 21 tons, and will cost 1s. 3d. per ton.

This type of wagon is strongly recommended by the county surveyor of Kent, but for a rural district the capital outlay may be a matter of considerable importance, the number of vehicles required being proportional to the total haulage per annum.

The question of payment, however, can be easily arranged over a period of, say, five years, and as a depreciation of 20 per cent is provided for in the figures before given, the wagons are therefore purchased within that period. (D. G. B., *Darlington.*)

316. Hydraulics. Describe a method of measuring the quantity of water flowing in a wide river. ("Enquirer.")

In gauging the flow of water in a wide river, great care must be exercised in the selection of the position for observation. A straight reach should be chosen in order that the flow may not be influenced



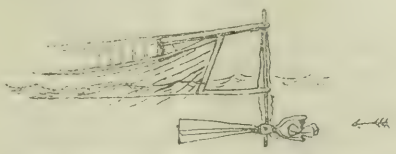
Current Meter.

by eddying currents due to curvature of the course, and the observations should be taken on a calm day in order that the velocity may not be unduly accelerated or retarded by the effect of the wind.

Having determined upon a suitable position and time, a length of the river should be measured and marked on each bank by poles, the imaginary line between each pair being at right angles to the flow of the river. An accurate cross-section should now be taken opposite each pair of poles, which can be done by systematic soundings, and the mean sectional area of the length under observation obtained.

It is now necessary to obtain the mean velocity over the whole cross-section, and this must be performed by observation either by use of floats or by a current meter.

Various types of floats are advocated by different authorities, of which, perhaps, the double float and the rod float give the most accurate results; the former consists of a thin flat surface float sustaining a larger cylindrical float carefully weighted and attached to the surface float by a thin wire. By this means the sub-surface velocities can be obtained at any required depth.



Method of Using Current Meter.

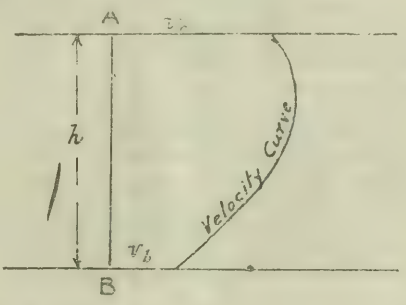
The rod float consists of a light wooden rod weighted at one end, and provided at the top with a flat cork float through which the rod is thrust a few inches. In the same manner as with the double float, by varying the lengths of the rod the velocities at different depths can be obtained, and it is estimated that with this type of float the velocity at ·94 of the depth gives the true mean velocity past any given vertical.

From observations made by Colonel A. Cunningham, the mean velocity in a vertical line may be found by the following formula:—

$$V_m = \tfrac{1}{2}(V_{\cdot 211H} + V_{\cdot 789H}).$$

where V_m = mean velocity, and $V_{\cdot 211H}$ and $V_{\cdot 789H}$ are the velocities at ·211 and ·789 of the depth below the surface. By means of double floats at these two points attached to a surface float the mean velocity may be found by a single observation.

It is generally accepted that the velocity in a vertical line takes the form of a parabola.



If, on a vertical line AB, representing the depth of the stream, the values of V are set off horizontally as ascertained at varying depths, a parabolic curve is obtained, and can be termed the vertical velocity curve for the section considered.

By the following formula the mean velocity can be obtained from observation of the surface and bottom velocities:—

$$V_m = \tfrac{1}{3}(2\,V_o + V_{\quad}).$$

Another formula has been devised by Bazin from which the mean velocity is obtained from observation of the surface velocity only:—

$$V_m = \frac{C}{C + 25\cdot4}\,V_o.$$

where V_m = mean velocity.
V_o = greatest surface velocity.
C = a constant corresponding to the hydraulic mean depth m,

m	= 10	c = ·75.
	= 20	= ·76.
	= 50	= ·78.
	= ∞	= ·79.

In all cases of observation by means of floats the results obtained are not so accurate as obtained with the use of a current meter.

The best instrument of this description is a modification of the invention by Prof. Harlacher, which is essentially a meter of the anemometer type. By ingenious gearing and electrical contact the instrument will record the number of revolutions of the wheel within a given time, and from a table of rating supplied by the makers the velocity of the stream, usually in feet per second, can be at once ascertained at any required depth.

The accompanying sketches show the type of instrument, and a convenient method of taking observations with it.

Having obtained the mean velocity of the stream

and the sectional area under observation, it now becomes a matter of simple calculation to find the flow of the river. (D. G. B., *Darlington.*)

The discharge of a wide river can be calculated from the area of the cross-section of the river and the velocity of flow.

The area of cross-section of the river is found from careful soundings taken across the river at equal intervals at some convenient point, and the width of the river at the same place.

The average velocity of flow is easily obtained by the aid of a small water meter, which consists of a small paddle and recording gear. It is fixed to the end of a pole, and held in the water at different points, the average result being taken of a number of trials.

An alternative method of finding the average velocity of flow is to make the necessary measurements to be substituted in the formula:—

$$V = \sqrt{\frac{KD}{S}}$$

in which

V = Mean velocity of flow in feet per second,

D = Mean hydraulic depth,

= Area of cross-section ÷ wetted perimeter (obtained from drawing of cross-section of river),

S = Slope, or length of river to a fall of 1,

K = A coefficient, depending on the composition of the river bed (see table below).

Description of river bed.	Values of K for velocities.	
	Less than 4 ft. per sec.	More than 4 ft. per sec.
Earth	7,200	6,800
Shingle	6,400	5,900
Rough, with boulders	5,300	4,700

In very large rivers the description of the bed affects the result so slightly that it may be practically neglected, and K assumed to have a value between 8,500 and 9,000.

Having found the area of cross-section of the river at a certain point, and also the average velocity of flow of the river—by either of the methods above explained—the quantity of water flowing in the river is obtained from the equation—

$$Q = AV,$$

where Q = Quantity of water flowing in cubic feet per second,

V = Mean velocity of flow in feet per second.

A = Area of cross-section in square feet.

(T. W. P., *Bexhill-on-Sea.*)

Hythe's Sea Wall: Serious Damage.—Hythe Town Council were informed by an expert on Wednesday that, as the result of the damage done to the sea wall in last Saturday's gale, the entire length of 900 ft. would have to be rebuilt at a probable cost of £10,000. The council decided that plans and specifications of the new wall should be prepared.

Institution of Civil Engineers.—On Tuesday evening next, at a meeting of the institution, to be held at the Institution of Mechanical Engineers, papers on "The Yield of Various Catchment Areas in Scotland," by Mr. William Carstairs Reid, and "Measurement of the Flow of the River Derwent, Derby-shire" by Mr. Edward Sandeman, M.INST.C.E., will be read.

Waterproofing of Cement.—We are requested to state that should any of our readers have friends in France, Belgium or Holland (or in the colonies of those countries), Messrs. Kerner-Greenwood & Co., King's Lynn, will be pleased to forward a thirty-page booklet on the powder Pudlo, used for the waterproofing of cement, the book having been translated into French and Dutch.

Urban District Councils' Powers.—In the House of Commons on Wednesday the Prime Minister stated that the Government could not undertake special legislation to enact that urban district councils with a like population shall have similar powers conferred upon them to those recently conferred on boroughs. The question would be considered with all proposals for conferring powers on local authorities.

LOCAL GOVERNMENT BOARD INQUIRIES.

The Editor invites the co-operation of Surveyor *readers with a view to making the information given under this head as complete and accurate as possible.*

INQUIRIES HELD.

Barry (Glam.) U.D.C. (March 20th. Mr. H. S. Stuart).—£1,250 for the erection of shelters at Whitmore Bay, Barry Island.—Councillor Manaton gave evidence in support of the application. There was no opposition.

Burton T.C. (March 20th. Mr. Edgar Dudley).—£1 250 for street improvement.—The town clerk (Mr. J. B. Chapman) stated that for many years the corporation had purchased property in Station-street, one of the principal shopping and business thoroughfares, in order to carry out the gradual widening of the street. The corporation now wished to provide the purchase money for the frontage of an old property consisting of four shops recently pulled down, and they were in negotiation with the owners of a further frontage which would almost complete the widening scheme.

Chippenham T.C. (March 20th. Mr. H. Ascough Chapman).—£1,000 for the purpose of purchasing two blocks of properties to enable the council to widen Blind-lane, which is in proximity to the new cattle market.—The town clerk, Mr. F. H. Phillips, said that it was proposed to pay £350 for one block and £300 for another. Councillor Small, who opposed, said the property was in such a state that it was not worth more than £400, but if the council wished to do away with those slums it should make a further application for power to build cottages for the sixty-eight persons who would be dispossessed if the Local Government Board acceded to the application. He suggested a modified scheme by pulling down two houses at the junction of Blind-lane and Factory-lane. The mayor said the housing question would be settled when the enlargement of the borough, which was now under consideration, was carried out.

Leyton U.D.C. (March 4th. Mr. Edgar Dudley).—£6,700 for the purchase of land for improvement purposes.—It was stated that the council proposed allocating the land (to be purchased for £265 an acre) as follows: Street improvements, ¾ acre, at £533 per acre: fire brigade purposes, 2½ acres, at £500; works depot, 7 acres, at £400; open-air swimming bath, 1 acre, £400; playing fields, 7 acres, at £140; and allotments 7 acres, at £131. The land was freehold, and without restrictions of any kind. It was stated that the street improvements provided for the widening of Church-road alongside the land to a minimum width of 50 ft. The land devoted to fire brigade purposes would be utilised for the erection of a fire station, capable of housing two first-aid appliances, and for the erection of firemen's cottages, and the remainder would be used for a drill ground. The swimming bath would be an open-air one, and would cost about £2,500. As regards the works depot, at the present time the stores were scattered about on eight or ten different pieces of land in various parts of the district, and the proposed depot would permit of them being collected together at one spot, under the control of the storekeeper.

Neath T.C. (March 11th. Mr. E. Leonard).—£15,700 for the erection of workmen's dwellings.—The town clerk, Mr. Edwin C. Curtis, outlined the scheme, and gave particulars of the present indebtedness of the corporation, and of the present position of the housing problem in the borough. Mr. D. M. Jenkins, borough engineer, explained the plans, and gave general evidence in relation to the scheme. The number of houses provided for is ninety-three, this being additional to sixty-one built under a previous sanction. The new houses will be in two classes, the one containing living room, scullery and pantry on the ground floor, with two bedrooms on the first floor, and the other consisting of living room, scullery (with bath in connection with combination range) and pantry on ground floor, and three bedrooms on first floor. The proposed rentals are 4s. 6d. and 5s. 3d. per week respectively, with 6d. extra for end houses in blocks. The houses will be built in blocks of from four to eight each. The roads and sewers have already been constructed under a previous sanction, and the land acquired at £325 per acre. The borough engineer explained that the object of the scheme is to remedy the overcrowding in the borough, and to make room for the occupiers of insanitary houses. There are at present in hand 133 applica-

tions for the first vacancies in the existing houses, and of the applicants about 50 per cent live in apartments and lodgings, while a substantial number live in insanitary dwellings. Private enterprise has not coped with the demand for cheap houses for the lower-paid labourers. The working-class dwellings privately built are of the six-roomed type, usually with a bath, and let at rentals of from 6s. 6d. to 10s. per week, the present tendency being to the higher figure. During the past ten years the total number of houses built in the borough is 760. Mr. W. Bowen Davies, sanitary inspector, gave evidence as to present housing conditions in the borough. He stated that there were 114 houses in the older parts of the borough incapable of being rendered fit for habitation, and for a number of which closing orders had been obtained. The rents of these ranged from 2s. 3d. to 4s. per week. Particulars of overcrowding were also given. Alderman Phillips spoke as to the objects of the corporation in promoting the scheme, and testified to the great demand for houses within the reach of the labouring classes.

St. Helens T.C. (March 18th. Mr. M. K. North).—£430 for works of street improvement.—Mr. W. H. Andrew (town clerk) said that by the local Act churches and chapels were not charged for the sewering and paving of the streets alongside their buildings, and the £430 had been expended for those purposes. Alderman Foote (chairman of the Finance Committee) objected to the holding of an inquiry in respect of so small a sum, but the town clerk replied that it was rendered necessary by Act of Parliament.

Sedgley U.D.C. (March 20th. Mr. M. K. North).—£5,600 for the purposes of the gas undertaking.—The clerk (Mr. J. R. Knight) stated that the present annual output of the gasworks was 40,000,000 cub. ft., which was the maximum. It was contemplated to demolish the retort house and bench, coal stores and manager's house, and to provide five arches—three to be completed forthwith and two for future extension—with six retorts to each arch, at a cost of £2,195. The estimated capacity of the three arches was 43,000,000 cub. ft. per annum on a basis of 12 000 cub. ft. per retort per day, but it was believed that, having regard to the quality of the coal now being used, these figures could be increased considerably. It was also proposed to provide a new retort house at a cost of £975; mechanical coal-handling plant, engine, dynamos and motors, £1,005; charging and discharging machines, £775; coal stores, £500, and exhauster, £150. Of the old loan on the gas undertaking raised in 1883 there was now outstanding a final instalment of only £556, which became due in May next. The present charges for gas in the district were 3s. per 1 000 cub. ft. by ordinary meters, and 3s. 7½d. by slot meters.—Particulars of the new plant were given by the gasworks manager (Mr. J. Brettle).

APPLICATIONS FOR LOANS.

Acton U.D.C.—£4,995 for re-surfacing certain roads with tar-macadam.

Basingstoke T.C.—£2,000 for the purchase of land for a fire station.

Bridlington T.C.—£1,340 for the erection of cottages.

Bucks C.C.—£434 for a police cottage at Newport Pagnell.

Itchen U.D.C.—£530 for the purchase of a site for an isolation hospital.

Ossett T.C.—£8,124 for the Spa sewage works.

Paignton U.D.C.—£130 for a new water main.

Radcliffe U.D.C.—£5,000 towards the cost of widening Church-street.

St. Helens T.C.—£2,500 for cemetery extension, £600 for the purchase of boats at Taylor Park, and £600 for a new conservatory at Victoria Park.

Southend T.C.—£1,100 for laying a storm-water sewer.

Whitley Bay U.D.C.—£9,700 for the provision of workmen's dwellings.

Wilts C.C.—£1,000 for alterations at the police station, Old Swindon, and £1,200 for sanatorium accommodation.

LOANS SANCTIONED.

Bideford U.D.C.—£18,409 for the water supply scheme. The board disallowed an application for a loan of £891 for scraping the mains.

Chislehurst U.D.C.—£500 for the improvement of road surfaces.

Hillsborough (Ireland) R.D.C.—£12,240 for the provision of labourers' cottages.

Ossett T.C.—£2,100 excess expenditure in the erection of the town hall.

Watford U.D.C.—£350 for the purchase of a steam roller.

FORTHCOMING INQUIRIES.

	£
MARCH.	
31.—**Wellingborough.** For works of surface-water drainage (Mr. R. H. Bicknell)	1,700
APRIL.	
1.—**Blyth.** For road improvement purposes (Mr. R. H. Bicknell)	2,000
1.—**Brixham.** For works of sewerage (Mr. H. R. Hooper)	650
1.—**Caerphilly.** For the provision of a recreation ground (Mr. Edgar Dudley) ...	900
1.—**Colwyn Bay.** For electricity, gas, and cemetery purposes (Major C. E. Norton)	12,150
1.—**East Dereham.** For the purchase of land for waterworks (Mr. Courtenay Clifton)	1,500
1.—**East Westmorland.** For water supply purposes (Mr. A. G. Drury)	1,300
1.—**Nottingham.** For the purchase of motor vehicles and depot extension (Mr. R. H. Bicknell)	5,850
1.—**Rhyl.** For the provision of lavatories and screening apparatus at outfall, and promenade extension (Mr. A. W. Brightmore)	6,280
1.—**Rochdale.** For works of street improvement (Mr. H. Ascough Chapman) ...	13,260
1.—**Stockport.** For works of sewage disposal (Mr. R. G. Hetherington)	61,000
1.—**Stroud.** For burial ground purposes (Mr. M. K. North)...	3,500
1.—**Weymouth.** For harbour improvement works (Mr. H. Shelford Bidwell) ...	—
2.—**Blackburn.** For public hall purposes (Mr. Edward Leonard)	40,000
2.—**Bolton.** For works of street improvement (Mr. H. Ascough Chapman) ...	4,000
2.—**Bridport.** For works of sewerage (Mr. H. Shelford Bidwell)	600
2.—**Cirencester.** For street widening purposes (Mr. Edgar Dudley)	1,250
2.—**Conway.** For works of water supply (Major C. E. Norton)	1,379
2.—**Grimsby.** For road improvement works (Major J. Stewart)	1,287
2.—**Halifax.** For electricity purposes (Mr. T. C. Ekin)	11,800
2.—**Llandudno.** For the improvement of the west shore (Mr. A. W. Brightmore) ...	847
2.—**Lowestoft.** For road improvement purposes (Mr. Courtenay Clifton)	572
2.—**Newport (Mon.).** For street and riverside improvement works (Mr. M. K. North)	4,089
2.—**Southport.** For sewage disposal works (Mr. A. G. Drury)	—
2.—**Totnes.** For works of sewerage and water supply (Mr. H. R. Hooper)	1,460
3.—**Cardigan.** For works of water supply (Mr. M. K. North)	2,084
3.—**Carnarvon.** For the provision of a cemetery (Major C. E. Norton)	2,000
3.—**Mudford.** For the provision of a burial ground (Mr. H. R. Hooper)	350
3.—**Oswaldtwistle.** For water, sewerage and town hall purposes (Mr. R. G. Hetherington)	8,507
3.—**Poole.** For works of sewerage (Mr. H. Shelford Bidwell)...	460
3.—**Stretford.** For works of street improvement (Mr. H. Ascough Chapman) ...	11,978
3.—**Worcester.** For the purchase of property for road widening (Mr. Edgar Dudley)	970
4.—**Chard.** For works of water supply (Mr. H. R. Hooper)	13,584
4.—**Hemsworth.** For sewage disposal works improvements (Major J. Stewart) ...	245
4.—**Wallasey.** For road widening purposes (Mr. H. Ascough Chapman)	602

Municipal Work in Progress and Projected.

The Editor invites the co-operation of Surveyor *readers with a view to making information given under this head as complete and accurate as possible.*

The following are among the more important projected works of which particulars appear below: Buildings—Buxton, Greenock Nottingham; housing and town planning—Bradford, Shipley; roads and materials—Durham £85,000, East Ham, St. Helens £60,000; water, gas and electricity—Galashiels, Glasgow.—Particulars of other works projected will be found on our "Local Government Board Inquiries" pages.

BUILDINGS.

Buxton U.D.C.—It has been decided to make extensive improvements of the hot baths.

Devon C.C. — The tender of Messrs. Fothergill Brothers, at £692, has been accepted for the construction of a new bridge at Cullompton.

Greenock T.C.—The question of providing public baths for Greenock is receiving the consideration of a committee. A proposal to erect the baths in Market-street, which met with considerable opposition, has been dropped, and a selection of four from a number of new sites has been made. The master of works has been instructed to make sketch plans of the sites selected.

Halifax T.C.—A large house, with 8 acres of land, in the neighbourhood of Wyke, has been acquired by the Health Committee, subject to the approval of the Local Government Board and the council, for the treatment of tuberculosis patients.

Nottingham T.C. — The plans of the baths to be erected on the site of the old tramway shed in Muskham-street, in the Meadows, provide that the swimming pond, which will be 100 ft. in length, will be emptied in winter and fitted with a movable top so that the hall can be used for public meetings and concerts. The dressing boxes will be collapsible, so that they can be folded against the wall. There will be no gallery, but at one end the seats will rise in steps. About twenty-six private baths will be installed. The Baths Committee have under contemplation a proposal to adapt the Sneinton baths in a similar manner.

Worthing T.C.—A feeling prevails in the town that the pier, which was wrecked in last Saturday's gale, should be taken over by the corporation, or that a sum sufficient to reconstruct it thoroughly should be advanced by the council.

HOUSING AND TOWN PLANNING.

Bideford R.D.C. — The medical officer of health, Dr L. B. Betts, in his annual report suggests that a dozen or twenty cottages might be built to begin with, and be distributed in different parts of the district, where there was the most demand for them. There were many quite sanitary, comfortable cottages, where there was plenty of air space and reasonable accommodation for an average family, but it was also the fact that there were many absolutely unfit for human beings to live in—with badly-paved floors, windows which would not open, ceilings so low that a person of medium height was unable to stand upright, and no proper water supply.

Bradford T.C.—It has been referred to the Health Committee to select a site for the erection of 200 workmen's dwellings.

Briton Ferry (Glam.) U.D.C.—The tenderer to whom the contract for building a further sixty houses was voted having withdrawn, the council have accepted the tender of Mr. Lawford Gower, of Briton Ferry, at £13,454.

Hay (Brecknock) U.D.C.—Twelve houses are to be built at an estimated cost of £1,800, subject to the sanction of the Local Government Board.

Shipley U.D.C.—Plans and estimates are to be prepared for the erection of twenty-one additional cottages on the estate at Dockfield. It has been further resolved to have plans prepared showing the best method of laying out the estate at Crag End, Windhill, for artisans' houses.

Torrington R.D.C.—It has been decided to offer a prize for the best design for a cottage, and a "spot" map is to be prepared showing where cottages would be required.

Warrenpoint.—A scheme for building fifteen houses in the neighbourhood of Oldtown has been approved.

Wath U.D.C.—A committee has been appointed to prepare a scheme for the erection of workmen's dwellings.

PARKS AND OPEN SPACES.

Bangor U.D.C.—The surveyor's plans of a sports pavilion and public lavatory in Ward Park, and also of a ladies' lavatory, at an estimated cost of £935, have been referred to a committee for a report.

Greenock T.C.—It is proposed to proceed with the work of completing the Lady Alice Park, for which an additional sum of £2 520 is required.

Llanelly U.D.C.—Sir Stafford and Lady Howard have announced their intention of purchasing 8 acres of land adjoining Parc Howard, and presenting it to the town. The land will be converted into a lake for boating.

Sheffield T.C.—By the opening last week of a recreation ground in the Wincobank district, the total playground area of the city is brought up to 643 acres. This gives 1 acre for every 733 persons, and entails an expenditure of about £10,000 per annum.

REFUSE COLLECTION AND DISPOSAL.

West Ham T.C.—The Health Committee are considering a proposal as to the best means of using the steam to be generated by the dust destructor which is about to be constructed. It is considered that the steam could be utilised by the electricity department if supplied under certain guaranteed conditions specified by the electrical engineer.

ROADS AND MATERIALS.

Brentford U.D.C.—A special committee appointed by the council to consider the question of widening the narrow High-street reports that the work would cost £361,300, and that the council could not undertake the operation. The committee, however, advises widening the section of the street from the church by the Brent to the dock gates, which includes the narrowest part of the road.

Bournemouth T.C.—It is proposed to reconstruct the tram lines from the cemetery to Bank-loop, Winton, and from the cemetery to King's-road along Charminster-road, a double line to take the place of the present single line and passing-places.

Crieff T.C.—The council have agreed to increase the loan of £6 000 previously sanctioned to £7,000, to meet the cost of various schemes lately undertaken, including between £3 000 and £4,000 for the purchase of the shop properties in High-street for the purpose of widening that thoroughfare at a narrow part near the Post Office; £1,250 for the purchase of North Forr Farm, part of which is to form a depot for the town's refuse; while it is estimated that over £1,000 will be required to repair the embankments of the farm lands which have been destroyed by flooding of the river Earn, which adjoins. There is also a sum of £600 to repay a loan, and some £350 for street channelling and other works.

Devon C.C.—Reporting on the tenders received for road work Mr. Hurrell, chairman of the Main Roads Committee, stated that the contracts considerably exceeded the estimates. The tenders sent in were very limited indeed. He expected a great many more tenders, but the contractors seemed to be very much afraid of the work. He thought there was money to be made out of it by contractors if they would only set themselves about it.

Durham C.C.—The Road Board have written approving of the scheme to spend £85,000 over the main roads of the county, and the council have accepted their offer of a free grant of £35,000 and a loan of £15 000, free of interest, for three years, towards the scheme.

East Ham T.C. — Plans and estimates have been approved amounting to £6,186 for the duplication and reconstruction of the tramway track in High-street North from Myrtle-road to Skeffington-road, the reconstruction of the track from St. John's-road to

Lathom-road, the paving of the highway margin from Barking-road to Heigham-road, and the setting back of the kerb near Kempton-road, of which amount the sum of £4,526 has already been sanctioned by the Local Government Board and the Board of Trade respectively.—The Works Committee are considering a proposal by the borough engineer, Mr J. E. W. Birch, for the purchase of a steam-driven water van, roller, wagon, and tractor combined.

Norwich T.C.—It has been agreed to pay £575 for a strip of land in King-street for improvement purposes.

St. Helens T.C.—The borough surveyor, Mr. A. W. Bradley, has presented to the Highways Committee a scheme for paving with granite setts on concrete foundations a large number of streets connecting the main thoroughfares in and out of the town. The scheme would complete the paving of Prescott-road, the top end of Borough-road, pave Boundary-road, Kirkland-street, College-street, Park-road Ashcroft-street, down to the bridge in Chancery-lane, and Peasley Cross as far as Robins-lane. The scheme, he said, would require five or six years to complete, but it would substitute good clean pavement for the present unsatisfactory macadam, and would reduce greatly the annual cost of repairs and scavenging. Altogether the cost would be £60,000. He suggested that they apply for a loan of £10,000 or £12,000, and proceed with the work until the scheme was completed. Such schemes had worked out very well in other places. The matter is to be discussed at the next meeting of the committee.

Staffs C.C.—Sir Reginald Hardy, in proposing the adoption of the Main Road and Bridges Committee's report at the recent meeting, pointed out that the estimate of the county surveyor (Mr. J. Moneur) was £2,000 more than last year. That was due, he said, to the altered condition of the roads, and the responsible factor was not only the ordinary motor car, but the heavy locomotive traffic, which cut through the crust of the roads and even shook the foundations. The committee had been very reluctantly obliged to sanction this increased expenditure. The rate per mile in the past year was £80 6s., and in the ensuing year it would work out at £83 12s.

Stirling C.C.—At a recent meeting of the Western District Committee it was intimated that the committee could formulate a scheme for the improvement of the roads under the Road Development Grant on a grant of approximately £700. It was recommended that the scheme to be carried out this year should be somewhat similar to that of last year. In answer to a member, the road surveyor reported that the average cost of upkeep of the roads in the district was £80 per mile, the cost of metalling the roads in the ordinary way £400 per mile, and the cost of making them according to the Road Board's specification £600 per mile.

SEWERAGE AND SEWAGE DISPOSAL.

Littlehampton U.D.C.—So much progress has been made with the drainage scheme that last week members of the council were able to inspect the storage tanks which have been built. The main tank is 200 yds. in length, with an average width of 12 ft. and a depth of 9 ft., the roof consisting of 2 ft. of concrete. At the shore end there is a duplicate tank some 50 yds. long, running parallel with the main tank, and capable of extension should the growth of the town necessitate it. It will be some two or three months before the whole work in connection with the scheme is finished.

WATER, GAS, AND ELECTRICITY.

Galashiels T.C.—The question of introducing an electric supply is being discussed, and a conference was lately held between the town council and representatives of local manufacturers interested. Mr. Parsons, Glasgow, who had been asked to prepare a report for the town council, set down the probable cost for power at not less than ¾d. per unit, but the manufacturers contended that it was possible to produce for power purposes at ½d. per unit. There was a strong feeling among the town councillors that the charge should be not less than ¾d. per unit, and it was decided to adjourn the conference until more information was available.

Glasgow T.C.—Approval was given at the last meeting of the town council to minutes of the Water Committee recommending the inclusion of Lochs Voil and Doine in the area of Glasgow water supply.

Linlithgow T.C. — The burgh surveyor, Mr. Swanson, has prepared plans of alternative routes for a new water main which it is proposed to introduce to meet the requirements in the upper reaches of the town.

Tynemouth T.C.—It was reported last week that the deficit of the electricity undertaking had been practically wiped out, and that the Electricity Committee proposed to make reductions in the charges for current.

Wolverhampton T.C.—It has been agreed to transfer the sums of £2,125 and £1 251, profits of the electricity and water undertakings respectively, to the credit of the town improvement fund.

MISCELLANEOUS.

Ham (Surrey) U.D.C.—The surveyor, Mr. R. W. Hindhaugh, has suggested the provision of a different kind of stall for the council's only horse, which will not sleep in its stable at night, and consequently nearly falls asleep while at work during the day. No doubt consideration was previously given to the alternative of providing a new horse for the existing stall.

Wolverhampton T.C. — A sum of £3,777 has been transferred from the profits of the tramway undertaking to the borough fund.

PERSONAL.

Mr. T. de Courcy Meade, city surveyor of Manchester, was last week voted an increase of his salary from £1 200 to £1,400 a year.

Mr. W. H. Eley, surveyor and inspector to the Newmarket Urban District Council, has been granted an increase of salary of £50 a year.

Mr. Herbert Crabtree, Colne, has been appointed surveyor to the Llandrindod Wells Urban District Council at a salary of £120 per annum.

Mr. P. R. Gibbs, surveyor to the Cookham Rural District Council, has been appointed an assistant surveyor to the Worcestershire County Council.

Mr. Samuel Charles Baggott, assistant borough surveyor of Macclesfield, has been appointed borough surveyor and water engineer in succession to the late Mr. C. W. Stubbs.

Mr. J. R. Treadwell, surveyor to the Easthampstead Rural District Council, has been granted an honorarium of £25 for past services, and has had his salary increased by £45 per annum.

Mr. W. J. Hobern, of Jerningham-road, New Cross, London, has been appointed, out of eighty-four applicants, as clerk of works for the Teddington Urban District Council's sewage disposal extension scheme. The salary is £4 a week.

Mr. H. Tillstone, borough engineer of Brighton, has recovered from a severe illness from which he has been suffering for some time past, and his return to his duties was reported with gratification at the last meeting of the town council.

Mr. John R. Rablin, M.Am.Soc.C.E., chief engineer, Massachusetts Metropolitan Park Commission, Boston, Mass., on March 6th delivered an illustrated lecture on "Metropolitan Park Systems" before the graduate students in Highway Engineering at Columbia University.

Mr. Edwin O. Sachs, chairman of the British Fire Prevention Committee, was received on Tuesday afternoon by the President of the French Republic. Mr. Sachs presented a report on the Paris Fire Preventative Organisation which M. Poincaré accepted with cordial expressions of thanks.

Mr. Amulya Charan Banerjee, of Sheoraphuli, Bengal appears to be the only Indian student in the long list of successful candidates at the recent associate-membership examination of the Institution of Civil Engineers. He is an articled pupil to Messrs. Henry Adams & Son, consulting engineers, of 60 Queen Victoria-street, London, E.C., and passed the whole examination at the first attempt.

Mr. J. D. Watson, engineer to the Birmingham, Tame and Rea Drainage Board, gave an illustrated lecture recently on the history of the Birmingham sewage works to the City of Birmingham Municipal Officials' Association. In the course of his remarks he stated that when the joint board came into existence in 1877, the area of the land in their possession was 260 acres; to-day it is 2,956 acres.

Mr. J. Kemp, formerly engineer to the Hampton Urban District Council, who became engineer to the Metropolitan Water and Sewerage Board, Brisbane, has had extremely heavy work under that authority. He designed, and is now constructing, an impounding reservoir, with masonry dam, to hold 6,000,000 gallons; laid about 17 miles of 36-in., 42-in., and 48-in. steel lock-bar water mains, with only a single leakage in the whole length, though it was laid through extremely rough and hilly country, the maximum pressure being 450 ft.; and he has also in hand 4 miles of tramway, a new pumping station and plant equal to 12,000,000 gallons per day; and new water purification works, including sedimentation and coagulation basins, slow sand filters, and service reservoir, &c. Before being appointed to the Water and Sewerage Board, Mr. Kemp served for three years as engineer to the municipal council, and he has just been appointed to the city engineership again, for five years, at a salary of £850 per annum. Mr. Kemp's many friends in the home country will congratulate him most cordially on this recognition of his abilities and personal qualities.

On Thursday, the 20th instant, the works of Messrs. J. & P. Hill, Sheffield, were closed for the funeral of Mrs. Hill, widow of the late Mr. William Hill founder of the firm.

FOR OTHER ADVERTISEMENTS

See End of Paper.

COOKHAM RURAL DISTRICT COUNCIL.
APPOINTMENT OF HIGHWAY SURVEYOR.

Applications are invited for the appointment of Highway Surveyor for the above district, which comprises seven parishes with an area of 27,803 acres. There are about 103 miles of district roads to be superintended and maintained.

The appointment will be considered a yearly one, and the commencing salary will be £140, which will, at the pleasure of the Council, and subject to the satisfactory performance of the duties, be raised £10 annually to a maximum of £160. Applicants must be cyclists or motor-cyclists, and the council will make an allowance towards the upkeep of a cycle.

The person appointed, who will be required to devote the whole of his time to the duties of his office, must be fully competent to perform the duties, to keep the accounts, and generally to comply with and abide by the instructions of the Council. He must have had at least two years' experience in a rural district.

He will be required to give security in the sum of £100 in some recognised guarantee society for the faithful discharge of his duties.

Applications (marked "Highway Surveyor"), in the candidate's own handwriting, stating age, previous occupation, and experience in the duties, and accompanied by copies of not more than three testimonials of recent date, must reach me not later than the first post on Tuesday, the 1st day of April next.

Canvassing members of the Council, either directly or indirectly, will disqualify a candidate.

(By order)
WILLIAM WEED,
Clerk.

Queen-street Chambers,
Maidenhead.
March 19, 1913. (303)

BOROUGH OF POOLE.

Draughtsman required; salary, £1 7s. 6d. per week.

Applications, stating age and experience, to be delivered to me not later than Monday, April 7th.

SAMUEL J. NEWMAN, F.R.I.B.A.,
Borough Surveyor.

Municipal Offices,
Poole. (304)

WANTED, immediately, in the office of a Council Engineer and Surveyor, two Surveying Assistants; commencing salary, 50s. per week; also two Junior Assistants commencing salary 40s. per week. Permanency to suitable men, with good prospects of advancement. Box 1,228, office of THE SURVEYOR, 24 Bride-lane, Fleet-street, E.C. (300)

ENGINEER, Architect and Surveyor (A.M.I.C.E.), in charge of a large Garden Suburb near London, has vacancy for a pupil. Moderate premium. Write, Box 1,225, office of THE SURVEYOR, 24 Bride-lane, Fleet-street, E.C. (305)

BOROUGH OF HAMMERSMITH.
BOROUGH SURVEYOR'S AND PUBLIC HEALTH DEPARTMENTS.

The Borough Council invite Applications for the following positions in the above Departments:

Chief Clerk.—Borough Surveyor's Department. Commencing salary £130 per annum, rising by annual increments of £5 to a maximum of £175 per annum. Applicants must have had experience in the supervision and execution of the clerical work of a Borough Surveyor's Department, including correspondence, accounts, &c., and be capable shorthand writers and typists.

Junior Clerks.—Borough Surveyor's and Public Health Departments. Commencing salary £40 per annum, rising by annual increments of £5 to a maximum of £65 per annum. Preference will be given to applicants of good education and possessing a knowledge of shorthand and typewriting.

Applications, on Forms to be obtained from the undersigned, giving full particulars of qualifications and experience, together with copies of not more than three recent testimonials, to be delivered at the Town Hall not later than 10 a.m. on Monday, the 7th April, 1913, endorsed "Borough Surveyor's Chief Clerk," "Borough Surveyor's Junior Clerk," or "Junior Clerk, Health Department," as the case may be.

LESLIE GORDON,
Town Clerk.

Town Hall, Hammersmith, W.
March 25, 1913. (306)

CHELTENHAM RURAL DISTRICT COUNCIL.
PRESTBURY SEWERS.

The above Council invite Tenders for the following Contracts:—

No. 1.—The Provision, Laying and Jointing of about 3,900 yards of 15-inch, 12-inch and 9-inch Stoneware Pipe Sewers, together with Manholes and Lampholes; also the Conversion of certain existing Sewers into Storm-water Drains and other incidental Works.

No. 2.—Connecting about 20 Houses to Sewers and Storm-water Drains and other incidental Works.

Drawings may be seen, and Specifications, Bills of Quantities and Form of Tender obtained, at the Offices of the Engineers, Messrs. Phillott & George, 31 Promenade, Cheltenham, between the hours of 10 a.m. and 5 p.m. (Saturdays between 10 a.m. and 1 p.m.), on payment of a deposit of £1 1s., which will be refunded on the receipt of a *bonâ-fide* Tender and the return of all documents.

The Contractor will be required to sign a Contract and to give satisfactory security for proper performance of the work.

Sealed Tenders, endorsed "Prestbury Sewers," to be delivered at my Office not later than 16th April, 1913.

The Council do not bind themselves to accept the lowest or any Tender.

GILBERT McILQUHAM,
Clerk to the Cheltenham Rural District Council.

Essex-place, Cheltenham.
March 27, 1913. (301)

BOROUGH OF CHARD.
CATTLE MARKET.

The Corporation invite Tenders for Laying about 1,281 square yards of Concrete *in situ* Paving, Supplying and Erecting certain Fencing, and other incidental Works in connection with the Laying-out for Market purposes the Market Field, Fore-street, Chard.

The Drawings may be seen, and General Conditions, Specification, Bill of Quantities, and Form of Tender obtained, at my Office on and after Wednesday next, the 2nd prox., on payment of a deposit of Two Guineas, which will be returned on the receipt of a *bonâ-fide* Tender and of all the documents.

Sealed Tenders, endorsed "Cattle Market," must reach the Town Clerk not later than 10 o'clock on the morning of Thursday, the 10th day of April, 1913.

The Council will not be bound to accept the lowest or any Tender.

ERNEST W. HEARN, C.E.,
Borough Engineer.

Guildhall, Chard.
March 27, 1913. (302)

The History of French Highways from the Middle Ages to the Revolution.

SOME IMPORTANT FACTS AND DATES.

[The following notes are from a paper in the January-February issue of the "Professional Memoirs" of the Corps of Engineers, United States Army, and Engineer Department at Large. This paper is translated from the French of M. Campredon, and brought up to date, 1912, by the translator, Major F. A. Mahan, the original having appeared in 1895. The matter is that under the heading "Service of the Ponts et Chaussees," a part of M. Campredon's paper, which was on the "Organisation des Services de Travaux Publics en France."]

The principal steps towards the organisation of the present day were: The creation of the office of Grand Voyer of France, in 1599, this officer having charge of the construction and police of roads and streets; the formation of the General Direction of the Ponts et Chaussées in 1715; the foundation of the School of Ponts et Chaussées in 1745; the reorganisation of the Corps in 1790; the creation of the Department of Public Works in 1830; and its reorganisation in 1839. A tendency towards decentralisation appeared in the law of May, 1836, and became more and more marked in subsequent Acts, 1866, 1871, and 1884. This decentralisation has thrown upon the departments and the communes a part of the work previously done by the State. [This tendency is called "retrograde" by M. Campredon, but is undoubtedly a sign of vitality, and a similar tendency in other countries points to the soundness of the principle of allowing local authorities to have a large share in highway administration.]

In France, as in Great Britain, the roads left by Roman civilisation were allowed to fall into decay, and although there are signs that the subject of communications received some attention in the reign of Charlemagne, there is no evidence that anything was done towards the establishment of lines of communication during the tenth and eleventh centuries, nor until towards the end of the twelfth century. It was at that period, in the reign of Philip Augustus, that the awakening of national vitality led to the carrying out of work on communications, including the reconstruction of bridges, roads, and passages, a term used of unclassified roadways opened by private individuals, who are bound to keep them up. [Corresponding, apparently, to our *ratione tenura* roads.] Such work was done by religious orders, the most celebrated of which was the order of the Pontiff Brothers (Pontifex, bridge builder), one of whom, Saint Benezet, built the bridge at Avignon (1177-1185). The Nôtre Dame bridge at Paris was built in 1500 by a Franciscan monk, Brother Nicolas; the bridge at Maëstricht and the Tuilleries bridge by a Dominican, Brother Romain. The funds were derived from bridge and road tolls, and charges for bait, as well as from pious gifts and subsidies from the Royal treasury, or some share of the salt tax or other funds collected for the State. Such funds were often misappropriated, and royal edicts of those days often included such admonitions as: "We —— say, declare and order, will, and it so pleases us, of our own motion, sure knowledge, full power and royal authority, that all and every of the moneys of the tolls aforesaid —— be employed for the repairs of bridges, roads, ferries and paths of places and defiles at which the said tolls are taken, so that people can pass there, go and come in safety, without danger, inconvenience and injury to persons, mounts, provisions, merchandise, and other goods." But in spite of frequent edicts of this kind, funds were continually being diverted from their proper purpose.

THE SEVENTEENTH CENTURY.

From the beginning of the sixteenth century the Royal authority grew firmer, and in 1599 was created the office of Grand Voyer of France, whose chief duties were to keep himself informed as to all the tolls levied for public works, and to visit works, and the sites of proposed works. Clearly such control could not in those days be really effective, but considerable progress was made. In 1607 the exchequer contributions to public works amounted to 870,000 livres, or about £36,000, but most of such annual contributions were devoted to navigable waters. An edict of 1621 put the control of road tolls into the hands of the treasurers of France, and an edict of 1626 suppressed the office of Grand Voyer, leading to decentralisation. Highways, bridges and ferries were neglected and fell into decay, but navigation was better looked after.

In the reign of Louis XIV., Colbert, who was the first Minister to hold the title of Controller-General of Finances, attached great importance to the development of highways, and appointed "intendants" in the different districts, who had, among other duties, the administrative and technical charge of roads and bridges, financial and legal matters being in the hands of the Treasurers of France. Tolls continued to be the main source of income, but abuses connected with their management were suppressed. The share of the cities in road maintenance was increased as the system developed, funds being derived from the ordinary "octroi" duties, or from special duties of the same kind. The personal service tax was instituted in some provinces, and became general half a century later. During the last years of the reign of Louis XIV., a period of wars and political difficulties and abuses reappeared, and the great roads and bridges were abandoned to their fate.

THE EIGHTEENTH CENTURY

In 1712 an attempt was made to reorganise the personnel of the Ponts et Chaussées, and persons described as "Architects to the King" were appointed to the number of twenty-two, eleven inspectors-general being added to the organisation in the following year. These arrangements came to an end a few years later. In this period the art of engineering does not seem to have advanced, the persons charged with engineering work having, in some cases, rather the qualifications of builders of palaces than of engineers.

The personnel of the Ponts et Chaussées was reorganised, and in 1716 the corps definitely known by that title was formed. There was one inspector-general and one architect first engineer, and there were three inspectors and twenty-one engineers. The organisation lasted through the eighteenth century, the best-known member of it being the famous road maker Trésaguet. The engineers found it necessary to make a determined agitation in order to secure suitable and punctually paid salaries. Considerable improvements were effected during this period. In 1724 regulations for traffic were made, restricting the number of horses used to draw a two-wheeled cart. Larger sums were devoted to public works, derived in part from special taxes, and closer supervision was exercised over finances. Large bridges were built, many of them of timber, and the art of the engineer developed considerably. In 1738 the system of personal service was made general—a serious factor in the political troubles that followed. The office of "conducteur" was instituted, these officials coming next under the engineers as at the present day. [The term conductor is still in use in British India, and the office is similar.] In 1744 an office of draughtsmen was formed in Paris by Trudaine, and soon developed into a school for engineers; and informal meetings, called together by the same official, formed the basis of the general council of the Ponts et Chaussées. In 1750 the number of engineers was raised to twenty-five, and the kingdom was divided into four parts, each under an inspector. A chief engineer and the director of the school of engineers were placed at the head of the service. There were sub-inspectors, sub-engineers, controllers of works, conductors and "picqueurs." In 1762 definite rules were laid down regarding specifications and contracts. Between 1733 and 1769 many great bridges were built, and it can be said of these that they "were more the works of a school" than those of single builders, the plans and specifications being discussed by the general assembly. During this period the annual budget of the Ponts et Chaussées rose to between 3,000,000 and 4,000,000 francs. To Turgot belongs the credit for making a change permitting of the commutation of

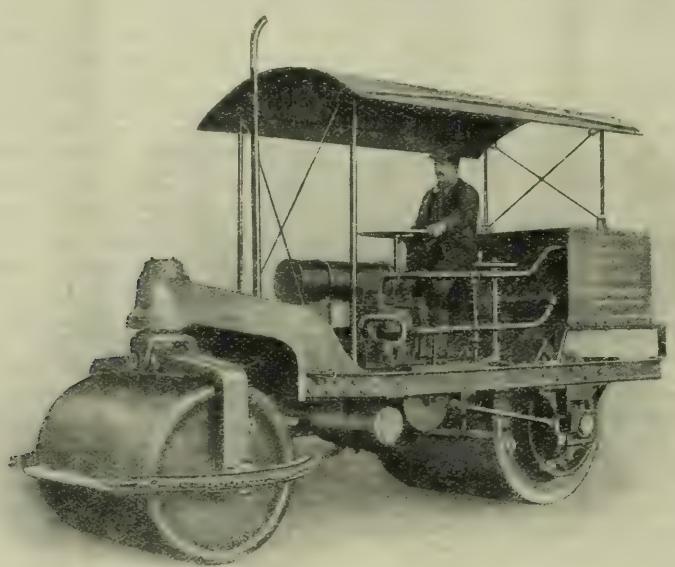
personal service; he obtained approval of his method in 1766, and in 1787 personal service was suppressed in the district of Limoges. In twenty-five years some 250 miles of road were made in that district, and were maintained in good condition. In 1783 the engineers of the Paris district were assimilated to the general body of the department, and the number of inspectors-general was raised from four to five. In 1786 the number of inspectors was increased from fifty to sixty, and the sub-engineers, of whom there were seventy-two in the year 1771, numbered, in 1784, no less than 124. Though Turgot succeeded in doing away with personal service in 1766, it was revived in 1776 by his successor, but never reached its previous dimensions, and was greatly improved. During the period from 1769 to 1789 there were serious administrative difficulties, a notable example being that afforded by the struggle between the *Parlement* of Guienne and the *intendant* of the Bordeaux district, which lasted for ten years. In 1786 it was decreed that the conversion of personal service into a money tax (the present-day *prestation*) should be tried for three years, and in 1787 service in kind was made absolute. In this period of twenty years important advances were made in road-metalling, particularly under the influence of Trésaguet's principles, and by the use of the road roller invented by Cassart. A decree of 1781 turned over to the cities all the streets and avenues within their jurisdiction, and in 1783 it was laid down that property owners should have a period of six months' grace for filing claims respecting property acquired for road making.

MOTOR ROAD ROLLERS.

The accompanying illustration shows Barford & Perkins' latest pattern motor road roller. It will be observed that this roller is fitted with extra large front roller cylinders. This alteration has been found to be an advantage when rolling tar-macadam and so forth.

This particular machine weighs about 6¾ tons empty and 8½ tons full. Both front and back cylinders are made to hold water-ballast. The roller is fitted with water-spraying arrangements connected to both front and back cylinders. Petrol is used for starting, and the roller can be run for the rest of the day on paraffin.

A roller exactly as illustrated has already been bought and put into use by the Taroads Syndicate, of Victoria-street, Westminster. The County Councils of Essex and Gloucestershire have also bought Barford & Perkins' motor rollers quite recently.



Barford and Perkins' Latest Pattern Motor Road Roller.

Public Health Law (By Sydney G. Turner. St. Bride's Press, Limited, 24 Bride-lane, Fleet-street, E.C. Price 10s. 6d. nett).—A manual for municipal and county engineers and surveyors, town clerks, clerks to district councils, and other officers, and to members of local authorities. The book is designed to be specially useful to officials in the preparation of reports and in the administration of the law, and to members of local authorities in the discharge of their public duties. It is also of value to students preparing for examinations as municipal engineers and in public health law. The subjects treated of from a legal point of view include the meaning of "sewer" and "drain," sewage disposal, sanitary fittings, river pollution, infectious diseases and hospitals, new streets and buildings, private streets, highways, open spaces, markets, slaughter-houses, housing, &c. This is, we believe, the first time these matters have been dealt with each in a separate chapter, which makes the book easy for reference. There are no reprints of Acts *in extenso*, but under each topic are given the Acts and clauses which refer to it. . . . We should say the work ought to occupy a place in every sanitary authority's office.—*Local Government Journal.*

Profitable Municipal Undertakings.—From municipal undertakings Wolverhampton benefits this year to the extent of 10d. in the £ off the rates.

"The Civic Engineer's Who's Who."—The first issue of "The Civic Engineer's Who's Who" (London: St. Bride's Press, Limited, 24 Bride-lane, E.C., 2s. 6d. nett) gives wonderfully complete lists of the engineering officials of England and Wales. For a first issue it is very creditable.—*Glasgow Herald.*

Worn Tram-rails: Coroner's Views.—At the inquest at Westminster on Saturday on James Cox, a coffee-stall attendant, the evidence showed that about 2 a.m. on the 20th inst. he was driving his stall along Vauxhall Bridge-road when the wheels skidded on the tram-rails near the terminus. The stall struck a refuge, throwing the man into the street, and the stall went over him. It was stated that the tram rails were worn down and the flange projected an inch. Mr. John Willing, the permanent-way engineer to the London County Council, said the wear of the rails was ½ in., but the coroner, Mr. Ingleby Oddie, said he had examined the place and was inclined to agree with two previous witnesses that it was about 1 in. Witness agreed with the coroner that the condition of the rails where the trams were stopping was dangerous, and said the rails would be taken out in a few weeks. Upon being pressed by the coroner, witness admitted the accident was caused by the rails being worn down, and they ought to be replaced. The rails at this point had been scheduled for repair shortly. The coroner said this was the kind of accident against which vehicles ought to be protected. These lines were put down under statutory powers, and they ought to be kept in such a condition that they would not be dangerous.

BARNSLEY SEWAGE WORKS.

VISIT OF YORKSHIRE STUDENTS.

The Barnsley Sewage Works, which were completed three years ago at a total cost of about £37,500, and are considered to be among the finest in the country, were visited last week by a number of students in Yorkshire of the Institution of Civil Engineers. The party, who were accompanied by the chairman of the Sewage Works Committee (Councillor England), Councillor Chappell, Councillor White, Mr. C. F. Wike (city surveyor of Sheffield) and Mr. E. W. Dixon (chief waterworks engineer to the Harrogate Corporation), were conducted over the works by Mr. J. H. Taylor, M.INST.C.E., borough surveyor and waterworks manager of Barnsley, and engineer for the works and Mr. H. Taylor (deputy surveyor).

The system of the disposal of the dry-weather flow of 1,250 000 gallons per day was explained in detail from the conveyance of the sewage, both from the high-level districts and the low-level, to its final treatment in the tanks and the series of nine circular percolating filters, eight of which are 100 ft. in diameter by 6 ft. deep, and the other 120 ft. by 6 ft. The tank effluent is distributed on to the filters by nine four-armed sprinklers, while the subsequent effluent is passed through humus tanks and secondary filters before reaching the river Dearne.

A small hydraulic and electrical power plant has recently been installed near the outfall of the hydraulic main at Lund Fields, consisting of a water turbine of 14-horse power, which, it was explained, is worked by the sewage, direct, coupled to a small dynamo with electrical batteries, and the tanks and offices are lighted with electric lamps. The Lund Hill smallpox hospital in the vicinity is also lighted by electrical lamps from the same batteries, displacing oil lamps which were formerly used, there being no gas laid on in the district.

At the conclusion of the inspection thanks were expressed to Mr. Taylor.

PORT OF LONDON ENGINEERSHIP.

MR. C. R. S. KIRKPATRICK APPOINTED.

Mr. Frederick Palmer, C.I.E., M.INST.C.E., who has just resigned the position of chief engineer to the Port of London Authority, in order to enter into partnership with Sir Alexander Rendel, is to be succeeded by Mr. C. R. S. Kirkpatrick, M.INST.C.E., the chief assistant engineer, and a former city engineer of Newcastle, while Mr. Palmer has been retained in the capacity of consulting engineer.

The Port Authority are entering on a gigantic task, and Mr. Palmer's "Proposals for the Improvement and Extension" of dock accommodation in the Port of London, submitted to the Authority in January, 1911, involve in their entirety an expenditure of £14,000,000. The first programme advocated by Mr. Palmer, and estimated to cost over £4,000 000, was immediately entered upon. Contracts extending to over £2,500,000 have been made, and these works are now in progress.

Mr. Palmer's entry into partnership with Sir Alexander Rendel, K.C.I.E., the eminent consulting engineer, under the name of Rendel, Palmer & Tritton, is interesting, observes the *Newcastle Daily Chronicle*, inasmuch as his first appointment to India was made on Sir Alexander Rendel's selection, and that he succeeds in the firm his old chief in India, Mr. F. E. Robertson. Mr. C. R. S. Kirkpatrick, Mr. Palmer's successor, has been associated with him throughout in the preparation of the proposals and conduct of the works entered upon.

SEA-COAST EROSION.—For a very complete and inexpensive library on the cause, prevention and repair of coast erosion the following three works are recommended: "Coast Erosion and Foreshore Protection," by John S. Owens, M.D., Assoc.M.Inst.C.E., F.R.C.S., and Gerald O. Case (price 7s. 6d., post free 7s. 10d.), with numerous illustrations and diagrams; "Sea-Coast Erosion and Remedial Works," by R. C. Allanson-Winn, M.Inst.C.E.I. (price 1s., post free 1s. 1d.); and "Erosion of the Coast and its Prevention," by F. W. S. Stanton, Assoc.M.Inst.C.E., F.S.I. (price 3s., post free 3s. 2d.), with numerous maps and other illustrations. The publishers are the St. Bride's Press, Limited, 24 Bride-lane, Fleet-street, London, E.C.

INSTITUTION OF MUNICIPAL AND COUNTY ENGINEERS.

President—Mr. R. J. Thomas, M.INST.C.E., County Surveyor, Buckinghamshire.

COUNCIL MEETING: OFFICIAL REPORT.

At a meeting of the council held at the offices of the Institution, No. 92 Victoria-street, Westminster, S.W., on Saturday, March 15th, there were present: Messrs. R. J. Thomas, T. W. A. Hayward, J. W. Cockrill, J. L. Redfern, W. Stubbs, G. F. Carter, J. P. Barber, W. H. Prescott, W. N. Blair, E. B. Martin, E. R. Matthews, E. P. Hooley, J. S. Pickering, T. Moulding, J. Paton, A. E. Collins, W. Harpur, H. T. Wakelam, C. F. Wike, O. E. Winter, N. Scorgie, Thomas Cole (secretary), and H. A. Giles (assistant secretary).

Elected as Members.—Messrs. H. L. Bottomley, assistant borough engineer, Brighouse; J. Barker, burgh surveyor, Dumfries; J. Edey, surveyor to the St. Neots Urban District Council; C. Watson, surveyor to the Ambleside Urban District Council; H. M. Driver, surveyor to the Tadcaster Rural District Council; G. R. Marsh, district main road surveyor, Dorset County Council; H. L. Baker, deputy borough surveyor, East Ham; J. Nuttall, surveyor of highways, Hunslet Rural District Council; F. Weeber, surveyor to the Horncastle Urban District Council; D. H. Steward, main road surveyor, Norfolk County Council, Aylsham district; J. W. Witts, chief engineering assistant, Leeds; H. V. Lynam, surveyor to the Alsager Urban District Council; F. W. Greig, chief assistant to county surveyor, Kent; H. D. Austen, general assistant to borough engineer, Fulham; G. H. Stevenson, highway surveyor, Shifnal Rural District Council; J. A. Waddell, burgh surveyor, Burntisland; P. A. Watford, surveyor to the Claypole Rural District Council; M. E. W. Fitzgerald, surveyor to the Warmley Rural District Council; R. H. Cole, deputy borough surveyor, Darlington; and C. E. Rivers, borough engineer and surveyor, Harrogate.

Elected as Associate Members.—Messrs. F. G. Coates, assistant engineer, Sandown, Isle of Wight; E. J. P. Bedford, assistant surveyor, Cleckheaton Urban District Council; C. C. Kidd, engineering assistant, Southend-on-Sea; J. J. Barnes, junior surveyor to county surveyor, East Sussex, Lewes; and S. S. Small, assistant engineer and surveyor to the Leigh-on-Sea Urban District Council.

Elected as Students.—Messrs. A. G. A. Davies, assistant surveyor, Richmond Corporation; A. J. King, borough surveyor's office, Devizes; P. C. McQueen, borough surveyor's office, Beccles; T. O. Guilbert, assistant surveyor to State surveyor, Guernsey; and H. M. Richardson, surveyor's office, Cowes (Isle of Wight) Urban District Council.

Transfer from Associate Member to Member.—Mr. P. C. Woodhall, borough surveyor, Blandford.

Transfer from Irish Affiliated Member to Member.—Mr. J. J. Noonan, county surveyor, North Riding, County Mayo.

Transfer from Scottish Affiliated Member to Member.—Mr. R. Drummond, county road surveyor, Paisley.

The council learnt with regret of the deaths of Mr. T. T. Allen and Mr. J. Proctor.

ARBITRATION CLAUSE.

Certain objections raised by the National Federation of Building Trades Employers were considered. On the recommendation of the committee the council adhered to the resolutions set forth in the last annual report, agreeing, however, to the deletion of Clause N, referring to the issue of certificates relating to payments to the contractor.

The request of the Association of Bituminous and other Paving Material Manufacturers for the alteration of the Arbitration Clause in general use in contracts prepared for municipal bodies in connection with the supply of bituminous paving materials was considered. The council were unable to accede to the request.

The request of the Builders' Merchants Alliance, Limited, for the insertion of a strike clause to be inserted in all contract forms was agreed to. The request for the alteration of the Arbitration Clause in general use in contracts prepared for municipal bodies was not agreed to. The request that a clause

relating to payment for loss or hire of sacks, &c., should be inserted in contract forms was not agreed to, the council being of opinion that the suggested clause was not one which should be included as a general clause in a contract, inasmuch as it related to details which should be dealt with in each case as circumstances may require.

NEW HOME OF THE INSTITUTION.

The New Offices Committee reported the completion of the removal to 92 Victoria-street, where the accommodation comprises a commodious council chamber and three separate committee rooms. The committee were voted the hearty thanks of the council for their labours, and were requested to complete the furnishing.

INTERNATIONAL ROADS CONGRESS, 1913.

A letter from Irish local authorities as to the appointment of delegates to the Roads Congress was referred by the council to the delegates of the institution serving upon the Roads Congress Committee.

ENGINEERING STANDARDS COMMITTEE.

Mr. E. J. Elford was elected as an additional representative of the institution on the Sub-committee on Tramway Rails. Mr. A. E. Collins was elected as representative of the institution on the Sub-committee on Tyres, Axles and Springs.

DISTRICT COMMITTEES.

The council resolved to invite each district secretary to send in a short report of the year's work in their respective districts, so that it may be incorporated with the council's annual report.

MUTUAL DEFENCE FUND.

The council resolved to ask each district secretary to bring the question of the establishment of the Defence Fund before the members of the institution, and to forward to headquarters the opinion of the districts with regard to this matter.

HOUSING AND TOWN PLANNING CONFERENCE.

It was resolved that the delegate's fee for the conference to be held at Great Yarmouth in July next (16th to 19th inclusive) should be fixed at one guinea. The list of papers already promised was approved.

AMSTERDAM VISIT.

The programme for a Whitsuntide visit to Amsterdam was approved and ordered to be issued to members.

NEW COUNCIL.

The scrutineers reported the following elections to the council for 1913-14:—

President: Mr. J. W. Cockrill (Great Yarmouth).

Vice-presidents: Messrs. T. W. A. Hayward (Battersea), J. S. Pickering (Cheltenham), and H. T. Wakelam (Middlesex County).

Honorary Treasurer: Sir James Lemon.

Honorary Secretary: Mr. Chas. Jones.

Ordinary Members of Council: Messrs. J. Patton Barber (Islington), W. N. Blair (St. Pancras), J. A. Brodie (Liverpool), J. S. Brodie (Blackpool), G. F. Carter (Croydon), A. E. Collins (Norwich), W. Harpur (Cardiff), W. T. Lancashire (Leeds), H. E. Stilgoe (Birmingham), and C. F. Wike (Sheffield).

The secretary was instructed to issue the district nomination forms, together with the foregoing list, to all members entitled thereto.

At the conclusion of the council meeting the president entertained the members to lunch in the new offices.

VISIT TO AMSTERDAM AND THE HAGUE, WHITSUNTIDE.

Arrangements have now been completed for the visit of the institution to Amsterdam and The Hague in May next.

Ladies are especially invited to attend this meeting.

Messrs. Cook, in whose hands are the details of travelling and hotel accommodation, state that hotel accommodation is already becoming very limited, and it is necessary to definitely secure rooms forthwith. Those who desire accommodation to be reserved for them should send name of hotel selected, and deposit of £1 per passenger, direct to Conducted Tours Department, Messrs. Thomas Cook & Son, Ludgate-circus, London, if possible not later than April 5th; the balance of the fare being payable nearer the date of departure.

Railway tickets to and from London (over 30 miles) will be supplied by Messrs. Cook at a fare-and-a-third rate.

PROGRAMME.

Thursday, May 8th.

Leave London (Liverpool-street Station) at 8.30 p.m., via Harwich and the Hook of Holland.

Friday, May 9th.

Arrive at the Hook of Holland and proceed to Amsterdam, arriving 7.30 a.m.

12.45 p.m.—Carriages leave hotels.

1.0 p.m.—Reception at the town hall by the Burgomaster and Aldermen of Amsterdam.

1.25 p.m.—Leave the town hall.

1.30 p.m.—Arrive at the Exchange, where the party will be received by Mr. A. W. Boss, the Director of Public Works, who, with Mr. F. S. Jacob and Mr. P. Lohr, city engineers, will give a description of the drainage and sewerage works of Amsterdam, dealing with the special difficulties presented by the peculiarities of the country, after which the members will proceed to visit works in course of construction (*inter alia*), the sewage pumping stations (electric pumps), the old and new sewage outfall works, tramway garage.

6.0 p.m.—Return to hotels.

Saturday, May 10th.

9.30 a.m.—Carriages leave hotels; visit to the city gasworks. These works are described as an installation with apparatus up-to-date in every detail.

1.0 p.m.—Return to hotels.
Afternoon free.

Sunday, May 11th.

10.0 a.m.—Leave Amsterdam for trip to the Isle of Marken.

6.0 p.m. Arrive back at Amsterdam.

Monday, May 12th.

Leave Amsterdam by train for Leyden. Take steamer trip; luncheon on board.
Return by train from Leyden to Amsterdam.

Tuesday, May 13th.

8.40 a.m.—Leave Amsterdam for The Hague. On arrival at The Hague, leave luggage at the Consigne. Carriages will convey the party to the abattoirs (these are considered the best example in Europe). The members will be received by Mr. Lindo, the Director of Public Works.

1.0 p.m.—Luncheon.
The members will visit "The House in the Wood," by kind permission.
Drive to Scheveningen.
Dinner at hotel.

10.47 p.m.—Leave The Hague for the Hook of Holland.

11.50 p.m.—Leave the Hook of Holland by steamer for Harwich.

Wednesday, May 14th.

Arrive Harwich and proceed by train to London, reaching Liverpool-street Station at 8.0 a.m.

DETAILS OF COST AND ACCOMMODATION.

Inclusive fare: £9 9s. each person, providing:—

(1) First-class travel tickets from London back to London.

(2) Hotel accommodation, consisting of plain breakfast, table d'hote luncheon, dinner at table d'hote, bedroom, lights, and service at the Hotel Pays Bas, Amsterdam, or similar class establishment, commencing with breakfast on Friday, May 9th, and terminating with breakfast on Wednesday, May 14th.

(3) Omnibus transfer of passengers and baggage between station and hotel wherever necessary.

(4) Drives and excursions as specified in the itinerary.

(5) Fees to hotel servants, railway porters, and to the drivers of the conveyances utilised; also in connection with train reservations.

(6) Admission fees to the places of interest visited while with Messrs. Cook's representative on the excursions specified in the intinerary.

(7) Free conveyance of 56 lb. of baggage from London back to London.

(8) The services of a competent representative to accompany the party from London back to London, generally supervising the arrangements and acting as an interpreter whenever necessary.

If accommodation is required at the Hotel Victoria, or similar class establishment, the inclusive fare will be £9 15s.

If at Brack's Doelen Hotel, or similar establishment, £9 17s.

If at the Hotel Europe, or similar establishment, £10 17s.

If at the Amstel Hotel, or similar establishment, £10 19s.

NORTH-EASTERN DISTRICT.

A meeting of the institution will be held in the North-Eastern District at Newcastle-on-Tyne on May 2nd and 3rd next.

ANNUAL MEETING: ALTERATION OF DATE.

The date of the annual meeting of the institution has been altered from July 23rd-26th to July 16th-19th.

SCOTTISH MEETING.

A meeting of the institution will be held in the Scottish District at Dundee on June 6th and 7th.

THOMAS COLE,
Secretary.

92 Victoria-street, S.W.

INSTITUTION OF MUNICIPAL ENGINEERS.

President—Mr. FRANK LATHAM, M.INST.C.E.I., F.S.E., Borough Engineer and Surveyor, Penzance.

GENERAL MEETING.

A visit will be paid to the International Building Trades Exhibition, at Olympia, London, on Saturday, April 12th, at 3.30 o'clock.

PROGRAMME.

3.15.—Meet at the exhibition entrance.
3.30.—Informal meeting within the exhibition.
4.0.—Proceed to inspect the various exhibits.

Tickets of admission have kindly been supplied by the exhibition authorities.

COUNCIL MEETINGS.

The following council meetings have been arranged: April 30th, London; May 31st, Manchester; June 28th, London; July 30th, London.

NORTHERN DISTRICT.

A meeting of the above will be held at Wallsend-on-Tyne to-morrow (Saturday).

PROGRAMME.

2.0.—Short business meeting in the borough surveyor's office.
2.30.—Leave for visits in the following order:
Newcastle electric power station;
Messrs. Parsons' works;
The new ferro-concrete bridge.

The Corporation of Wallsend will entertain the members to tea.

JOHN ROBINSON,
Hon. District Secretary.

Union Offices,
Darlington.
March 20, 1913.

NORTH-WESTERN DISTRICT.

A meeting will be held at the Victoria Hotel, Manchester, on Saturday, April 16th, at 7 o'clock, when a paper on "Sewage Treatment" will be read by Mr. R. J. McKenn, manager of the Heywood Corporation sewage works.

EXAMINATIONS.

The next examination will be held in London and other centres during the week ending May 17th next. Copies of syllabus and forms of application to sit may be obtained from the secretary. Notice of intention to sit must reach the secretary not later than April 21st.

B. WYAND,
Secretary.

39 Victoria-street, S.W.

THE SURVEYORS' INSTITUTION.

The next ordinary general meeting will be held at the institution on Monday, April 7th, when a paper entitled "Reinforced-Concrete Construction" will be read by Mr. P. J. Waldram. The chair will be taken at 8 o'clock.

SOCIETY OF ENGINEERS.

At a meeting of the Society of Engineers, to be held on Monday, April 7th, at the Institution of Electrical Engineers, Victoria Embankment, W.C. (south end of Savoy-street, near Waterloo Bridge), a paper on "The Status of Engineers and Engineering, with Special Reference to Consulting Engineers," will be read by William Ransom, ASSOC.M.INST.C.E.

This essay gained the second premium (the first not being awarded) in the Status Prize Competition last year, and deals with questions affecting engineers in their relations with clients, assistants, contractors and the general public. The author also discusses the training of engineering pupils, the question of registration, and a variety of other matters affecting the remuneration and professional status of engineers.

The chair will be taken at 7.30 p.m.

Bridge Building.—Students, young engineers, and surveyors will find much useful information in "Preliminary Studies in Bridge Building," by Reginald Ryves, ASSOC.M.INST.C.E. (London: St. Bride's Press, Limited, 24 Bride-lane, E.C. Price 2s. nett.) The book is described as the "first of a series of small volumes, each complete in itself, dealing with the design of ordinary highway bridges of moderate span." Though highway bridges alone are referred to, the matter contained in this volume is largely applicable to railway bridges, aqueducts, and similar engineering undertakings. The five primary types of bridges are described, and the conditions determining the best site for each of the three types of streams are discussed in detail; while in connection with wandering streams various modes of designing abutments or approach spans are dealt with. Improvements of fords and the effect of eccentric loading of vehicles on the girder loads are among the numerous other items touched on. —*Scotsman.*

APPOINTMENTS VACANT.

Official and similar advertisements received up to 4.30 p.m. on Thursdays will be inserted in the following day's issue, *but those responsible for their despatch are recommended to arrange that they shall reach* THE SURVEYOR *office by noon on* **Wednesdays** *to ensure their inclusion in the weekly list of summaries. Such advertisements may, in cases of emergency only, be telephoned (No. 1359 Holborn), subject to later confirmation by letter.*

ROAD SURVEYOR.—March 29th.—Sutherland County Council. £350 per annum.—Mr. A. Argo, county clerk, Golspie.

DEPUTY SANITARY SUPERINTENDENT.—March 29th.—Corporation of Manchester. £350 per annum.—Mr. Thos. Hudson, town clerk.

TEMPORARY ASSISTANT.—March 29th.—Corporation of Truro.—Mr. F. A. Barnes, city engineer and surveyor.

HIGHWAYS AND GENERAL FOREMAN.—March 31st.—Hipperholme Urban District Council. 30s. per week.—Mr. G. Wharton Thompson, engineer and surveyor.

INSPECTOR OF NUISANCES.—March 31st.—Saffron Walden Town Council. £80 per annum.—Mr. W. Adams, town clerk.

SEWAGE WORKS MANAGER.—March 31st.—Corporation of Faversham. 40s.–47s. 6d. per week.—Mr. Guy Tassell, town clerk.

COUNTY ROAD SURVEYOR.—March 31st.—Midlothian County Council. £450.—Mr. A. G. G. Asher, county clerk, County Rooms, Edinburgh.

COUNTY SANITARY INSPECTOR.—April 5th.—Lancashire County Council. £250 per annum.—County Medical Officer of Health, County Offices, Preston.

CLERK OF WORKS.—April 7th.—Harrogate Town Council. £104 per annum.—Mr. C. E. Rivers, borough engineer.

CLERK OF WORKS.—April 10th.—Corporation of Bolton. £3 3s. per week.—Mr. S. Parker, town clerk.

CLERK OF WORKS.—April 12th.—Bingley Urban District Council. £2 10s. per week.—Mr. A. Platts, clerk.

CHIEF ASSISTANT ENGINEER.—April 12th.—Port of London Authority. £1,200.—Mr. F. Ayliffe, secretary, 109 Leadenhall-street, E.C.

BOROUGH ENGINEER AND SURVEYOR.—April 12th.—Corporation of Ipswich. £350 £550.—Mr. W. Bantoft, town clerk.

STOKER AND DRIVER.—April 14th.—At pumping station of Borough of Dorchester Waterworks. 21s. per week, with house, coal and light.—Mr. A. G. Symonds, town clerk.

ASSISTANT ENGINEERS. — May 1st. — Indian Public Works and State Railway Departments.—Secretary, Public Works Department, India Office London, S.W.

ASSISTANT ENGINEER.—May 15th.—Board of Trustees for the Improvement of Calcutta. 500—700 rupees per mensem.—Mr. C. H. Bompas, chairman, 5 Clive-street, Calcutta.

WATERWORKS ASSISTANT.—Experienced person for waterworks office. £156 per annum.—Box 1,226, office of The Surveyor, 24 Bride-lane, Fleet-street, E.C.

MUNICIPAL COMPETITIONS OPEN.

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ABERTILLERY.—April 9th.—Plans for an elementary school for 500 boys and girls and 300 infants, for the urban district council. The successful plans will be adopted, and the successful architect appointed.—Mr. N. J. Llewellyn, secretary, Education Committee, Council Offices.

ARBROATH.—April 12th.—For the erection of public baths, for the town council. Premiums £25, £15, and £10.—Mr. W. K. Macdonald, town clerk.

READING.—April 18th.—Designs for a boys' and girls' school, for the Reading Education Committee. Competitions limited to local architects.—Clerk of the Education Committee.

NORTHAMPTON.—April 21st. — Designs for a council school. Limited to local architects.—The Clerk, Education Offices.

BARNET.—April 29th.—Designs for new municipal offices, for the urban district council. Premiums £25, £15, £10.—The Clerk.

DEVONPORT.—June 14th.—Designs for municipal buildings and a guildhall, for the Corporation of Devonport. Premiums of £350, £150, and £100 are offered. The assessor is Mr. Ernest Newton, A.R.A., F.R.I.B.A.—Mr. R. J. Fittall, town clerk.

NEWCASTLE-ON-TYNE.—June 19th.—Designs for laying out portion of the Walker estate, for the corporation. Premiums £50, £30, and £20.—Mr. A. M. Oliver, town clerk.

MUNICIPAL CONTRACTS OPEN.

Official and similar advertisements received up to 4.30 p.m. on Thursdays will be inserted in the following day's issue, *but those responsible for their despatch are recommended to arrange that they shall reach* The Surveyor *office by noon on* **Wednesdays** *to ensure their inclusion in the weekly list of summaries. Such advertisements may, in cases of emergency only, be telephoned (No. 1359 Holborn), subject to later confirmation by letter.*

Buildings.

NORTHUMBERLAND.—March 29th—April 16th.—For the erection of a school, for the Education Committee.—Mr. C. Williams, secretary, The Moot-hall, Newcastle-on-Tyne.

STAFFORD.—March 29th.—For the construction of ward block at isolation hospital, for the corporation.—Mr. W. Plant, borough engineer and surveyor.

FARNBOROUGH.—March 31st.—For the erection of a refuse destructor, with buildings and chimney stack, for the urban district council.—Mr. J. E. Hargreaves, surveyor.

EDMONTON.—March 31st.—For the erection of a public convenience, for the urban district council.—Mr. C. Brown, engineer.

DURHAM.—March 31st.—For the erection of a retaining wall, for the county council.—Mr. J. A. L. Robson, County Secretary for Higher Education, Shire Hall, Durham.

EDINBURGH.—March 31st.—For the erection of a school, for the School Board.—Mr. John Stewart, clerk.

HORNCASTLE.—March 31st.—For rebuilding a bridge, for the rural district council.—Mr. J. E. Chatterton, clerk.

FROME.—March 31st.—For the construction of underground brick water-storage tank, for the rural district council.—Mr. J. A. Beynon, surveyor.

PORTSMOUTH.—March 31st—For the reconstruction of public conveniences, for the corporation.—Borough Engineer.

MANCHESTER.—March 31st.—For the erection of a school and caretaker's house, for the corporation.—Mr. Thomas Hudson, town clerk.

DAVENTRY.—April 1st.—For the erection of a hospital for infectious diseases, for the rural district council.—Mr. J. D. Spearing, clerk.

NORWICH.—April 1st.—For the erection of six cottages, for the corporation.—Mr. A. E. Collins, city engineer.

COLWYN BAY.—April 1st.—For the provision of labour and materials for erecting a sea wall, construction of slipway, and other works, for the urban district council.—Mr. James Amphlett, clerk.

LEICESTERSHIRE.—April 2nd.—For rebuilding a brick and concrete bridge, for the county council.—Mr. George Rowlatt, clerk to the Highway Committee, 10 New-street, Leicester.

RUSHDEN.—April 2nd—For the erection of conveniences and bridges, for the urban district council.—Mr. W. B. Madin, surveyor.

WALLSEND.—April 3rd.—For the erection of a boundary wall, for the corporation.—Mr. W. V. Mulcaster, town clerk.

LANCASHIRE.—April 4th.—For the erection of an elementary school for the Education Committee.—Mr. Harcourt E. Clare, clerk, County Offices, Preston.

SURBITON.—April 4th.—For the construction of two public conveniences, for the urban district council.—Mr. F. W. Wood, clerk.

HERTS.—April 5th.—For the erection of a police station, for the county council.—Mr. U. A. Smith, county surveyor, Hatfield.

DERBYSHIRE.—April 7th.—For alterations to a school, for the Education Committee.—Mr. G. H. Widdows, architect, St. Mary's-gate, Derby.

OXFORD.—April 7th.—For the erection of a bathing-place, for the corporation.—Mr. R. Bacon, town clerk.

READING.—April 7th.—For the erection of a shed and other works at the cattle market, for the corporation.—Borough Engineer.

FIFE.—April 11th.—For enlarging a clay-puddle reservoir, and the construction of filters and water tank, for the county council.—Mr. John Macpherson, district clerk, St. Andrews.

ABERDARE.—April 12th.—For the erection of two bridges, for the urban district council.—Mr. D. L. Griffiths, clerk.

LURGAN.—April 12th.—For the erection of fifty-four workmen's dwellings, for the town council.—Mr. F. W. Pollock, clerk.

MANCHESTER.—April 15th.—For the roofing over of avenue at Hyde-road car works, for the corporation.—Mr. Thomas Hudson, town clerk.

CARNARVON.—April 16th.—For the erection of a police station and court room at Llandudno, for the Joint Committee.—Mr. A. Bodvel-Roberts, Clerk of the Peace, Carnarvon.

LINDSEY.—April 17th.—For the erection of a school, for the Education Committee.—Mr. S. M. Grant, secretary, 286 High-street, Lincoln.

LAMBETH.—April 24th.—For the erection of a pavilion, for the borough council.—Mr. B. Penny, town clerk.

Iron and Steel.

SOUTHEND-ON-SEA.—April 3rd.—For the supply and delivery of cast-iron special pipes required in connection with the sewage disposal works, for the corporation.—Mr. H. J. Worwood, town clerk.

SOUTHEND-ON-SEA.—April 3rd.—For the supply and delivery of sluice and other valves in connection with the sewage disposal works, for the corporation.—Mr. H. J. Worwood, town clerk.

NOTTINGHAM.—April 3rd.—For the supply of galvanised iron closet pails, for the corporation.—Mr. W. J. Board, town clerk.

SHROPSHIRE.—April 5th.—For laying on a water supply, for the Small Holdings Committee.—Mr. F Crowte, clerk, Shrewsbury.

TEDDINGTON.—April 5th.—For the supply and erection of two destructor furnaces, boiler settings, and flues, with two Lancashire boilers, for the urban district council.—Mr. G. H. Salmons, clerk.

DAVENTRY.—April 14th.—For the supply and erection of a water-softening plant (capacity 10,000 gallons per hour), and a water-level indicator, for the corporation.—Mr. Frederick Willoughby, town clerk.

Roads.

EAST GRINSTEAD.—March 29th.—For the supply of 1¼-in. Quenast granite, Quenast granite screenings, tarred granite macadam, hand-picked broken surface flints, 2-in. Kentish ragstone, and brick rubble, for the urban district council.—Mr. E. P. Whitley Hughes, clerk.

LANCASHIRE.—March 29th.—For the hire of steam rollers, for the county council.—Mr. Harcourt E. Clare, clerk.

RAMSEY (Huntingdon).—March 29th.—For the supply of tarred slag, broken granite, and Tarvia, for the urban district council.—Mr. Richard F. Serjeant, clerk.

PEMBROKE (Co. Dublin).—March 29th.—For the execution of granolithic pathway paving works, for the urban district council.—Mr. J. C. Manly, clerk.

ROMNEY MARSH.—March 29th.—For the supply of granite or quartzite, and Kentish rag, for the rural district council.—Mr. W. B. Smith, district surveyor, New Romney.

NORMANTON.—March 29th.—For the supply of stone and concrete flags, kerbs, channels, setts, granite, limestone, whinstone, limestone and granite chippings, and tar-macadam, for the urban district council.—Mr. J. W. Martin, clerk.

LYDD.—March 29th.—For the supply of tarred Kentish ragstone and Rhenish columnar basalt, for the corporation.—Mr. Thomas Kettle, borough surveyor.

CARMARTHEN.—March 29th.—For work of road improvement and bridge widening, for the county council.—Mr. R. Williams Jones, county surveyor, County Offices, Carmarthen.

WANDSWORTH.—March 31st.—For making up and paving Genoa-avenue, Putney, for the borough council.—Mr. D. A. Nichol, town clerk.

PETERHEAD.—March 31st.—For the maintenance of certain roads, for the Deer District Committee.—Mr. George M. Gray, district clerk, Peterhead.

EARSDON.—March 31st.—For the supply of hand-broken whinstone, slag, whinstone kerb, and cartage, for the urban district council.—Mr. John J. Watson, clerk, Shiremoor.

YORK.—March 31st.—For work in connection with the construction of New-street, including the laying of a 21-in. pipe sewer along Piccadilly, for the corporation.—Mr. F. W. Spurr, city engineer.

TYNEMOUTH.—March 31st.—For laying cement-concrete footpaths, for the corporation.—Mr. John F. Smillie, borough surveyor.

ROWLEY REGIS.—March 31st.—For tar-spraying 41,000 sq. yds. of roads, for the urban district council.—Mr. Daniel Wright, clerk, Old Hill, Staffs.

WOLVERHAMPTON.—March 31st.—For making up a street, for the corporation.—Mr. G. Green, borough engineer.

WANDSWORTH.—March 31st.—For the repair of part of Welham-road, Streatham, for the borough council.—Mr. D. A. Nicholl, town clerk.

SOUTH STONEHAM.—March 31st.—For carting flint and granite, for the rural district council.—Mr. E. T. Westlake, clerk.

CLECKHEATON.—March 31st.—For granite paving works, for the urban district council.—Mr. John H. Linfield, clerk.

WANTAGE.—March 31st.—For the supply and delivery of 750 tons of broken and unbroken granite, basalt, and limestone, for the urban district council.—Mr. E. B. Ormond, clerk.

UCKFIELD.—April 1st.—For tar and granite paving works, for the urban district council.—Mr. Charles Dawson, clerk.

MAGOR AND ST. MELLONS.—April 1st.—For the supply of broken limestone and gravel, for the rural district council.—Mr. A. H. Rees, clerk.

NEWMARKET.—April 1st.—For the supply of broken Leicestershire granite, best slag, and flint, for the rural district council.—Mr. S. J. Ennion, clerk.

MALDON.—April 1st.—For the supply of broken granite, basalt, flints, gravel, picked stone, steam rolling, and cartage, for the rural district council.—Mr. Edgar J. Ennals, surveyor.

SEDGEFIELD.—April 2nd.—For making up certain private streets, for the rural district council.—Mr. J. W. Lodge, clerk.

GLANFORD BRIGG.—April 2nd.—For making up a certain road, for the rural district council.—Mr. W. H. Buttrick, engineer.

CRANBROOK.—April 2nd.—For the supply of Penmaenmawr or other granite and unbroken Kentish ragstone, for the rural district council.—Mr. E. Clarke, clerk.

GRAVESEND.—April 3rd.—For the supply of basalt, or Penlee elvan stone, granite setts, and rag chippings, for the town council.—Mr. F. T. Grant, borough surveyor.

EASTBOURNE.—April 3rd.—For the supply of road materials, for the rural district council.—Mr. T. E. V. Kirtlan, clerk.

HEATON NORRIS.—April 3rd.—For the execution of street works, for the urban district council.—Mr. F. W. Brooke, clerk.

NEWMARKET.—April 4th.—For the supply of Leicestershire granite, Tarvia granite chips, granite chips and slag chips, for the urban district council.—Mr. W. H. Eley, surveyor.

BEXHILL-ON-SEA.—April 4th.—For the supply of imperial blue quartzite macadam, for the corporation.—Borough Surveyor.

STEYNING, EAST.—April 7th.—For the supply of flints, for the rural district council.—Mr. Arthur Flowers, clerk, Shoreham.

DOVER.—April 7th.—For the construction of carriageway and footpaths, for the corporation.—Mr. W. C. Hawke, borough engineer.

BULKINGTON.—April 7th.—For the supply of stone, for the urban district council.—Mr. H. W. Wilson, surveyor, Attleborough.

EAST PRESTON.—April 7th.—For work of steam rolling, for the rural district council.—Mr. Arthur Shelley, clerk, Littlehampton.

HORNSEY.—April 8th.—For making good a road, for the corporation.—Mr. E. J. Lovegrove, borough engineer and surveyor.

HOUGHTON-LE-SPRING.—April 9th.—For the supply of blast-furnace slag, road metal, slag riddlings, and blue limestone for asphalting, for the rural district council.—Mr. D. Balfour, surveyor.

HARWICH.—April 9th.—For making up two roads, for the corporation.—Mr. F. H. French, borough surveyor.

ERITH.—April 9th.—For the supply of 30,000 to 40,000 gallons of tar, for the urban district council.—Mr. J. K. Allerton, clerk.

RAWTENSTALL.—April 9th.—For works of paving and sewering, for the corporation.—Mr. James Whalley, town clerk.

HACKNEY.—April 10th.—For making up certain roads and wood paving work, for the borough council.—Mr. N. Scorgie, borough engineer and surveyor.

WEYMOUTH.—April 10th.—For work of wood paving, for the corporation.—Mr. K. J. S. Harris, borough surveyor.

TANGIER.—April 10th.—For the construction of a sewer and a road, for the Special Committee of Public Works.—Commercial Intelligence Branch of the Board of Trade, 73 Basinghall-street, E.C.

SMETHWICK.—April 11th.—For paving work, for the corporation.—Mr. A. Hosken, borough engineer and surveyor.

TANGIER.—April 12th.—For the construction of the second section of Casablanca-road, for the Special Committee of Public Works.—Commercial Intelligence Branch of the Board of Trade, 73 Basinghall-street, E.C.

INVERNESS.—April 12th.—For road improvement works, for the Badenoch District Committee.—Mr. A. M. Grant, district road surveyor, County Buildings, Kingussie.

HARPENDEN.—April 14th.—For the making up of private streets, for the urban district council.—Mr. Chas. S. Tuckey, clerk.

HAVERHILL.—April 14th.—For the supply of broken granite or basalt and tar-macadam, for the urban district council.—Mr. John H. Clarke, surveyor.

BRIGHTON.—April 14th.—For the supply of the necessary materials and laying of tarred slag macadam, or other material of quality and durability equal to tarred slag macadam, on Preston-road, for the corporation.—Mr. Hugo Talbot, town clerk.

BECKENHAM.—April 16th.—For resurfacing with tar-macadam, or with macadam grouted with pitch or other approved bituminous compound, Wickham-road, Albemarle-road, and Newlands Park-road, for the urban district council.—Mr. F. Stevens, clerk.

FRINTON.—March 17th.—For work of tar paving, for the urban district council.—Mr. E. M. Bate, surveyor.

Sanitary.

GOOLE.—March 29th.—For scavenging for one year, for the rural district council.—Mr. G. England, clerk.

SOUTHAMPTON.—March 29th.—For the removal of refuse, for the corporation.—Town Clerk.

HINCKLEY.—March 29th.—For laying a new main outfall sewer, consisting of about 416 lin. yds. of 36 in. diameter cast-iron pipes, and 1,102 lin. yds. of egg-shaped concrete tubes, varying from 42 in. by 28 in. to 30 in. by 20 in., together with necessary manholes, for the urban district council.—Mr. E. H. Crump, engineer and surveyor.

SOUTHWICK.—March 29th.—For the construction of surface-water drains, for the urban district council. —Mr. J. E. Dell, clerk.

SHIFNAL.—March 29th.—For laying pipe sewers and manholes and construction of sewage disposal works, for the rural district council.—Messrs. Willcox & Raikes, 63 Temple-row, Birmingham.

ITCHEN.—March 31st.—For laying sewers and constructing manholes and storm-water tanks, for the urban district council.—Mr. T. A. Collingwood, surveyor, Council Offices, Portsmouth-road, Woolston, Southampton

WIRRAL.—March 31st.—For scavenging work, for the rural district council.—Mr. J. E. S. Olive, clerk.

STANLEY.—April 1st.—For the removal of refuse, for the urban district council.—Mr. J. G. Ridley, clerk.

HAMPTON WICK.—April 4th.—For work of scavenging and watering, for the urban district council.—Mr. H. Fawssett, clerk.

HASTINGS. — April 7th. — For laying cast-iron sewers, for the corporation.—Mr. Ben F. Meadows, town clerk.

ROYSTON.—April 9th.—For works of sewerage and sewage disposal, for the urban district council.—Mr. H. F. Banham, clerk.

NORTH BATTLEFORD (Canada).—April 15th.—For the supply of vitrified tile sewer pipes and junctions, for the town council.—Secretary, North Battleford, Saskatchewan.

Stores.

KENT.—March 29th.—For the supply of shovels, forks, scavenging brooms, scoops, scrapers, cart grease, tallow, oil, and other tools and materials, for the county council.—Mr. W. B. Prosser, clerk.

SOUTHAMPTON.—March 29th.—For the supply of broken granite, for the corporation.—Mr. J. A. Crowther, borough engineer.

SOUTHWICK.—March 29th.—For the supply of hand-picked flints or dug flints, for the urban district council.—Mr. G. W. Warr, surveyor.

NUNEATON.—March 31st.—For the supply of blue bricks, kerbs, coal, slack, disinfectants and soap, earthenware pipes, granite kerbs and setts, iron castings, petroleum, and Portland cement, for the corporation.—Mr. F. C. Cook, borough surveyor.

WANSTEAD.—April 2nd.—For tar-dressing certain roads, for the urban district council.—The Surveyor.

TEDDINGTON.—April 5th.—For the supply of forage, granite, flints, sewage precipitant, cement, tar-paving, coal, coke, smith's work, team labour, gullies, pipes and tools, for the urban district council. Mr. G. H. Salmon, clerk.

CORNWALL.—April 5th.—For the supply of materials, haulage and team labour, for the county council. —Mr. A. E. Brookes, county surveyor, Truro.

WAKEFIELD.—April 7th.—For the execution of private street works, for the corporation. Mr. J. P. Wakeford, city surveyor.

TENDERS FOR MUNICIPAL WORKS OR SUPPLIES.

The Editor invites the co-operation of Surveyor *readers with a view to making the information given under this head as complete and accurate as possible.*

* Accepted. † Recommended for acceptance.

BARNES.—Accepted for building a thatched pavilion and a sanitary convenience (above ground), for the urban district council.—Mr. G. Bruce Tomes, surveyor :—

Pavilion.—R. T. Hughes & Co., Limited, Sheen-lane, Mortlake, S.W., £339.

Convenience.—R. T. Hughes & Co., Limited, Sheen-lane, Mortlake, S.W., £315.

BRIDLINGTON.—For extensions to the electricity works, for the corporation.—Mr. E. R. Matthews, borough surveyor :—

J. Sawdon, Havelock-street, Bridlington, £560.

BRITON FERRY.—For the erection of sixty-two houses, in rows of 9, 10, 11, 12 and 20 houses respectively, for the urban district council.—Mr. H. A. Clarke, architect and surveyor :—

H. M. Grant & Co., Limited, Cotteridge, Birmingham	£17,935
F. Bond, Beda-road, Cardiff	15,000
C. Gower, Skewen, near Neath	14,565
Vickery Brothers, Newland-road, Barry Dock	14,500
White Brothers, Sketty, Swansea	14,434
Johns & Hampton, Briton Ferry	14,255
H. Rogers, Manselton, Swansea	14,190
W. & J. Jenkins Brothers, Penydarren, Merthyr	13,934
W. Rogers & Son, Penylan, Cardiff	13,640
Lawford Gower, Briton Ferry*	13,454
D. John, Church Village, Pontypridd (withdrawn)	13,189

Architect's estimate, £13,676.

CARRICKMACROSS.—For the erection of twenty-five houses in four blocks on one site, for the urban district council :—

P. Ritchie, Belfast, £4,350.

CHELMSFORD.—Accepted for the erection of new offices, for the rural district council :—

F. J. French, Chelmsford, £1,503.

CHISWICK.—For laying 9-in. to 30-in. pipe sewers, and constructing new 60-ft. and 50-ft. highways, Burlingwick estate, with new culvert and bridge over Duke's Ditch.—Mr. E. Willis, engineer :—

J. Mowlem & Co., Westminster	£5,445
J. Ford, Willesden	5,098
G. Wimpey & Co., Hammersmith	4,896
T. Adams, Wood Green	4,844
T. W. Pedrette, Enfield	4,780
Clements, Knowling & Co., Brentford	4,777
F. Brummell, Willesden*	4,366

Engineer's estimate, £4,381.

COCKERMOUTH.—The following tenders have been accepted by the rural district council :—

Allerby.—J. Allison, £65, stone (per yard), 7s.
Oughterside.—R. Osborne, £80, 7s.
Above Derwent No. 1.—N. Pryce, £70, 5s.
Ditto, No. 2.—T. Thwaite, £91 15s., 7s.
Ditto, No. 3.—N. Pryce, £46, 5s.
Bassenthwaite.—W. Clark, £96.
Bothel, No. 1.—D. Johnston & Son, £46, 5s.
Ditto, No. 2.—W. Horn, £95, 5s.
Bewaldeth.—J. Jacques, £37, 5s.
Bridekirk & Dovenby.—J. Tunstall (Bridekirk), £11 10s., 5s. 6d.; (Dovenby), £21 10s., 7s.
Broughton.—W. Pearson, £164, 8s. 6d.
Broughton Moor.—R. Metcalf, £228, 10s.
Blindbothel.—J. Ackerley, £82, 8s.
Brigham.—G. Rayson, £72, 7s.
Brackenthwaite.—T. Head, £112, 7s. 6d.
Buttermere, No. 1.—B. Rigg, £36, 4s.
Ditto, No 2.—W. Burns, £76, 3s.
Great Clifton.—W. M. Owen & Son, £57, 8s.
Little Clifton.—W. M. Owen & Son, £38, 8s.
Crosscanonby.—J. Henderson, £88, 7s.; W. Robinson, £80, 7s.
Dearham.—W. Moore, £155, 7s.
Dean, No. 2.—J. Norman, £140, 8s. 6d
Ditto, No. 3.—J. Anderson, £150, 9s. 6d.
Eaglesfield.—J. Armstrong, £70.
Embleton, No. 1.—J. Gibson, £70, 6s. 3d.
Ditto, No. 2.—J. Garner, £89, 15s. 3d.
Flimby.—J. Jenkinson, junr., £92, 7s.
Gilcrux.—J. Stagg, £131, 7s. 6d
Greysouthen.—J. Rayson, £100, 7s.
Isel Old Park.—G. Bell, £52, 6s. 3d.
Lorton.—J. Fearon, £106, 6s.
Loweswater, No. 1.—C. Graham, £128.
Ditto, No. 2.—J. Anderson, £126, 10s. 6d.
Mosser.—J. Storr, £40, 7s.
Whinfell.—J. Storr, £44, 6s.
Papcastle.—J. Dalton, £60, 7s.
Plumbland.—J. Benson, £120.
Ribton.—J. Pearson, £28, 7s.
St. John's, No. 1.—J. Pearson, £47 16s. 3d., 6s.
Ditto, No. 2.—J. Pearson, £50 8s. 9d., 6s.
Sunderland.—P. Thirlwall, £24, 5s. 6d.
Setmurthy.—J. W. Bragg, £145, 5s. 6d.
Stainburn.—W. M. Owen & Son, £29, 8s.
Pallantire.—J. Gibson, £91 10s., 7s.
Winscales.—W. M. Owen & Son, £22, 8s.
Workington Rural.—W. M. Owen & Son, £41, 8s.
Wythop.—J. Robinson, £60, 7s.

DROXFORD.—For the hire of steam rollers and scarifiers, for the rural district council :—

	Per day. £ s. d.	Per yd. d.
E. W. Wright, Alton, Hants	1 8 0	⅞
Eddison Steam Rolling Company, Dorchester*	1 6 11	¾
Barnes Brothers, Wilts	1 7 6	1

Granite &c.

Johnston Brothers, Mark-lane, E.C. (Rhenish), 12s. 2d. per ton.*
Roadstone Supply Company, Shepton Mallet (Somerset basalt), 11s. and 11s 6d. per ton.*

The Surveyor

And Municipal and County Engineer.

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Minutes of Proceedings.

A Country Roads Board for an Australian State.

The creation by the Victorian Government of a Country Roads Board cannot fail to have far-reaching effects upon the highway system of that prosperous State, and will doubtless go a long way towards effecting a more equitable distribution of the cost of highway maintenance between the various classes which, directly or indirectly, benefit by the provision of good roads. The board has wide powers with respect to the making of surveys, the purchase of land, and the construction of deviations; as well as in the matter of buying machinery and plant. It will, in addition, serve as a central information department for making investigations and records, and publishing the results of these and similar studies. The relation in which the board will stand to the other highway authorities is thus summed up by the *Melbourne Argus*: "By appointing this board the Government of Victoria has entered into partnership with the county shires, the business being the construction and maintenance of roads"; and the view is expressed that the objective of the board is "to make every main road in Victoria capable of carrying traffic even in the worst weather." The financial provision of the Act is that the Government finds a sum of £2,000,000, or £400,000 a year for five years, half of which is a grant and half a loan, which will be repaid with reasonable interest during a period of thirty-one and a half years.

The board consists of three members. The chairman, Mr. William Calder, M.INST.C.E., engineer of the city of Prahran, is very well known by repute in this country as an able and energetic official with high technical qualifications and a long record of useful work, and the State of Victoria is to be congratulated upon the wisdom of the choice made by the Government. The contributions which Mr. Calder has made to technical literature provide evidence of his breadth of view and grasp of the main essentials in matters of engineering administration, and we look forward with confidence to the first-fruits of his activities in his new sphere. The other members of the board are Mr. F. B. Fricke, head of the Local Government Branch of the Public Works Department, and Mr. W. T. B. M'Cormack, an engineer of the Public Works Department. Mr. Fricke has been for nineteen years in the Local Government Branch, and has qualified as a municipal clerk, municipal auditor, and licensed auditor. These seem to be very desirable qualifications in a member of the board, and Mr. Fricke has had the further important experience of acting as secretary to the Shires Reclassification Board. Land settlement is a matter which should, whenever possible, precede all important engineering works in settled countries. Mr. M'Cormack, who is younger than his fellow members of the board, has had considerable experience as a shire engineer and in road construction and hydraulic work. The latter qualification, it may be suggested, is one which is of considerable importance in road construction; and it will doubtless be an advantage in the matter of road improvement in the United Kingdom if the importance of a competent knowledge of hydraulics and practical experience of hydraulic problems were recognised in that connection. It may be confidently predicted that, unless some unfortunate political interference with the work of the board should take place, the result of its creation will be to add to the comfort and convenience of the inhabitants of the State of Victoria and to increase their material prosperity.

* * *

The Protection of Lake Water Supplies.

The long distances to which sewage may be carried on or under the surface of a great lake are not generally known. It might well be assumed that a water supply intake situated, say, 4 miles out from the shore, at a depth of 75 ft. below the surface, could not possibly be polluted by a relatively small quantity of sewage discharged near the shore. It is to be remembered that the Great Lakes of America are each of many thousand square miles in area and of great depth, and that their water is of great purity. Nevertheless, it has been proved very clearly that the intakes carried far out to the deep waters are at times liable to draw sewage-polluted water, and that the result is a very high typhoid death-rate in the Lake cities.

A paper read before the Engineers' Club of Philadelphia by Mr. George C. Whipple is dealt with more fully elsewhere in these pages, and contains information which should be considered carefully with regard to our own problems of purification by dilution, and outfalls into the sea and tidal estuaries. Mr. Whipple gives the clearest evidence that the currents induced by winds may, and do under certain conditions, pollute the water miles from the shore. That "the sewage is projected through the lake water for several miles with relatively little dilution" is certain. The methods of protection advocated by the author appear to be the purification of the water rather than the attempt to obtain absolutely pure water at the source, or the absolute purification of the sewage. The possibility of failure to render such water pure at all times, even by sterilisation, is, however, demonstrated. The sand filter and the mechanical filter, as is well known, are by no means always sufficient; instances of failure through improper working are quoted, and the

author in apparently preferring filtration to sterilisation is evidently doing so when looking at the two processes as alternatives instead of as supplementary the one to the other. The fact that the typhoid death-rate in Toronto fell after the introduction of a filter cannot surely be held to show the superiority of filtration over sterilisation. When one considers the exceptional pollution of the Toronto water, described in our issue of January 24th, almost any result might have been expected. "We had the makings of the largest typhoid epidemic ever known," are the words of Dr. George Nasmith. Mr. Whipple does well, however, to draw serious attention to the dangers which attend the haphazard methods of mixing and applying hypochlorites to water. "That effective sterilisation of the water can be obtained by this method is admitted by sanitarians; that it actually is obtained with practice is more doubtful." We have frequently in the past drawn attention to the crude methods in general use for applying hypochlorite to waters in America, and Mr. Whipple's remarks are certainly justified.

The general conclusions to be drawn from a study of this paper are that, as far as may be practicable, every safeguard should be employed in order to protect water supplies. These safeguards consist of an intake in the safest place possible, purification of the sewage, and filtration of the water, followed by sterilisation. The omission of any one of these increases the possibility of danger, while the inclusion makes it more remote.

* * *

A Memorandum on Housing.

The Local Government Board have in the past often been asked to advise local authorities as to the principles which should be observed in the construction of houses for the working classes. They have accordingly just issued a memorandum summarising their views on this important subject. The value of this memorandum is considerably enhanced by a series of model plans of dwellings of a simple type which are attached to it. The memorandum appears at an appropriate time, inasmuch as the impetus which was given to cottage building by the Housing and Town Planning Act of 1909 shows no sign of abating. The memorandum points out generally that the principal points to be observed are economy and simplicity of design. It is not desired, however, to stereotype the design of cottages, and the board, while giving model sketch plans, have accordingly refrained from publishing designs for elevations. It is pointed out that cottages should be built as substantially as possible, and that unless a reasonably high standard of construction is maintained the full loan period of sixty years cannot be applied. It is not surprising that, as regards the type of house, the board favours the self-contained cottage. It is now generally conceded that, except in cases where the high price of land prohibits this type of building, it ought to be adopted as being preferable in every respect to the tenement dwelling. Dealing with the accommodation to be provided and the arrangement of the interior of the houses, the memorandum contains many practical suggestions. It is particularly pointed out, for example, that bedrooms should be as large and airy as practicable, that cellars should be avoided, and that adequate window area should be provided in every room. The board emphasise the desirability of local authorities availing themselves promptly of any gifts of land, or of any opportunities to acquire land on favourable terms. This is of special importance because certain landowners have recently generously offered to give land in certain cases for housing purposes, while others have expressed their willingness to sell it at its agricultural value. As regards by-laws, the board are careful to point out that those in force must in all cases be complied with, but they take the opportunity of emphasising the desirability of bringing up to date any code of by-laws which may be obsolete. The full text of the memorandum will be found in another column.

* * *

Colonial Appointments.

It has been suggested to us that we should be rendering some service to British municipal engineers who may be contemplating the acceptance of Colonial appointments by impressing upon them the extreme desirability of making careful inquiry as to the terms and local conditions of service before abandoning a permanent post in the Old Country for a Colonial career. The relationship of the salary offered to the cost of living is one matter that ought to be carefully considered. Then, again, there is a prevalent practice of making appointments for a term of years. The British engineer having full confidence in his own ability is apt to accept such appointments assuming that they will be renewed on the same terms at the expiration of the period for which they are originally made. But this is by no means always the case. In one instance which has recently come under our notice an appointment as city engineer was made for three years at a salary of £750 per annum. At the end of that time, however, the terms of the appointment were reconsidered, and the engineer was reappointed at a salary of £550 per annum.

It must not be assumed, however, that in all such cases the authorities are to blame. We have caused inquiries to be made in official quarters, and we are bound to say that the general explanation offered does not seem to be an unreasonable one, although, on the other hand, there are no doubt some cases of hardship caused by the capricious action of local councils—a phenomenon not unknown in this country! It appears that many Colonial appointments are made for a term of years because in comparatively undeveloped countries it is often impossible to foresee what the circumstances will be after the lapse of a few years. Thus a district may depreciate, or it may flourish, in either case with an extraordinary rapidity. If the conditions under which the original appointment was made have completely changed during the allotted period, it is not surprising that the terms of the appointment should be altered also. British engineers, however, should be thoroughly alive to this possibility, and in accepting Colonial appointments of this kind should bear in mind the fact that at the end of a few years they must place themselves entirely in the hands of the authority which they serve.

* * *

The Bath Road: Five Miles of Asphalt.

The decision of the Middlesex County Council to adopt the recommendations of their Highway Committee with respect to the resurfacing of 5 miles of the Bath Road with asphalt will be hailed with satisfaction by highway engineers who, whatever views they may hold on the subject, will one and all be interested in this trial of a stretch of road long enough to provide adequate data as regards the relations between first cost and maintenance, and long enough, too, to strike a reasonable average between various factors which influence the rates of wear and tear of road crusts. The Road Board are encouraging the enterprise by a contribution, partly by grant and partly by a loan free of interest, regarded as amounting altogether to a share of one-third the cost. Further knowledge is much needed as to the extent to which pavings usually associated with city streets are economically and conveniently applicable to roads which are more or less country roads as regards their surroundings, but are subjected to very severe traffic. Among such roads some of the most important are the chief of those radiating from London, and carrying a high proportion of fast and middle speed

motor traffic. For several practical reasons the application of wood paving or asphalt to roads of this kind can conveniently be studied on these particular routes. The condition of some of them, however, very strongly suggests the importance of considering whether the crust of a carriageway is the part of the road which should first claim attention when the expenditure of capital for the improvement of the road has, in principle, been approved of. This matter is of special importance in the present connection, for fair comparisons between radically different methods of crust construction cannot be made unless the road, as an engineering work, is in a satisfactory state. In some cases a new element is introduced by the consideration that the use of a paving of an urban character would obviate the need for making structural changes, or so minimise the losses resulting from the unsatisfactory state of the road in this respect that the relative importance of capital charges and maintenance charges would be altered. In due course we shall place before our readers the main technical features of this interesting departure.

* * *

The Salary Question Again. An advertisement was recently issued inviting candidates to apply for the post of surveyor and master of works for the burgh of Kirkcudbright. It might be expected that the official whose office bears this rather high-sounding title would have only dignified duties to perform, for which he would receive adequate remuneration. That this is not the case, however, is shown by the list of duties which has been officially issued, a copy of which is now before us. It is true that the duties are many and varied, but it is arguable that many of them are hardly within the scope of the work of a surveyor. For example, he has to visit the slaughter-house and act as meat inspector; to scour the water mains and clean out all tanks and catch-pits twice in each year, and to act as inspector under the Shops Act. The list of duties also reveals that the officer appointed will be at the beck and call of the chairman or convener of several different committees; thus, for example, he has to call every morning before 9 o'clock on the convener of the Streets Committee for any instructions he may have to give, and attend promptly to these instructions, and he is required generally to carry out the instructions of the various committees or conveners, given either orally or in writing. It will thus be seen that the unfortunate person appointed may not only have to serve two masters, but several. He will further be required "to keep a daily register setting forth each day what he has been doing, and submit the register to each monthly meeting of the council, or to any committee that may ask for production of it." And what is the remuneration? The salary is the princely one of £80 a year, and for this salary the person appointed must devote the whole of his time to the duties of his office. Further comment is almost needless. If a local authority believe that a competent surveyor and master of works is to be obtained under these conditions, and for this remuneration, we sincerely hope that they will prove to be mistaken.

* * *

Another Case. In appointing a clerk of works at their last meeting certain members of the Nantwich Rural District Council were inclined to be facetious. Three candidates appeared before them for interview, and the chairman of the council was given a list of technical questions drawn up by the surveyor to be put to them. A suggestion, which was at first taken to be jocular, was made by the chairman that each candidate should be asked, in addition, whether he was a teetotaller, and what were his politics. Some surprise was caused when, after the first candidate had answered the technical questions put to him, the chairman proceeded to ask him whether he was a total abstainer. Although certain members protested against this procedure, the chairman put the same question to the second candidate, who evoked some applause by replying, "I am temperate." The third candidate had declared his views in his application, a fact which may give some clue to the reason why the other candidates were asked. At the conclusion of his interview, however, a councillor put forward the bantering suggestion that he should be asked as to his religion, and the chairman had to explain that this was meant for a joke. The whole proceedings do not reflect much credit upon those chiefly concerned, and it would be well if the members of councils when making appointments would bear in mind that their decisions, though possibly of little importance to themselves, are of very great importance to the candidates whose livelihood is concerned.

* * *

Municipal Engineers' Day. In the advertisement pages of this issue will be seen a general announcement of the arrangements of the forthcoming International Building Exhibition at Olympia, with special reference to the municipal engineering section of it which is organised by the management of The Surveyor. April 19th, the middle Saturday of the period over which the exhibition extends, has been selected as "Municipal Engineers' Day," and we take the opportunity of explaining that it is so entitled by ourselves, with the hope that if one particular day be borne in mind it will afford a better opportunity for civic engineers to foregather than if their attendances were spread over several days of the exhibition. The term, however, does not, and is not intended to, imply any sort of official sanction. With regard to The Surveyor conference of municipal and county engineers, which will be held on that day at 3.15 p.m., Sir George Gibb, chairman of H.M. Road Board, has again kindly consented to take the chair, more particularly in view of the fact that the conference will discuss solely questions of road administration and engineering. Five propositions will be submitted for discussion, and their terms and other details will be given in our next week's issue. Opportunity will be afforded (at 2.30 p.m.) to witness a demonstration, in a road adjacent to Olympia, of the interesting motor vacuum road-cleansing machine of Messrs. Hill, of Sheffield.

* * *

The Limerick County Vacancy. The position of county surveyor of Limerick, rendered vacant by the resignation of Mr. J. Horan, who has served the county council so well, is to be divided between two officers. This decision was come to after considerable discussion in the council, and in defiance of a recommendation in favour of the appointment of a single official made by a committee of the whole council, by whom the matter was carefully considered. The proposition was that a whole-time officer should be appointed at an initial salary of £500 per annum. When the subject came before the open council it was, in the first instance, proposed to invite applications for one or two county surveyors, upon the rather strange plea that the council would thus be enabled to ascertain how many of the candidates were qualified. One would have thought that professional competence was a *sine qua non* whether one or two vacancies were advertised for, but this was apparently considered to be dubious by Mr. Coleman, the author of the proposition. Eventually, as has been stated, it was decided that two surveyors should be appointed at the initial salary of £300 a year each, rising to £400.

Storm Water Discharge.

By R. O. WYNNE-ROBERTS, M.INST.C.E., F.R.SAN.I., Consulting Engineer, Regina, and T. BROCKMANN, DIPL.ING.(BERLIN), Civil Engineer, Regina.

Mr. Symons, in 1878, observed a precipitation in Camden Town, London, England, falling at the rate of 12 in. per hour, continuing for 30 seconds (Moore). In the Central States of America a rate of 3·7 in. for 10 minutes, 2·8 in. for 20 minutes, 2·3 in. for 30 minutes, and 1·7 in. in 60 minutes may be expected (Folwell).

The following are a few recorded examples of the intensity of rainfall. Those recorded in Toronto in different parts of various countries. Still, the records suffice to show that the maximum intensity ordinarily lasts only for a few minutes, sometimes at the commencement of a storm, other times in the middle or at the end of it. Furthermore, the area of maximum intensity is usually circumscribed, and often located in different parts of a district.

It frequently occurs that after a prolonged drought rainfalls of great intensity are experienced. Some-

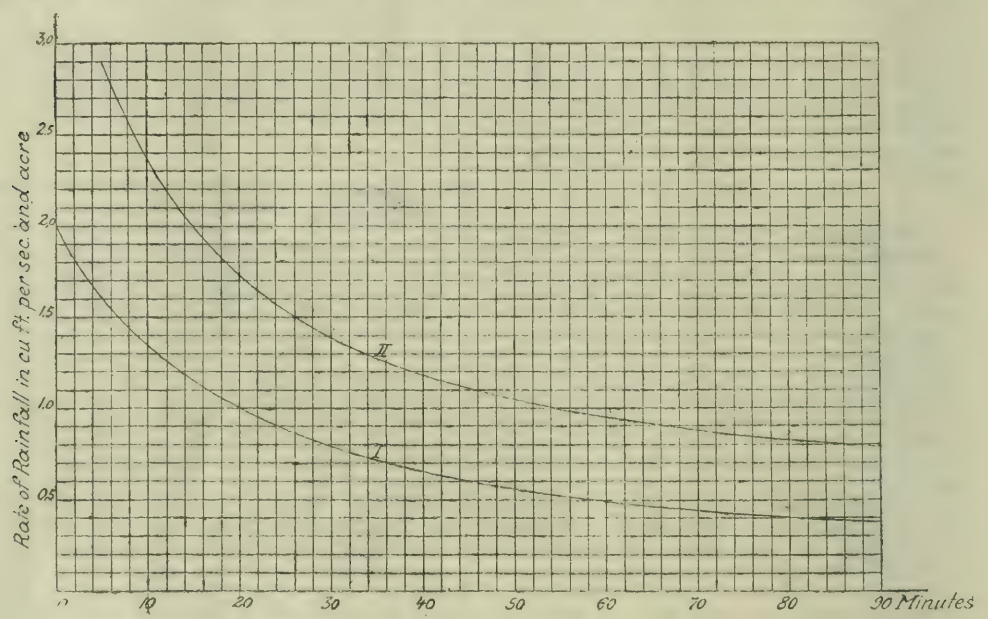


Fig. 1. Rainfall Intensity Curves.

(Curve I. represents all moderate amounts of rainfall in Birmingham ; Curve II. covers the mean heaviest rainfalls in Germany.)

were kindly supplied by Prof. Stupart, the director of the Meteorological Service.

Year.	Place.	Duration of storm in mins.	Actual rainfall recorded, ins.	Rate of rainfall, ins. per hour.
1905	Ponder's End, England	19	1·05	3·32
1905	Birmingham, England...	27	1·04	2·31
1905	Birmingham, England...	7½	0·56	4·50
1906	Burnham, England	40	1·78	2·60
1906	Guildford, England ...	8	0·87	6·68
1907	Worcester, England	8	0·43	3·22
1905	Wallington, England	65	2·77	2·55
1869 1891	New York, U.S. ...	10	1·20	7·20
1871 1891	Washington, D.C. ...	5	0·80	9·60
1905	Washington, D.C. ..	78	3·11	2·38
1884 1891	Philadelphia, Pa. ..	20	1·60	4·80
	Brooklyn	25	2·60	6·24
1899	Frankfort, Germany	6	0·40	4·00
1899	Frankfort, Germany	4	0·267	4·00
1891	Frankfort, Germany ...	6	0·47	4·70
1890	Frankfort, Germany ...	7	0·55	4·70
1905	Toronto, Ontario ..	5	0·11	1·32
1903	Toronto, Ontario ..	15	0·60	2·40
1903	Toronto, Ontario	5	0·10	1·80
1904	Toronto, Ontario	7	0·28	2·40
1904	Toronto, Ontario ..	10	0·51	3·06
1904	Toronto, Ontario ...	8	0·48	4·80
1905	Toronto, Ontario ...	5	0·22	2·64
1905	Toronto, Ontario ...	5	0·25	3·00
1905	Toronto, Ontario	5	0·38	4·56
1907	Toronto, Ontario ...	5	0·25	3·00
1911	Toronto, Ontario ...	7	0·51	4·63
1912	Toronto, Ontario	6	0·25	3·00
1912	Almasippi, Manitoba ...	90	0·73	0·50
1912	Crescent Lake, Sask. ...	30	0·48	0·96
1912	Barbo, Alta.	60	1·20	1·20
1912	Delia, Alta.	45	1·20	1·60
1878	Chicago, Ill.	7	0·97	8·30

It is unfortunate that there is comparatively little information available as to the intensity of rainfall

times it happens that during long periods of wet weather, when the surface is already saturated, and the sewers are flowing practically full, a rainfall of greater intensity will fall and thus give rise to floods, unless the sewers are of more than ordinary capacity. If records of rainfall in wet districts are carefully studied, it will doubtless be found that the intensity is relatively lower there in comparison with drier districts.

Fig. 1 shows two curves illustrating rainfall intensity. Curve I. represents moderate amounts of rainfall observed at Edgbaston, Birmingham, England. This curve is a copy of one prepared by Mr. Wallington Butt, who stated that it is more or less applicable to other parts of England, and by its storm-water discharges can be estimated in that country. Curve II. represents the mean highest rainfalls observed in Germany, and this generally constitutes the maximum intensity assumed in that country.

Both curves serve to show that the intensity of a rainfall varies inversely with the duration of the storm. For example, a rainfall of 20 minutes' duration has an equivalent intensity of 1 cub. ft. per second-acre in Birmingham, and 1·73 cub. ft. per second-acre in Germany, while a 10 minutes' rainfall has an intensity of 1·33 and 2·36 cub. ft. per second-acre respectively.

Although the foregoing diagram will be found useful as a graphical method of ascertaining the factor of rainfall intensity with sufficient accuracy, it will doubtless be acknowledged that it is highly desirable to ascertain the intensity in any particular district by means of reliable automatic recording raingauges, of which the simplest is usually the best.

In countries where a considerable accumulation of snow takes place, such as in Canada, and this melts in springtime, it is a matter of great import-

ance to give this point careful thought, for it often occurs that rain falls when the temperature rises, and this causes serious floods. No statistics are at present available on this feature of our inquiry, so it must be left for the reader to bear it in mind when undertaking investigations.

In addition to ascertaining the rainfall intensity in any district, it is practically certain that it will not be of uniform intensity throughout that area, especially if the area is at all extensive. An interesting example of this is referred to by Sir Maurice Fitzmaurice, who, when discussing Mr.

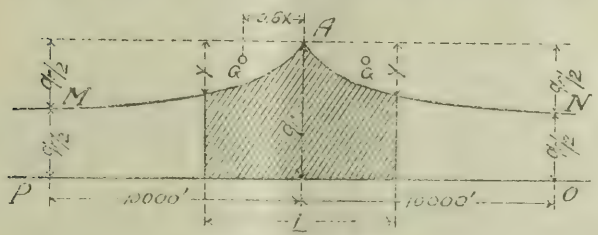


Fig. 2.

Lloyd-Davies' paper, remarked that very heavy showers were extremely local in character, and mentioned a case where rain falling heavily at Hampstead caused a sewer at King's Cross, London, to be gorged and some lives to be lost, although, where the men were working, no rain had fallen. The distance between the two places is only about 3 miles.

Careful observations have been made, in Germany, for instance, and it was found that the mean intensity of rainfall became less as the drainage area increased in size, or the sewers increased in length, beyond a certain radius from the point of heavy rainfall.

It may be stated that observations were made in Breslau, Germany, on an area of about 1,700 acres to ascertain the relative intensity at three stations located as far apart as possible, and it was found that during a period of 760 minutes rain fell simultaneously for only 90 minutes at two stations, and at the three stations for only 28 minutes. In view of these facts, it was not justifiable to assume a uniform intensity over a large area. Further investigations were therefore instituted, so as to ascertain in what manner the maximum intensity qr varied, with the result that it was found that the intensity diminished to $qr/2$, in a distance of about 10,000 ft. from the point of observation.

It may be objected that it is too unfavourable to base a conclusion on such a limited number of instances, where rain fell on all three or two stations at the same time, and to ignore the larger number of rainfalls which occurred at solitary stations. It is submitted, however, that such precaution is justified by the limited extent of the observations, by their local character, and by the fact that storms are not stationary, but travel in different directions, sometimes across a district, sometimes diagonally, and at other times along the major axis of the drainage area; in the latter case, a proportionately larger quantity of storm water will naturally have been precipitated and have to be dealt with.

It may also be contended that it would be more accurate to take, instead of the length of 10,000 ft., a value depending directly on the intensity, for as the area decreases the intensity increases. The results of the observations, however, are not sufficient to ascertain, with any degree of accuracy, the relation which subsists between the intensity of a rainfall and the area; and, moreover, those downpours taken into consideration have some features in common in the manner of occurrence, and do not differ very much in their intensity.

For the sake of simplicity, it may be assumed that the curve representing the decrease from the maximum intensity qr to that at the remote part of a district, $qr/2$, is that of a parabola, so that the intensity and extent of any storm are represented by a solid of revolution, generated by the revolution of a parabola along its axis, and a section along this axis will therefore be, as shown in Fig. 2, at M, A, N, O, P, being limited on the top by two parabolas. The ratio between the solid of revolution and a cylinder representing a uniform rainfall, then, will give the coefficient I, by which the highest intensity assumed has to be multiplied so as to obtain the average intensity of storm, and this factor is called the "coefficient of intensity."

Let A be the zero point, then the parameter p is found from $10{,}000 \quad p = \frac{(qr)^2}{2}$ or p equals $\frac{qr^2}{40{,}000}$: the equation of the parabola will be $y^2 = \frac{qr^2 \times x}{40{,}000}$

The circumference described by the centre of gravity in revolving is $2 \times 0{\cdot}6 \times y \times \pi$: therefore the content of the solid of revolution corresponding to the shaded area (cylinder minus parabola) is—

$$x^2\pi qr \quad \tfrac{2}{5}xy1{\cdot}2x\pi = x^2\pi\,(qr - 0{\cdot}8y),$$

$$\text{and } I = \frac{x^2\pi\,(qr - 0{\cdot}8y)}{x^2\pi qr} = 1 - 0{\cdot}8\frac{y}{qr}.$$

$$\text{As } \frac{y}{qr} = \sqrt{\frac{x}{40{,}000}}, \quad I = 1 - \frac{0{\cdot}8\sqrt{x}}{\sqrt{40{,}000}}$$

The downpour will yield the maximum storm if A is located in the centre of the drainage area, and then x may be assumed to be equal to one-half of the length of the sewer, and it will be—

$$I = 1 - 0{\cdot}0028\sqrt{L}$$

L is the length of the sewer in feet.

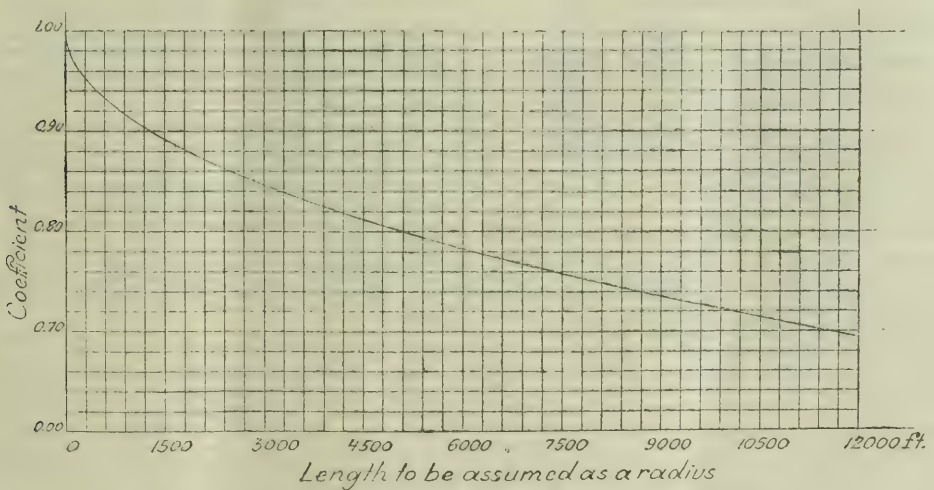


Fig. 3. Diagram for Determining the Coefficient of Intensity.

If qr be taken equal to y, then from the equation of the parabola the values x equals 40,000 ft., and L equal to $2x$, equal to 80,000 ft., will be obtained. This, therefore, is the limit of the application of the above equation, and obviously this limit will accordingly not be attained, even in the case of very extended sewerage systems.

The following table will give the coefficients of intensity ascertained by means of the foregoing formula $I = 1 - 0{\cdot}0028\sqrt{L}$:—

L in feet	Coefficient of intensity	L in feet	Coefficient of intensity
500	·937	5,000	·802
750	·923	5,500	·793
1,000	·9115	6,000	·782
1,250	·900	7,000	·766
1,500	·892	7,500	·758
1,750	·883	8,000	·750
2,000	·875	9,000	·733
2,500	·860	10,000	·720
3,000	·847	12,000	·692
3,500	·845	15,000	·660
4,000	·823	20,000	·605
4,500	·813		

Fig. 3 has been prepared to give the above information.

As an explanation of the foregoing table and diagram, it may be stated that if the calculations in connection with a proposed sewerage system are based upon a high rainfall intensity of, say, 1·428 cub. ft. per second-acre, the sewer being, say, 1,650 ft. long, the coefficient for which in the above table and diagram is 0·89, then $1{\cdot}428 \times 0{\cdot}89 = 1{\cdot}271$ cub. ft. per second-acre, which is the intensity to be provided for when designing the sewers.

It will be observed that it is necessary in this connection to reduce the rainfall which is measured in inches depth to cubic feet per second-acre. As 1 in. of rain per hour on 1 acre is practically equal to 1 cub. ft. per second-acre, it will be a simple matter to make the conversion.

Thus 1 inch of rain per hour equals 1 cubic foot per second-acre
0·5 " " " " 0·5 " " "
0·1 " " " " 0·1 " " "

and so on.

(To be continued.)

Private Bill Procedure.—A number of private Bills affected by a new Standing Order relative to such matters came before the Examiners of Private Bills of the House of Commons last week. In the past it has been the custom to refer the Bills to the examiners for certification prior to second reading, but by the new arrangement the measures may now be read a second time first, and then be certified for that stage after it has been taken, in the event of all the Standing Orders being found to be duly complied with.

Salford Highway Department Economies.—Following a sub-committee's recommendations, a system of centralisation is to be adopted in the highways and paving department at Salford. At the present time there is a highway depot and storeyard in each of the Salford, Pendleton, and Broughton townships. These are controlled by three district surveyors under the supervision of the borough engineer, Mr. J. Corbett, and the total number of employees is 215. Under the new arrangement the Pendleton highway yard will become the central depot, and the Hulme-street depot, the Liverpool-street storeyard and the Broughton depot will be closed. Under these conditions it has been found necessary to revise the positions of certain of the committee's employees, the services of some not being retained. The North Divisional surveyor and assistants and the West Divisional surveyor and assistants are to be transferred from the Broughton and Pendleton Town Halls, respectively, to Salford Town Hall. The borough engineer is directed to rearrange the duties of the district surveyors in order that the chief highway surveyor shall be responsible for the preparation of all plans relating to street works, and that the two highway surveyors shall be responsible for the supervision and inspection of all draining, flagging and paving. Whenever vacancies occur in the positions now held by the North and West Divisional surveyors, the salaries of such positions will be reconsidered by the committee. It is estimated that an annual saving of £1,200 will be effected by these changes.

INSTITUTION OF CIVIL ENGINEERS.

PAPERS ON WATER SUPPLY.

The yield of various catchment areas in Scotland and the measurement of the flow of the river Derwent were the subjects of two papers presented on Tuesday evening at a meeting of the Institution of Civil Engineers. Abstracts of the contributions are appended.

THE YIELD OF VARIOUS CATCHMENT AREAS IN SCOTLAND.

By William Carstairs Reid.

This paper deals with the yield of several catchment areas in Scotland which for a number of years past have been under the observation of the author and his firm. The utilisation of the catchment areas for water supply purposes has been sanctioned by Parliament. The areas under review are situated respectively in the counties of Peebles, Midlothian and Perth.

Reference is made in the first place to the observations having been undertaken on one at least of the areas because the information available in regard to rainfall was insufficient to permit of the proper quantity of compensation water being determined by a Parliamentary tribunal. A comparison is made between the rainfall and the actual flow of the streams according to steam-gauge recorders or having regard to the rise and fall of water in reservoirs of known capacity. The results of observations on an evaporation gauge at Talla reservoir, Peeblesshire, are given. The extent of the Peeblesshire catchment areas is 6,180 acres, taken as a whole, but separate information is given in regard to a portion of this area amounting to 3,000 acres. The Midlothian area is 3,825 acres, and the two Perthshire areas are respectively 1,166 and 1,437 acres.

Some information is given as to the minimum flow in the areas for various different periods, such as one week, one month, and four and five months.

MEASUREMENT OF THE FLOW OF THE RIVER DERWENT, DERBYSHIRE.

By Edward Sandeman, M.Inst.C.E.

The flow of the river Derwent has been measured since 1905, when a weir was built by the Derwent Valley Water Board to ascertain the yield from an area of about 50 square miles of the northern portion of its watershed.

The area in question varies in elevation from 500 to 2,060 ft. Rain gauges to the number of forty-six were fixed on this area, being approximately 1 to each 700 acres. In the last thirteen years the recorded rainfall has averaged 46·34 in. The lowest rainfall of any of the gauges was 34 in., and the highest 61 in.

The measuring weir is in two parts, one 90 ft. and the other 30 ft. wide, the latter being 18 in. lower than the former, so that it will measure the lower flows.

Since the pool formed by the weir tends to silt up, openings were made in the weir (provided with wooden doors), through which the deposited material can be removed by sluicing. A floating boom is placed across the river above the weir in order to catch trees, timber, &c., and prevent damage to the knife-edge weir. The flows over the weirs are recorded on a rotating drum driven by clockwork with cam attachment.

The highest flood on the drainage area occurred before the building of the weir. It was calculated to have reached a flow of 486 cub. ft. per second per 1,000 acres from an area of 9,321 acres. The minimum flow recorded was 0·29 cub. ft. per second per 1,000 acres. Records of evaporation from a water surface 6 ft. square showed a variation from 10·25 in. in 1907 to 19·62 in. in the year 1911.

The general result of the measurement of the rainfall and the yield of the river showed that the quantity of water collectable was—on the average of the seven years under consideration—equal to 75·2 per cent of the rainfall.

STUDENTS' ANNUAL DINNER.

The thirty-eighth annual dinner of the London students of the Institution of Civil Engineers will take place on Wednesday, the 30th inst., at the Trocadero Restaurant.

The Provision and Arrangement of Working-Class Dwellings.

LOCAL GOVERNMENT BOARD MEMORANDUM.

The Local Government Board, in connection with schemes and proposals submitted to them by local authorities in pursuance of Parts I., II. and III. of the Housing of the Working Classes Act, 1890, as amended by subsequent Acts, have had occasion to consider the principles which should be observed in the construction of houses for the working classes when these are provided either by a local authority or by other bodies or persons under grants, leases or contracts to which the local authority are a party. In a memorandum [price 3d.] issued on Friday last the board have summarised as follows their views upon the more important of these principles so far as they are applicable to the erection of separate houses or cottages (whether detached, semi-detached, or in rows or terraces), and of tenement dwellings in small houses.

STANDARD OF CONSTRUCTION.

In designing houses for the working classes the first consideration is that they shall meet the reasonable needs of the class of persons whom it is proposed to accommodate; and, while it is desirable that simplicity of design and economy in construction and general arrangements should be aimed at, it would be well to bear in mind that houses erected by a local authority ought generally to be such as will be a model or standard for houses for the working classes which may be erected by private persons.

Moreover, if a local authority propose to borrow money to defray the cost of the erection of houses, the board, in fixing the period for the repayment of the loan, could not allow the maximum period adopted by them for this purpose—namely, sixty years—unless the houses were to be built substantially.

As a general rule, therefore, the standard of construction should, in the board's opinion, be such that, with only a moderate annual outlay for repairs, the houses should be capable of being maintained in a state in all respects fit for human habitation for a period of at least sixty years.

Special circumstances may exist in some cases rendering it desirable for the local authority to construct houses of a less permanent character, and to repay the loan in a much shorter period than sixty years. The saving effected in such a case in the cost of the erection might be such that a loan for the shorter period would not involve a larger annual outlay in respect of loan charges than if the houses had been constructed more substantially, and a loan for the greater cost of construction obtained for the full period of sixty years. In considering this point it is to be borne in mind that, taking interest at 3½ per cent, an annuity of £6 9s. 4d. would repay a loan of £150 in sixty years, £141 in fifty years, £128 in forty years, or £110 in thirty years.

CLASS OF PERSONS FOR WHOM ACCOMMODATION IS TO BE PROVIDED.

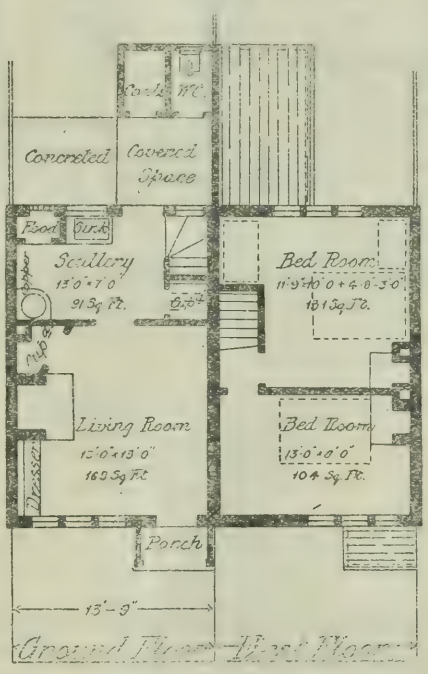
As a general rule, experience shows that houses suitable for the accommodation of persons of the better paid working-class community (who can afford to pay a rent which will provide a fair return on the capital employed) are more likely to be provided by private enterprise than houses at low rents, which are necessary for the accommodation of the poorer classes. It will therefore frequently be the case that the efforts of the local authority will be directed mainly to the provision of houses of the latter class. This has been borne in mind in connection with the suggestions in this memorandum.

TYPES OF HOUSES MOST SUITABLE.

The type of dwelling which may, perhaps, be regarded as the most suitable in ordinary circumstances is the self-contained house. This type is generally more popular than the tenement dwelling contained in large blocks, and has advantages in respect of health and comfort which are not shared by the latter. Occasionally there may be a demand for accommodation of a limited character—*e.g.*, accommodation for newly married couples or for aged persons without a family—and in such cases it may be desirable to meet the demand by the provision of two-storey houses consisting of two self-contained dwellings; but, generally, it would seem desirable to avoid where practicable the erection of blocks of buildings containing a series of tenements.

NUMBER AND ARRANGEMENT OF BUILDINGS ON THE SITE.

(*a*) *Generally.*—The arrangement of houses on the site, and to some extent the design of the houses, will depend upon the size, situation and character of the land; but the site should be so utilised as to secure ample open space in connection with the houses, and the best possible aspect for the living rooms. Overcrowding of houses on a site should be avoided, and care must, of course, be taken to comply with any by-laws or local provisions in force in regard to new streets or open spaces in connection with buildings. On the question of the number of houses to be erected on a site, the local authority will, doubtless, consider it necessary to have regard to the cost



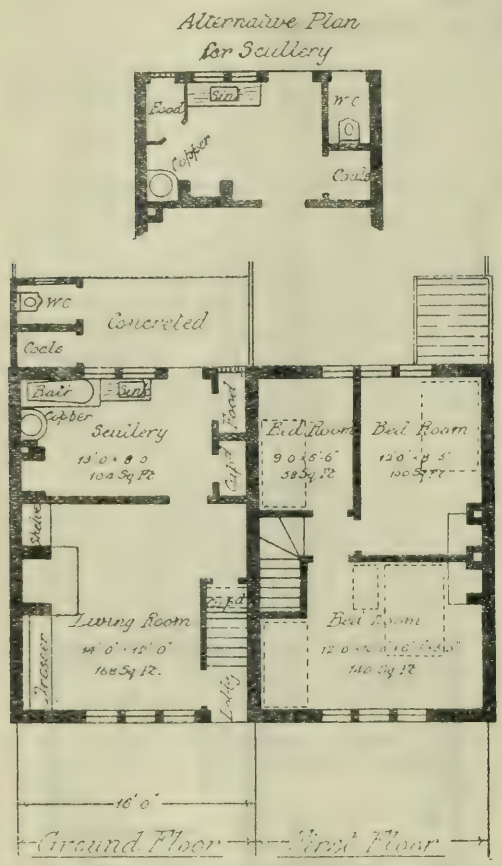
Two-Storey Cottage, with Three Rooms and Scullery.—Type A.

(Cubic contents, 6,579 cub. ft., exclusive of coals and w.c.)

of the site and the extent to which street works will be necessary; but it would be well to bear in mind that the annual charges in respect of a loan for the land, spread over the maximum period of eighty years, would in most cases constitute a comparatively small proportion of the total annual cost of providing the houses. On the basis of ten houses to the acre, and land at £100 per acre, the loan charges per house for land purchase would be less than 2d. a week. Landowners, in some cases, have expressed themselves willing to provide land for housing purposes at a nominal price or free of cost. Local authorities are empowered to accept a donation of land for these purposes under sec. 8 of the Housing Town Planning, &c., Act, 1909, and wherever they are able to obtain suitable land on these favourable terms they should promptly avail themselves of the opportunity.

(*b*) *Building in Rows: Back Streets.*—Where the houses are built in rows, it is desirable that they should be set back from the street line, so as to allow small gardens or forecourts to intervene between the houses and the street. It is also undesirable that long rows of houses without a break should be constructed; and, as a rule, the number of houses in a continuous row

should not exceed ten or twelve. Long rows are open to objection, not only because overcrowding of houses on the site may be the result, but also because they give a monotonous and depressing appearance



Two-Storey Cottage, with Four Rooms and Scullery.—Type B.

(Cubic contents, 8,118 cub. ft., exclusive of coals and w.c.)

and prevent easy inter-communication between streets. Where houses are erected in rows, back streets may be necessary for the removal of house refuse and delivery of coals, goods, &c., and for the laying of sewers. Though back streets, if not properly controlled and lighted, may be a source of nuisance, they have the advantage, in addition to their use for sanitary purposes, of affording a second means of access to the dwellings, thereby saving objectionable traffic through the living rooms.

(c) *Detached or Semi-detached Cottages.*—The erection of detached or semi-detached cottages is somewhat more costly than the erection of cottages in blocks of four or more, but if the circumstances are such as to justify the additional expenditure involved, the erection of detached or semi-detached cottages may be of advantage. In this connection it may be observed that larger ground area and frontage will, as a rule, be more often possible in rural areas than in urban areas and where large gardens are provided and a slightly increased rent is charged, the tenants should be able to secure some return in the form of garden produce, &c.

(d) *Other Arrangements of Houses on Site.*—Where the by-laws admit, it may be desirable to consider other arrangements of streets and buildings which may reduce the expenditure on land and on street construction—*e.g.* (1) the formation of groups of houses on back land, access to the houses being either from comparatively narrow streets, i.e. the houses are set well back from the street line and if the streets are not intended or likely to become important thoroughfares, or from streets of full width, of which portions might be turfed or planted with trees; (2) the grouping of a number of houses round an open space which would serve as a recreation ground for the occupants of the houses (see sec. 11 of the Housing of the Working Classes Act, 1903); and (3) the formation of the street which will be the means of approach for vehicles at the back of the houses, leaving a stretch of garden ground between the fronts of the houses and a footway giving access to those fronts.

(e) *Frontage of Houses.*—In the laying out and development of sites for building the execution of the necessary street works is frequently a source of heavy expense, and there is a tendency, especially where the streets are wide and of costly construction, to make the greatest use of the frontage. As a result houses are sometimes built with an unduly narrow frontage, the necessary internal space being obtained by making the houses deep from front to back, or with projections at the back. These methods of construction interfere with the due access of light and air to the rooms, and in order to avoid these objections the frontages should not be unduly restricted. In the case of houses containing three bedrooms on the first floor it is desirable that the frontage should in no case be less than 16 ft.

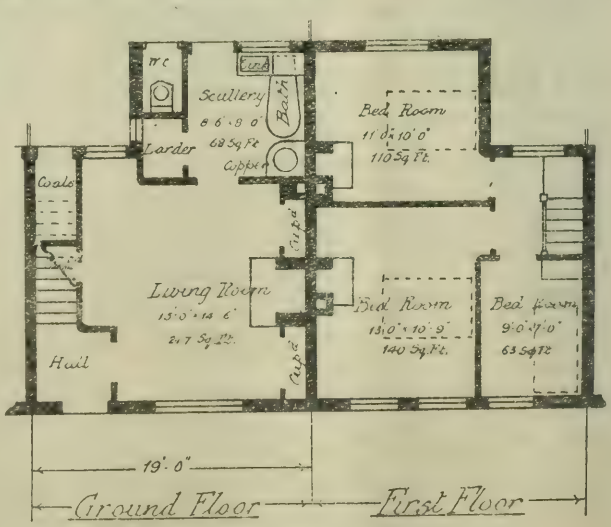
ACCOMMODATION TO BE PROVIDED AND ARRANGEMENT OF INTERIOR AND OUTBUILDINGS.

(a) *Generally.*—The house, as previously stated, should be designed to meet the reasonable needs of the prospective occupants, and the internal arrangements will no doubt be influenced to some extent by custom of the locality and by the habits of the population. Although the actual arrangement of the rooms may not lend itself to any great variety of planning, the dimensions of the rooms and the arrangement of doors, windows, fireplaces, &c., need careful attention, and some suggestions in regard to these matters are made under the appropriate headings below.

(b) *Simple Type of House.*—The type of dwelling adapted to the ordinary working-class family of, say, five to seven persons should comprise a living room, scullery, food store, three bedrooms, and the necessary conveniences and out-offices. In such a house the ordinary necessities would be met by the following arrangements:—

Living Room.—The living room, being used by all the family in common, ought to be as large and commodious as possible, and should contain a good cupboard and dresser, and a kitchen range with a boiler for hot-water supply.

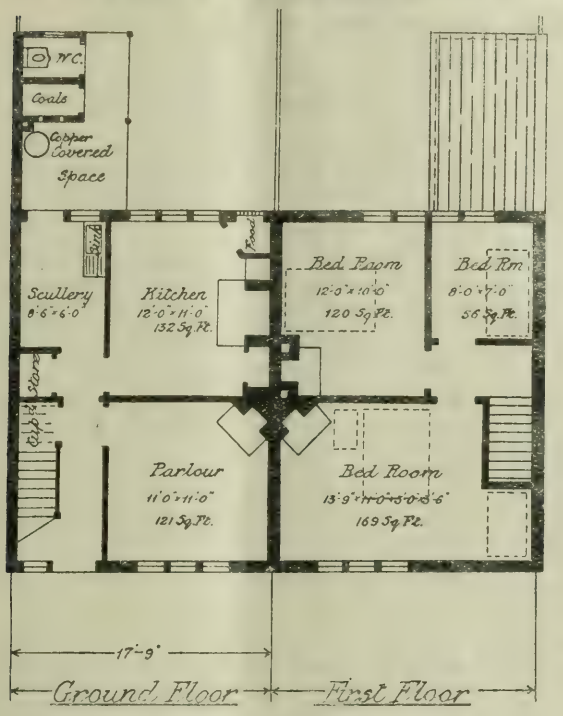
Scullery and Bath.—The scullery may be fitted with a small range or open fire, or with a gas stove, so that cooking may be done here in the summer when the warmth of the fire is not needed in the living room. A bath, fitted with hinged top to form a table



Two-Storey Cottage.—Type C.

(Cubic contents, 9,246 cub. ft.)

when not in use, can advantageously be fixed in the scullery, hot water being supplied to the bath and sink from a copper in the scullery, from a tank connected to a small boiler in the kitchen range, or from a copper heated by the kitchen range. Baths, which need not necessarily be of the full size, should be of vitreous-enamelled iron, and should not be encased. The provision of a covered space outside the scullery in which washing, &c., can be done, and in which the copper can, if desired, be placed, will be found a convenient arrangement.



Two-Storey Parlour Cottage, with Five Rooms and Scullery.—Type D.
(Cubic contents, 9,567 cub. ft., exclusive of coals and w.c.)

Food Store.—The food store should be well lighted and ventilated by a separate window opening into the external air, and, in order that it may be kept cool, should not be placed so as to adjoin any fireplace or chimney flue, and a sunless aspect is desirable.

Bedrooms.—Bedrooms should be as large and airy as practicable. It is desirable that one of the rooms should have a floor area of at least 120 sq. ft. Bedrooms which cannot be provided with a fireplace should have special ventilation. This may be provided by means of fixed louvres over the door, and the door should be at the opposite end of the room from the window. The doors, windows and fireplaces in the bedrooms should be arranged so as to secure convenient spaces for the bed and furniture, and to ensure the freest circulation of air.

Closet accommodation.—Separate accommodation should be provided for each house, and the entrance to it should be placed outside the house. A water-closet may be placed close to or built as part of the house, and access to the entrance should be under cover if possible. If an earth closet is provided it should be placed at some distance from the house.

Coal Store.—A store for coal and fuel should be provided.

Yard.—Any provisions in force in regard to the paving of yards or open spaces must be complied with, and in any case it is desirable that there should be a paved or concreted area immediately adjoining the back of the house.

Height of Rooms.—The height of the rooms need not exceed 8 ft. 6 in., and 8 ft. may suffice with good ventilation.

(c) Staircases.—It is desirable that the staircase should be arranged independently of a living room. The staircase should be well lighted and ventilated, should be furnished with a handrail, and be of an easy gradient, with risers not exceeding 8 in., "winders" being avoided if possible.

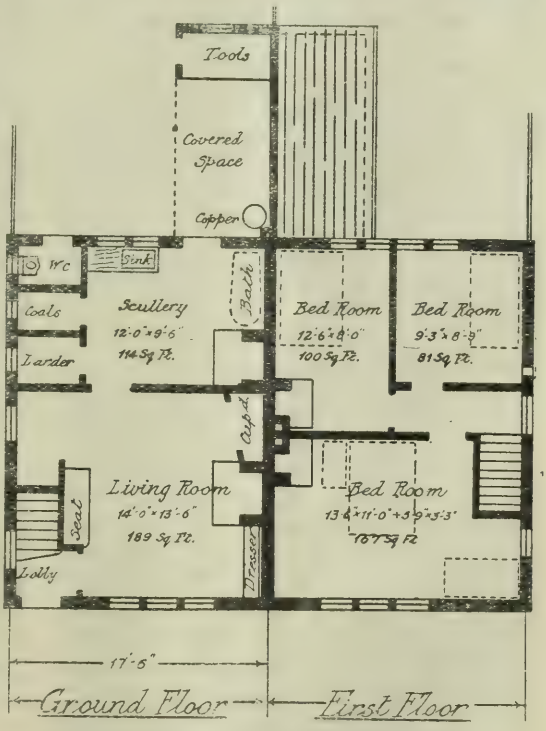
(d) Cellars.—Unless special circumstances necessitate their provision, it is not desirable that cellars should be provided. They add substantially to the cost of a house, and, apart from dangers that may arise from damp or ground air, they are liable to be made receptacles for rubbish and to become a nuisance.

(e) Windows.—The window area of each room should not be less than one-twelfth of the floor area of the room; the windows should be made to open, and should be so placed as to ventilate the upper as well as the lower portions of the room, and at the same time be sufficiently low down to enable children to see out of them. A good and inexpensive form of window is that of the ordinary casement type, with opening lights above a transom.

MATERIALS: WALLS: FLOORS: DOORS.

The materials of which the houses should be constructed will vary according to the locality. Brickwork, covered externally with rough cast or cement, is an economical form of construction, though of not such lasting quality as plain-faced brickwork. Half-brick internal walls which carry the floor joists should be built in cement. Walls of habitable rooms should be finished internally with plaster, sculleries, larders, outbuildings, &c., being pointed and lime-whitened.

Floors of living rooms and bedrooms should be constructed of deal flooring, those of sculleries and outbuildings being of solid concrete finished in cement. The floors of living rooms can be constructed of deal boards, either on joists or laid on concrete, and nailed to fillets embedded in the concrete, but care must be taken that the concrete is absolutely dry before the boards are fixed. A layer of bituminous composition beneath the boards is desirable. Red Staffordshire quarries bedded on concrete make a serviceable and clean flooring.



Two-Storey Semi-Detached Cottage.—Type E.
(Cubic contents, 9,860 cub. ft., exclusive of rear addition.)

Strongly made ledged and braced doors are preferable to panelled doors of inferior quality.

MODEL PLANS.

Annexed to the board's memorandum are plans designed to meet different requirements.

Type A is a design for a house containing two bedrooms only, which would be suitable for a family of four or five, consisting of the parents and three young children.

Types B and C are illustrations of the type of house described in paragraph 6 (*b*) of this memorandum. It might serve to accommodate a family of, say, four adults and three children.

Type D illustrates a house containing a parlour in addition to a kitchen and scullery. The provision of a parlour will necessarily add to the cost of the house, and, consequently, it should not be provided unless a sufficient rent is obtainable to justify it. It is desirable that the provision of a parlour should not lead to a reduction of the size of the kitchen or living room.

Type E is an illustration of a semi-detached house suitable for a family of seven.

These plans are intended to serve as a basis upon which dwellings may be designed to suit the particular circumstances for which they are required. They purposely show only suggested arrangements of rooms or other accommodation. The result of suggesting official models of elevations might be to stereotype designs to some extent, and the board are desirous of avoiding this. They think that the general designs and elevations may best be left to be decided by local custom or wishes. In this way it is hoped that there may be full scope for variety and pleasing effect, and that the dulness of uniformity may be avoided.

The cubic capacity in the five types illustrated varies from 6,579 cub. ft. to 9,860 cub. ft. In arriving at these figures a height of 8 ft. has been taken for the rooms. The approximate cost of each dwelling may be obtained by multiplying its cubic capacity by the current cost per foot cube in the locality in which the dwelling is to be erected. Thus, if the current cost per foot cube were 4d., the approximate cost of a dwelling of 6,579 cub. ft. would be £110, and of a dwelling of 9,860 cub. ft. would be £165. If the current cost were 5d., these figures would be increased by 25 per cent.

COMPLIANCE WITH LOCAL BY-LAWS AND STATUTORY PROVISIONS.

The observations or suggestions in this memorandum must be read as subject to the by-laws in force. Care must be taken to comply with the local by-laws and statutory provisions in force in the district relating to streets, open spaces, and new buildings, but in connection with this point special attention is drawn to the board's circular letter of August 29, 1912, in which they urged the importance of local authorities reviewing the requirements of their by-laws, so that, while prescribing reasonable provisions with a view to securing stability, protection from fire, and conditions essential to health, they should not be unduly restrictive in regard to the erection of small dwelling-houses.

West Bromwich Corporation Proposals.—The West Bromwich Corporation Bill, which empowers the borough of West Bromwich to provide and work a trolley vehicle system, to provide and work motor omnibuses, to extend their power with regard to their gas and electricity undertakings, and for other improvements in the borough, has been presented in the House of Commons and read a first time.

Road Board Grants for Ireland.—The total amount of road grants made and indicated for Ireland amounts to £140,106. Of this, however, only £83,958 have been actually made, due no doubt to the arrangements not yet having been accepted. Kerry heads the list with £18,000. Cork, a very large county, comes next with £14,750, and Donegal third with £10,000. Down comes next with £8,322, all of which has been paid. Antrim and Armagh, both of which counties have taken up steam rolling vigorously, have been granted £7,200 and £6,100 respectively, though Antrim has not taken up any of its grant yet. Clare has been allocated £4,958, of which £2,600 has been paid. The *Irish Motor News* states that the only counties which have not taken up any of the Road Board grant up to the present are Donegal, Limerick, Londonderry, Wexford, and Wicklow.

APPOINTING A CLERK OF WORKS.

CANDIDATES' ORDEAL AT NANTWICH.

At the last meeting of Nantwich Rural District Council it was reported that the sub-committee had gone through the applications for the position of clerk of works to the Willaston sewerage scheme, at a salary of £2 10s. per week, and the three following, says the *Crewe and Nantwich Observer*, were selected to appear before the council:—

Mr. Charles Harvey, fifty-four years of age, of St. Helens, formerly a practical bricksetter, with experience of clerk of works to sewage disposal schemes.

Mr. B. M. Smith, thirty years of age, civil engineer and surveyor, of Pontefract.

Mr. Harry L. Lloyd, twenty-nine years of age, civil engineer and surveyor, of Wolverhampton.

The chairman was given a list of technical questions by Mr. C. E. Davenport, the sanitary surveyor, to put to the candidates, and in addition the chairman banteringly suggested that each candidate should be asked whether he was a teetotaller and what were his politics. (Laughter.)

When Mr. Harvey had answered the technical questions, he was asked by the chairman if he was a teetotaller, and the applicant said he was, whereupon

Mr. W. Emberton protested against such a question being put to the candidates. When the chairman mentioned it he took it as a jocular remark.

The chairman said it was the other question about politics that was the joke.

Mr. Emberton protested that such a question ought not to be put.

The chairman (to the applicant): You are not at all hurt at my asking you the question, are you?

Applicant: No, sir.

When Mr. Smith came in, Mr. Emberton moved that the question as to the applicant being a teetotaller be not put. He wished to test the meeting.

The Chairman: I won't test the meeting. He can answer it if he wishes.

The applicant did not answer. Mr. R. W. Cartwright asked, "Is the gentleman an abstainer?" and he replied, "I am temperate." (Cries of "Hear, hear.")

Mr. Emberton: Sensible man.

The next applicant (Mr. Lloyd) had said in his application that he was a teetotaller, and after he had answered the questions the chairman inquired of the council, "Any other questions to ask?"

Mr. Emberton: Better ask him what religion.

The Chairman (confidentially to the applicant): It's all right. That's a joke.

Mr. John Loring said as it was a highly technical question he would like the surveyor's opinion on the applicants.

Mr. Davenport said he preferred the practical man, Mr. Harvey, who was formerly a bricksetter. The other men were better qualified technically, but he could do the technical work himself.

Mr. Loring also asked whether 54 or 30 was the better age, and whether the younger or the older man would be more efficient.

Mr. Davenport said the man at 54 appeared to be an active man.

Mr. W. J. Dutton asked whether the surveyor considered practical experience or theory was the more valuable in this case?

Mr. Davenport: Practical experience.

Mr. Dutton: That will decide my vote.

Mr. Harvey was appointed by 35 votes to 9, the latter number being in favour of Mr. Lloyd.

The Wheel and the Road.—A paper on this subject will be read on Wednesday evening next by Colonel R. E. Crompton, C.B., at a meeting of the Institution of Automobile Engineers, to be held at the Institution of Mechanical Engineers, Storey's-gate, S.W. The chair will be taken at 8 p.m.

Royal Sanitary Institute. — "The Open Spaces Policy and its Local Aspect" will be the subject of discussion at a sessional meeting of the Royal Sanitary Institute to be held at Pelham-road schools on Saturday, the 12th inst., at 10.30 a.m. Tickets for admission of visitors may be had on application to Mr. C. H. Cooper, M.INST.C.E., and Dr. E. H. T. Nash, Town Hall, Wimbledon, who are acting as the local hon. secretaries of the meeting; and of Mr. E. White Wallis, secretary of the institute.

Office Conversations.

MORE OR LESS IMAGINARY.

[*Contributed.*]

IX.—A Lesson in Surveying.

That's all, thanks, Miss Bruce. I'll sign them when I come back this afternpon. You might tell Mr. Sparks that I want him. Now, Sparks, I've a job for you to-day. You've been doing very well lately—quite a marked improvement. No more snooker pool, eh? No, you've been sticking to it like a brick—kept your promise, as I knew you would. Thanks to me? Well, in a way, perhaps; but I knew you had it in you, and—— But there, all this is beside the question. It's a grand day, and I'm a bit fagged with detail and interviews, and all that sort of thing. I'm going to have a day off, and—— Are you going with me? Yes, and if you'll just collect the surveying instruments we'll make a start. You've not had any field work yet, have you? You've been reading Usill's book, I suppose, and you'll have just a glimmering notion of the work; but you'll find it very different once you're in the field. We're going to tackle that 40 acres at Bacon-lane—you know, the land the council acquired recently for a recreation ground. Survey and contour, that's the programme. Of course, we could do both together with a couple more assistants; but it's to be you and I for it. It's to be a practical lesson, and, mark you, you've got to put your back and your brain into the job.

* * * *

Got 'em all? Chain, pins, tape? And the level, tripod and staff? I don't suppose we'll touch the levelling to-day; but you may as well bring them along. Call one of the men to help you to carry them—it wouldn't do for me to be seen humping along with a load—loss of dignity, you know. Here we are, then. Now watch me throw the chain out. There are two ways to do it, as there are to do everything else—a right and a wrong way. Now take this handle and stretch it along, then come back to me and see on your way that there're no kinks in the chain. We've some scores of chain lengths to take, and a couple of inches out on every length makes all the difference when it comes to triangulation. Now, if you go up to that corner of the field, you'll see a peg. Take these three poles and stick one firmly in at the peg. In the peg? No, at the peg—you'd have a job to drive the pole into it! Mind that the pole is absolutely vertical from every point of view. Then walk back towards me with the other poles—mind, straight towards me; don't wander all over the field. When you've gone about a couple of hundred feet—say eighty paces in your case—stick in another pole exactly where I tell you. You won't be able to hear me? No, and I shan't try to make you—I've only one pair of lungs to last me out. You'll have to watch my hand, and when you see me drop my hand—like this— screw the pole in hard and vertical. Then another couple of hundred feet and do the same with the remaining pole, and that done come back to me here and we'll start chain line No. 1.

* * * *

Thought you'd find me? Well, I can't say that I exactly thought *you* would; but I knew that I'd never get half an hour to myself. Must come along with you? Well, that's pretty cool. Must! You—oh, the young fool; he's got the pole at an angle of about 45. Hi! Hi! Of course, he can't hear; he—he'll have to go back, that's all. Now, Mr. Trotman, what is it exactly you do want? The briefer your reply the better it 'll suit me. To come to Ronald-road? Question of building line? You'd better see Mr. Simms, the inspector—— Right! that's better—vertical as a chimney shaft. The chairman there? What does he want? Meeting the trustees? Now, look here, Mr. Trotman, I ask you, is it fair to spring a thing of this kind on me at a minute's notice? You could 've rung me up this morning at the very least. Here am I prepared for a day's survey—a pressing job—absolutely got the first line ranged out, and—— Right! Come on! And here you want me—nay, you order me—to come with you. Of course, if you've the chairman with you, and he gives his instructions, there's an end of the matter as far as I'm concerned. I'm bound to obey him when I can; but I've no cause to thank you. Very good, my lad, but that farthest pole's a little out of the vertical—run along and straighten it up. The others are O.K. I suppose it won't take me long, anyway, and I can get back here before lunch. Tell the chairman I'll be with him in a few minutes. Can't I come now? No, I can't, and what's more, I don't mean to. Say a quarter of an hour—no, not a moment sooner!

* * * *

A very good line, indeed, Sparks, now you've straightened that pole. Look down them—the poles appear as one, don't they? That's how they should be. I've got to go to Ronald-road now, and you'd better meet me here after lunch. It'll be no use trying to start again before. Yes, you can leave everything here except the levelling instruments. Take them back with you—it's quite certain we shan't want them to-day. Hullo, here's another of 'em. One—two—three—why it's quite a deputation. Morning, Colonel Jubber. Your solicitor? Pleased to meet you. Good morning. Anything important? I'm afraid I haven't a moment to spare—just off to Ronald-road. Five minutes? Yes, I can give you that. Dear me, that's very bad. Bolted, you say? And shattered your entrance gate? Man drunk? No, I don't think you're right there, Colonel Jubber. The man's a staunch tote—— Oh, yes, he is; I know it, for the simple reason that he's the only one we have. No, that isn't why I put him on the water van, Mr. Pounce. Want me to come and see the damage at once? Well, that's just what I can't do. You intend to claim? Well, of course you do. Bless your innocent heart, Mr. Pounce, what else could you do, having regard to the fact that you're acting for the Colonel? Send your claim along, and I'll look into it and report in due course to the council. Sack the scoundrel? No, Colonel Jubber, I scarcely see my way to do that, and I've yet to learn that a man's a scoundrel because his horse runs away. I remember a case not so very long back of a gentleman driving, and—— Don't want to hear about it? Nothing to do with the present case? No, but when you brand a man as a scoundrel, I——

* * * *

No, I can't come now, and that's absolute. Make your claim and I'll do what's right. Now, my lad, just put that chain in the ditch out of sight—eh? Oh, I thought you spoke—seemed to me you said something you might be sorry for if you repeated it. Good day, Colonel Jubber. Good day, Mr Pounce—you'll send your claim along, won't you? I don't suppose you'll forget. The pins? Oh, take 'em with you—they're things easy to pick up. Run along now and be back after lunch. You might have an hour with Usill—it'll do you no harm now just to look up a few—— Hullo, what now? No, no reply, thanks. "Calling—three—o'clock—important—Carston." Well, that's about done it, as they say in the police reports. Absolutely put the cap on! It's no use, Sparks; we must give it up. Take everything back. Yes, pull up the poles. Lor', what a day off! Anything wrong? No, nothing much, only I've to meet Mr. Carston at three o'clock, and that'll mean a trip down to the new tanks, and the rest of the day gone. But there, I mustn't stand talking here—the chairman 'll be fuming and fretting by now, I reckon. Tell Miss Bruce that I'll be back at half-past two, and ask her to have the letters ready for me to sign then, as I probably shan't return when I go out with Mr. Carston.

* * * *

Have I come home? Well, it looks like it, dear, doesn't it? At least I presume I'm here. Don't be foolish? I'll try not to be, but really I feel sometimes as though what's left of my brain is turning. Had a good time? Thought I was going surveying? Yes, so did I; but I hadn't got a line ranged out before a message came for me to meet the chairman at Ronald-road. Then hard upon that followed old Jubber and his solicitor. Some rot about damage to one of his gates. Action? Oh, yes, it's bound to mean that unless the council pay up, and I don't suppose the solicitor (our solicitor, I mean) 'll advise

that. It'd be much too short a proceeding. Yes, it'll mean a day for me, I suppose. Well, no sooner had old Jubber gone than along comes a wire from Carston to meet him at three o'clock, and you know what *that* means. The rest of the day's a blank, and the evening too. Bring him home? No, that wouldn't suit Carston. He likes what he calls a run round. He's an awfully decent chap, but I do wish he'd settle down. Not bound to go with him? No, of course I'm not; but—er—— I want to go? My dear girl, you've hit it right off. Really, I never looked at it in that light myself before—yes, I do believe I do want to go. Humbug, am I? Well, I'm afraid I must plead guilty to the soft impeachment. Still, you mustn't grumble. It's not often that I have an evening really off. And, Kate, I *have* come home to lunch, haven't I? That's a bit out of the customary, isn't it?

DUTIES OF A SURVEYOR AND MASTER OF WORKS.

KIRKCUDBRIGHT'S LIST OF "REGULATIONS."

SURVEYOR and MASTER of WORKS (with sanitary qualifications preferred) wanted for the BURGH of KIRKCUDBRIGHT.—For conditions of appointment apply to John Gibson, Town-Clerk, Kirkcudbright, with whom applications and copies of testimonials are to be lodged on or before 5th April, 1913.

From information which has reached us it would appear that the above innocent-looking advertisement has induced quite a number of municipal engineers to apply for copies of the conditions drawn up in connection with the appointment, but whether there will be an overwhelming rush of actual candidates, either with or without the desired "sanitary qualifications," is, we imagine, somewhat open to question. The regulations, as they are termed, make such interesting reading that we reproduce them verbatim:—

REGULATIONS

FOR THE

DUTIES OF THE SURVEYOR AND MASTER OF WORKS FOR THE BURGH OF KIRKCUDBRIGHT.

The surveyor and master of works will be paid, to begin with, a salary of £80 a year, and for this salary he must devote the whole of his time to the duties of his office. The engagement will be for one year, and thereafter at one month's notice on either side, and his duties will be as follows—viz:—

SLAUGHTER-HOUSE DEPARTMENT.

To visit the house every day that cattle are being killed, examine the carcases, and see that any diseased meat is destroyed, and report such cases immediately to the veterinary inspector.

To collect the dues for the animals killed in the slaughter-house, give the butchers receipts therefor, account for the dues to the chamberlain each week, and get the counterfoils of the receipts issued to the butchers initialed by the chamberlain.

Generally to see that the house is kept clean and in good order and repair, and that the regulations and by-laws are duly observed and enforced. To report to the town council every contravention of the regulations and by-laws without delay.

WATER DEPARTMENT.

To see that the waterworks are kept in good order, and report any defects to the convener of the committee.

To report to the convener of the committee from time to time the quantity of water in store, the conditions of the reservoirs, springs and filter beds, and their tributaries.

To prepare estimates of cost of extensions and alterations of water mains.

To superintend all extensions, alterations and repairs of mains and hydrants.

To regularly inspect all pipes, taps and cisterns in houses once each quarter, and to enforce compliance with the regulations as to the supply of water to houses, &c.

To regularly scour the water mains, and thoroughly clean out all tanks and catchpits in October and February in each year, and to intimate to the convener of the Water Committee when this work is to be done.

To go round once every week all outside closets and see that they are kept clean and in good order, and report to the proprietor of the premises and the convener of the Public Health Committee when any of the closets require attention.

SEWERAGE DEPARTMENT.

To prepare plans, specifications and estimates of the cost of extensions or alterations of main sewers.

To superintend all extensions, repairs or improvements of the sewerage system.

To see that alterations and connections with private drains are properly made and tested, and that all junctions are formed with fireclay collars.

To see that all private drains, soil pipes and sanitary appliances are kept in good order and repair, and intimate all defects to the respective proprietors or their factors and to the convener of the committee.

To carry out any special instructions which may be given him by the council or the convener of the Public Health Committee.

ROADS DEPARTMENT.

To call every morning before 9 o'clock on the convener of the Streets Committee for any instructions he may have to give, and attend promptly to these instructions.

To superintend the repair, cleansing and watering of streets and roads, and see that all the conduits for carrying the roof water below the foot pavements are kept clean.

To calculate the quantity of road metal required for the season, and measure the same when broken in heaps.

To prepare plans, specifications and estimates of cost of any proposed improvements.

To measure contract work, and give certificates for sums due to contractors.

To grant orders for opening the streets when required for connecting water, sewer or gas pipes, and see that the openings are properly filled up to the satisfaction of the committee.

To see that the burgh workmen and scavengers begin their work timeously in the morning, and go round and see that the work is properly performed.

BUILDINGS (NEW AND OLD).

To examine plans of proposed new buildings, and alterations of existing buildings, and see that the statutory provisions are complied with; to inspect buildings during construction, and report to the council any case of contravention of the statutory regulations or of the warrant granted.

GENERALLY.

To see that all lands, houses, fences and grounds belonging to the burgh are kept in good order, the grass in St. Mary's Park and Moat Brae is properly and regularly cut, and the fences and seats kept in repair.

To prepare plans, specifications and estimates of cost of any new works, and superintend their execution, whether by contract or by day labour.

To check all accounts incurred in the various departments, and submit same to the Finance Committee; and generally to carry out the instructions of the various committees or conveners given either orally or in writing.

To have full control as to the engagement or dismissal of occasional workmen when employed at work ordered by the council or the convener of a committee, and to pay the wages of such workmen.

To report at once to the council or the Streets Committee any insubordination or disobedience to orders on the part of any of the workmen or scavengers.

To act as inspector under the Shops Act, 1911.

To carry out all the duties of a burgh surveyor, whether herein mentioned or not.

To undertake any other duties if required by the town council at such remuneration as may be determined.

To attend monthly meetings of Council and Finance Committee, and special meetings when required, and to give in a written report of the work that has been going on.

To report at once to the council when he becomes aware of any repairs being required on any of the burgh property.

To keep a daily register setting forth each day what he has been doing, and submit the register to each monthly meeting of council, or to any committee that may ask for production of it.

Roadmen's Wages in Norfolk.—At Monday's meeting of the Forehoe Rural District Council, the surveyor, replying to the question of a member, stated that the wages of roadmen in the district were 13s. a week and 15s. for gangers.

Law Notes.

Edited by J. B. REIGNIER CONDER, 11 Old Jewry Chambers, E.C., Solicitor of the Supreme Court.

The Editor will be pleased to answer any questions affecting the practice of engineers and surveyors to local authorities. Queries (which should be written legibly on foolscap paper, one side only) should be addressed to "The Law Editor," at the office of The Surveyor, *accompanied by the writer's name and address, but correspondents who do not wish their names to be published should also furnish a "nom de plume." Where necessary, copies of local Acts or documents referred to should be enclosed.* **All explanatory diagrams must be drawn and lettered in BLACK ink only, and in such style as to be fit for direct reproduction—i.e., without re-drawing or amendment.** *Unless these conditions are complied with we cannot undertake to reply to queries.*

QUERIES AND REPLIES.

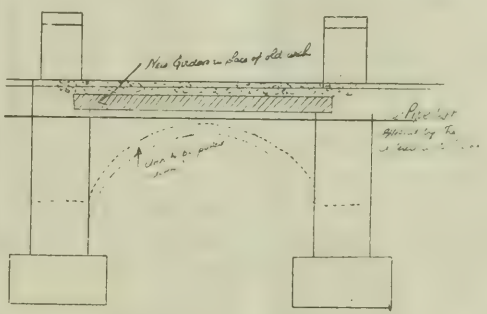
In order to avoid confusion querists are requested to use binations such as X.Y.Z., and words such as "engineer" and "surveyor," should never be used.

Private Street Works Act, 1892.—"Tesremos" is instructed by his council to prepare the necessary drawings, estimates and preliminary apportionment under the above Act for the making up of a number of roads and footpaths in and about a certain square in the middle of the town these being at the present time private streets repairable by an expenditure annually appointed by the residents of the various houses situate round the square. The question now arises as to the proper way in which the expenses should be charged and the apportionments made out. On the one hand it is contended that the whole of the expenses should be lumped together, the whole of the frontages measured, and the apportionment based on the average cost per foot frontage; on the other hand it is thought that as each particular length of street differs from the others either in the fact of

houses facing both sides of the street, and in the amount of work required to be done, the whole of the roads and footpaths should be divided into separate lengths and each length treated as a separate street. For instance, No. 1 length has two footpaths, one on either side (one being very wide), and a narrow roadway requiring special treatment to avoid injury or interference to cellars partly under the road. No. 2 length has only one footpath of extra width. No. 3 length has no footpath at all on one side, and two short lengths of narrow width on the other. It appears almost impossible to in any way equalise the costs of each length of road under these conditions. It is not advisable to decrease the width of the footpath shown in lengths No. 1 and 2 on account of the cellars underneath, as the making of a roadway over such cellars and rolling with a 10-ton steam roller might cause the arches to give way.

In my opinion the plan shows four separate streets—viz.: (A) Nos. 1 and 2; (B) No. 3; (C) Nos. 4 and 5; and (D) No. 6, and it would not be correct to treat them as a single street. Whether the council can deal separately with the component parts of streets A and C is a more difficult question, and the point does not appear to have been decided. But I incline to think that they can do so (subject possibly to the decision of the magistrates if objection is taken). The language of sec. 6, sub-sec. (1) of the Act is fairly wide.

Gas and Water Pipes: County Bridge.—"Gascon" writes: I should be very much obliged by an expression of opinion (1) as to who is liable for the expenses incurred in altering the line and level of gas and water mains which at present are run under the surface of the metalling of, but over the crowns of, the arches of a county bridge situated on a main road in a rural district, the pipes being the property respectively of the gas and water companies in the adjacent county borough, having power to supply in the rural district and laid (the pipes) under the provisions of the Gasworks Clauses Act and Waterworks Clauses Act of 1847. The county council are about to alter the level of bridge in question. The gas and water companies are incorporated under Private Acts in which are incorporated provisions of the above Public Act. (2) I take it that sec. 153 of Public Health



Act of 1875 cannot apply in any way. (3) Are gas or water companies empowered in any way, under sec. 6 and sec. 28 of the 1847 Acts respectively, to break up, cut away, or in any way interfere with the fabric of the bridge when laying pipes? I take it the Acts intend the soil and pavement strictly. (4) In the event of a bridge, as in case (1) being altered and rebuilt, although the county must continue to find support for the pipes underneath and such cover over as is necessary to protect them from damage by traffic, are they compelled to provide cover to protect the pipes from frost? The point is, that the level of the bridge could easily be altered without moving the pipes, which can still be supported, and would, of course, be quite protected from traffic, but open to the air and consequent risk of freezing.

(1) In the absence of anything to the contrary in the private Acts, I think the expense would have to be borne by the owners of the pipes. (2) No; this section only applies to "streets," and the definition of "street" in sec. 4 of the Act excludes county bridges. (3) No; the sections only refer to the soil and pavements. (4) In my opinion they are not. See *Southwark and Vauxhall Water Company* v. *Wandsworth Board of Works* (62 J.P., 756).

How to Become a Barrister.—"Sewerman" writes: If it comes within the scope of your columns in The Surveyor, I should be very much obliged if you could let me know through them where information can be obtained as to qualifying as a barrister-at-law. Is there any handbook published on "How to become a barrister"?

There is a book published by Stevens & Haynes, 13 Bell-yard, Temple Bar, by Gibson & Weldon, entitled "How to become a Barrister," price 2s. 6d. nett.

We have to draw the attention of querists to the directions laid down for their guidance in regard to the preparation of diagrams. Rough sketches obviously cannot be made use of, and we should be obliged if correspondents would therefore send only carefully-prepared drawings, preferably about 6 in. in width, and without colouring or wash of any description. Failure to observe these rules will involve the risk of queries remaining unanswered.

THE HOUSING, TOWN-PLANNING, &c., ACT.

ITS OPERATION IN SCOTLAND.

A memorandum relative to the operation of the Housing, Town Planning, &c., Act, 1909, and the earlier Acts as amended by that Act, has been issued by the Local Government Board for Scotland [price 2d.].

The board state that in the three years during which the Act has been in force they have had every reason to be satisfied with the wide interest shown by local bodies and the public generally in connection with its administration and execution. They observe that the records of the work done by local authorities since the passing of the Act afford ample testimony that greater and better-directed efforts are being made for the improvement of housing conditions in Scotland.

It is pointed out in the memorandum that the Act provides methods of procedure for dealing with two different classes of defective houses—viz., (1) the house that, while not reasonably fit for occupation, may be made so, and (2) the house that is "so dangerous or injurious to health as to be unfit for human habitation." The former class of house falls to be dealt with under sec. 15; the latter under secs. 17 and 18.

A table shows that while from December 3, 1909, to May 15, 1911 (fully seventeen months), the total number of notices issued was 338, the number of notices issued during the ensuing twelve months to May 15, 1912, rose to 1,002, an increase of 196 per cent. Moreover, the number of local authorities taking action during the later period shows an increase of 90·9 per cent, the numbers for the respective periods being twenty-two and forty-two. It is noted, however, that during the seventeen months ended May 15, 1911, 290, or 92·9 per cent, of the local authorities issued no notices under the section, as compared with 270, or 86·5 per cent, of the local authorities during the twelve months ended May 15, 1912. This proportion of local authorities that have taken no action is considered to be too great, and the board impress on local authorities the necessity for more general action.

The board are aware that a number of bodies continue to effect improvements on dwelling houses by informal representations, and by action under the Public Health Act, so that a certain number classified as taking no action are taking action of a kind. This practice of proceeding under the Public Health Act does not, however commend itself to the board, their opinion being that the Act of 1909 confers the appropriate and more comprehensive powers, and they are pressing local authorities to discontinue the practice.

A second table shows the increasing use that local authorities have made of their powers under secs. 17 and 18 during two periods—from December, 1909, to May, 1911, and from May, 1911, to May, 1912. The number taking action practically doubled itself in the shorter period, being 113 as compared with 57, while the number of houses as to which representations were made rose from 996 to 1,995. The hope is expressed in the memorandum that this rate of progress may be maintained now that local authorities are more conversant with their powers and duties.

The information in the two tables shows that the procedure under secs. 15 and 17 has resulted in houses to the number of 1193, previously in need of repair or insanitary, being made fit for habitation.

It would appear that Scottish authorities have been slow to avail themselves of their extended powers under Part III. of the Act, which enables them to borrow money on much more favourable terms than hitherto for the acquisition of land and the construction of houses. So far, only one housing scheme has been submitted to and approved by the board. Another scheme has been submitted, but approval has not yet been given. Only one local authority has exercised its powers for the acquisition of land on which to erect houses for the working classes.

Negotiations are, however, proceeding with various local authorities, and it is to be expected that several housing schemes will be submitted for approval on an early date.

In the matter of town planning the board state that as to this they have reason to be gratified at the action taken and being taken by local authorities. The progress made is regarded as the more remarkable when due allowance is made for the novel character of the Act, and the natural reluctance of local authorities to enter upon schemes costing time and money for benefits that may not accrue for some considerable time. Further, the board feel confident that when the advantages of the Act have been practically demonstrated by the pioneering local authorities, others will be encouraged to avail themselves of its provisions. Every opportunity is given to local authorities to confer with officers of the board, as they consider that in an Act of this nature much more may often be effectively accomplished by interviews than through the usual channel of correspondence. The frequency with which interviews are sought is taken to indicate that local authorities recognise the advantages of this course.

DIVINING ROD EXPERIMENTS.

REMARKABLE RESULTS IN PARIS TESTS.

M. Armand Viré, a professor at the Museum of Natural History, Paris, is investigating, under the auspices of the Congress of Experimental Psychology, the subject of rhabdomancy, or dowsing, and on Thursday of last week tests were made in the Bois de Vincennes of the powers of four wielders of the magic rod.

A large deserted quarry undermines a portion of the wood, and the diviners were asked to point out the underground galleries and shafts. At the end of the experiment their statements were to be compared by M. Viré with a specially constructed chart. The organisers stated that it was impossible for any of the competitors to have had any previous knowledge of the subterranean passages, M. Viré being the only person aware of the exact positions.

The first man with the divining-rod was M. Pelaprat, a sturdy peasant, who carried a supple forked wand of hazel. For some time he walked steadily forward, the hazel wand trembling slightly. Suddenly the wand twitched, and M. Pelaprat, stopping, said, "A cavity begins here." After walking round on the grassy slope to measure the extent of the cavity he gave the result of his observations to M. Viré, saying that the cavern was over 17 yds. deep and that it was quite dry.

WHALEBONE WANDS.

The other competitors stepped forward in turn. They used wands of whalebone, bamboo, and copper. Three other underground pits were, like the first, marked out by them with bits of paper, with the approximate depth. M. Probst, the last to use the trembling rod, went so far as to indicate, somewhat vaguely it is true, four galleries which branched off from the main shaft, the site of which he had marked out on the turf.

M. Viré, says the *Daily Mail* in its interesting report of the tests, then unrolled the official map, and there was a moment's breathless silence. Every one of the competitors had succeeded with more or less accuracy in marking out caverns or pits which actually existed, and the four galleries spoken of by the last competitor were also traced on the map. The depths given were correct.

As a final proof of the virtues of the magic rod, M. Probst consented to be led blindfold over the area, and the result he obtained corresponded almost exactly with the first indications he had given.

M. Hemon and M. Mager, two of the diviners, as a proof of the magnetism with which they were endowed, placed their hands on an ordinary compass and made the needles jump and swing from pole to pole.

Richmond Bridge.—In reply to questions at the last meeting of the Middlesex County Council, the chairman of the Highways Committee stated that the Surrey County Council had agreed to appoint a sub-committee to confer with them on the subject of improved means of communication between both sides of the river.

The Amenities of Surrey Lanes.—Guildford Rural District Council have decided not to turn the country lanes in their district, of which there are about 200 miles, into hard metal roads suitable for motoring. At the last meeting of the council Mr. F. B. Eastwood (the vice-chairman) protested against changing the character of these country lanes, and said that to have motorists tearing along them would make life a burden. The council resolved to reduce the quantity of material to be ordered, and saved £202 on the estimates for the ensuing half-year.

Assistants' and Students' Section.

Conducted by SYDNEY G. TURNER, Assoc.M.Inst.C.E.

All communications in regard to this page must be addressed to The Editor, St. Bride's House, 24 Bride-lane, Fleet-street, E.C. *Envelopes must be marked "Assistants' Section" in the top left-hand corner. Correspondents are invited to submit questions for consideration and answers to the questions which appear. For the contributions considered to be the most meritorious, one or more premiums in books will be awarded monthly. Diagrams must be drawn to scale on separate sheets, ready for reproduction.*

THE MONTHLY PREMIUM.

The premium for March is awarded to

Mr. D. G. Bevan,
Town Hall,
Darlington,

whose contributions have, in the opinion of the adjudicators, been the best received during the month.

Mr. Albert V. Cole, of Nelson, has selected the following books in respect of the February premium:

"Specification, 1913." (Technical Journals, Limited.)

"Practical Design of Reinforced-Concrete Beams and Columns," by W. N. Twelvetrees. (Whittaker.)

"Modern Road Construction," by Francis Wood. (Griffin.)

"A Text-Book on Sewage Disposal," by H. Lemmon-Cannon. (St. Bride's Press, Limited.)

These have been duly forwarded to him.

QUESTIONS.

This week answers are invited to the following questions:—

314. Concrete Roof.—It is desired to construct a semi-circular barrel roof in concrete of 50-ft. span, reinforced with expanded metal. Show the dimensions of the supporting walls, which are to be 15 ft. high from the top of the footings. The roof is to be ribbed with an extra thickness of concrete over the piers. (H. V. A., *Clapton.*)

315. Surveying: Theodolite.—If the graduated plate of a theodolite is not correctly centred, how may the error arising therefrom be eliminated? Prove that the method adopted does eliminate the error referred to. (T. W. P., *Bexhill-on-Sea.*)

317. Strength of Beam.—A rolled steel I beam of British Standard Section, 12 in. by 6 in., and weighing 54 lb. per foot, is capable of sustaining a load of 15 tons uniformly distributed over a span of 20 ft. What would be the safe load uniformly distributed which could be placed on either half of the lower flange? ("Pupil.")

319. Hydraulics.—Fig. 1 illustrates a cast-iron pipe line leading from a reservoir.

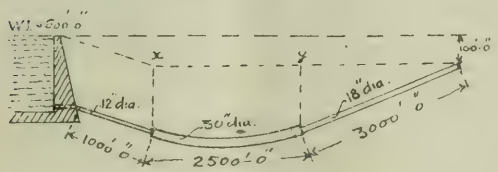


Fig. 1.

With the data given (1) calculate the discharge at the extremity of the pipe; (2) find the diameter of a single line to displace the system shown; (3) find the piezometric heights x and y at the junctions of the pipes. (E. A. B., *Leicester.*)

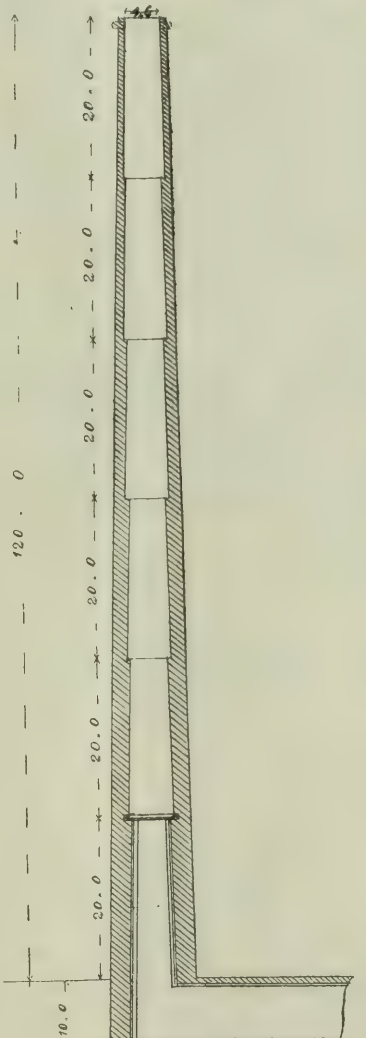
320. Water Tower Design.—Design a small water tower to hold 8,000 gallons, top water level being 30 ft. above ground level, tank of cast-iron, framework of tower of steel. Show full calculations, including wind pressure allowances. (W. H. B. *Bocking.*)

[The Editor is at all times glad to hear from readers who desire to submit questions regarding matters of general interest, points of daily practice, &c., for insertion in the "Assistants' and Students' Section." Questions which are published are taken into consideration, as well as other matter, in awarding the Monthly Premium.]

REPLIES TO QUESTIONS.

318. Chimney Design. Design a chimney 120 ft. high above ground, internal diameter of flue at top 4 ft. 6 in. Also design for foundations. ("Enquirer.")

The brickwork at the top must be 9 in. thickness, increased by a half-brick every 20 ft. downwards, so that the first 20 ft. from the ground must have 31½ in. thickness of brickwork, and the batter should not be less than 1 in 48, and the diameter of the shaft



at the ground level will be about 11 ft. The cornice at the top must not project more than 9 in.

The firebrick lining must not be less than 1½ in. away from the brickwork, and the intervening space kept free from falling dirt by a sailing course over the lining.

Concrete foundation is required, 20 ft. square and 6 ft. depth; the top of the concrete must be 10 ft. below the surface of the ground. (J. O'N., *Portadown.*)

CORRESPONDENCE.

For every ill beneath the sun
There is some remedy or none;
If there be one, resolve to find it;
If not, submit, and never mind it.
— Anon., *circa* 1843.

THE KENSINGTON SEWER FATALITY AND SEWER VENTILATION.

To the Editor of The Surveyor.

Sir,—This fatality, which resulted in the deaths of one sewerman and two firemen who went to the rescue, strongly suggests that, when the available facts are considered, the time has now arrived for adequate protection for sewermen as well as for the general public.

The cause of these fatalities can be found in the public disregard of dangerous non-smelling gases, which, in the old sewers, were allowed to escape through gratings in the centre of the road; but now, to please the public, these openings have been closed down, confining the gases heavier than air in the sewer.

The question bristles with questionable theories, and through following these theories such fatalities as these occur.

It may be of public interest to know that for some years past, with a view to preventing such occurrences, work has been going on in several of the London councils' sewers, and the result of such work shows that, assuming the accident to be entirely due to coal-gas, it would have been avoided had the present up-to-date ventilators been fixed in open gratings at regular distances along the line of sewer on which this fatality occurred.

The fatal point of coal-gas is given as 60 per cent. Now, on sewers where my ventilator is installed a leakage of coal-gas equal to a pipe of 1⅛-in. bore would only raise the gas pollution to 20 per cent, even in a combination of sewer gases. In fixing these ventilators, I have carried out a large amount of testing work, and from a report which I prepared in November, 1910, it is clearly shown that, apart from coal-gas, accidents of this kind are liable to happen at any time, through gases liberated from the sewage itself, and which remain in them through imperfect ventilators.

In Kensington I find that the following gases are liberated daily from the sewage running through their sewers:—

Marsh gas	18 947 cub. ft. ...	927 lb.
Carbonic acid	3,709 cub. ft. ...	523 lb.
Nitrogen	2,472 cub. ft. ...	222 lb.
Sulphuretted hydrogen...	494 cub. ft. ...	54 lb.

The great danger to sewermen and the public lies in the fact that the gases heavier than the air collect in the sewer, and are forced by the pneumatic action in the sewer to certain points where, unless disturbed, they remain in banks. Should a small leakage of coal-gas accidentally mix with these, then the danger is intensified.—Yours, &c.,

R. Harris Reeves.

Walton-on-the-Naze.
March 31, 1913.

ASPHALTS AND BITUMENS.

To the Editor of The Surveyor.

Sir,—The article on the above subject appearing in your current issue merely reopens the nomenclature problem without providing a solution.

Unquestionably it is highly desirable that proper commercial definitions of the following widely different range of materials now in use for paving purposes should be arrived at and adopted:—

(1) Natural asphalts containing a large percentage of free mineral bitumen;
(2) Natural rock asphaltes or bituminous limestones;
(3) Bituminous residuums obtained by distillation of asphaltic and semi-asphaltic base petroleums;
(4) Coal tars, their distillates and residues.

Notwithstanding that there are only three or four natural asphalts upon the markets of the world for paving purposes, I must say that I foresee very great difficulty in getting the proprietors or concessionnaires of them to waive their right to the word asphalt and adopt bitumen in its stead so long as such inferior articles as blown petroleum residuums are being marketed, sometimes with and sometimes without proprietary names, but always as asphalts, which titular description of them is not warranted.

Until recently these blown petroleum residuums were described as asphaltums, so as to differentiate them from asphaltic cements manufactured from natural asphalts; but to-day they are boldly marketed as asphalts guaranteed to contain as nearly as makes no matter 100 per cent of pure bitumen, with the result that road engineers, the great majority of whom are not also chemists, having no comprehensive idea of the origin or production of these materials, have to rely not upon laboratory tests, which these materials may answer perfectly well, but upon the physical test.

It is therefore only after any given materials have been under practical trials that road engineers can place any reliance in their observation of their behaviour; hence it is that properly refined and fluxed natural asphalts are to-day being recognised as absolutely the best bituminous binders extant; neither is it at all surprising that Nature's own materials should come out of such tests superior to artificial substitutes.

I have always maintained that residuums obtained from careful distillation of asphaltic, semi-asphaltic or even paraffin base petroleums can only be regarded as of any real value when used as fluxes or as amendments, to a limited extent, in connection with natural asphalts. Their very nature prevents their use as the main source of bitumen in the manufacture of paving materials, which fact has long since been realised in the United States of America, and evidence of it is not now wanting in this country.

In view of the approaching International Road Congress I would suggest that a conference of those interested should be held without delay, when proper commercial nomenclature and definitions of the different kinds of natural asphalts, natural rock asphaltes, petroleum residuums and other bituminous materials, as also of the various classes of asphaltic and bituminous pavements manufactured therefrom, could be unanimously arrived at and submitted for standardisation.—Yours, &c.,

Cecil Nathan.

3 London Wall Buildings, E.C.
March 25, 1913.

[We are glad to find that our correspondent takes the same view as ourselves with regard to the desirability of a settlement being arrived at on this matter, which is one of considerable importance. As regards the use of the term "asphalt" in descriptions of materials which do not contain any of the materials known to engineers and chemists as asphalt, this practice is certainly to be discouraged.—Ed. Surveyor.]

LAND VALUATION BOARD APPOINTMENTS.

To the Editor of The Surveyor.

Sir,—Will you allow me to reply to "Valuation Assistant" and "Mancunian"? When I spoke of the department seething with discontent I spoke of it generally and not as a whole, and I still maintain that at present 80 per cent of the whole staff are sick and discontented with their lot. No doubt "Valuation Assistant" and "Mancunian" owe their present positions not so much to ability as to favouritism.

Unfortunately favouritism is one of the prevailing features of the Valuation Department, not only as to the salaries but as to promotion. I know of a junior draughtsman being appointed assistant valuer over the head of a senior draughtsman only on the strength of his being a friend of a permanent official. Do "Valuation Assistant" and "Mancunian" consider this fair to the senior draughtsman? No doubt they do. I will again state that a good many young surveyors were misled when they took up office, and were quite given to understand when they were interviewed, apart from the surveying questions they were asked, that they were coming into the department for the purpose of surveying and not door knocking, the idea of valuation and clerical work being very far from their minds. Again, the advertisements issued by the Government officials clearly stated that surveyors were required—not clerks or canvassers.

"Valuation Assistant" says in his letter that it is not the department which is to blame, but the way young surveyors came into it. I quite agree with him here. Had the Government officials given the young surveyors to understand that they would not be required to do any surveying but to go into the

The Surveyor
And Municipal and County Engineer.

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country knocking at every door in the street and asking the questions which "Disgusted Parent" mentions, and then having to come to the office and do the donkey work, as well as the clerical work for the valuers, they would have remained under the council who employed them.

"Mancunian" asks if I have ever attended a staff dinner. Yes, I have. The one I attended 50 per cent of the staff were absentees, having had enough of the one before. I saw no enthusiasm; most of those present were very chary in taking anything said for granted. They winked the other eye, saying, "We have been bluffed before!" Again, I state that we are working under a cloud, and that it is the intention of the department to keep us so. Nothing but chaos and discontent can result until something definite is done.

When I stated that some valuers had not seen a provisional valuation I was generous. I should have stated that some valuers engaged had never done or seen any valuation whatsoever, they having been previously engaged in rates or municipal offices. Such being the case, how can they assist a young surveyor, even supposing he wished to go in for valuation, when they do not know their own work? As further proof of this I should like to draw attention to a letter in the *Times*, under date March 20th and signed "Headmaster," in which it states that a valuer called to inspect the schools, and said he only required the height to cube them.

I have nothing to say about the office in which "Mancunian" works so expeditiously and in unison with his brother professionals. His office may be the one which goes to prove the rule being the exception. But how does he account for the wholesale resignations which are going on in others? Men, as a rule do not throw up Government berths for pleasure or fun. Then there must be a reason.

Some time ago I asked one of the most respected district valuers in the kingdom his opinion, as man to man, on the prospects of the department. His reply was without fear and to the point—viz., "Absolutely hopeless."—Yours, &c.,

SITE VALUE.

March 28, 1913.

INSTITUTION OF MUNICIPAL AND COUNTY ENGINEERS: ELECTION OF DISTRICT OFFICERS.

To the Editor of THE SURVEYOR.

SIR,—In view of the ballot papers for the district officers in connection with the above institution being issued shortly, I desire to draw the attention of members to the fact that the district chairmen and district secretaries are not *ex-officio* members of the council.

The result of this not being generally known previous to the last election resulted in several members who occupied the above-mentioned offices and did most of the work staying at home while ordinary members attended the council meetings.

I beg, therefore, to suggest that, until the by-laws are amended, members should vote for the district chairmen and secretaries being also the district representatives, because they must have a more intimate knowledge of the requirements of a district than an ordinary member.—Yours, &c.,

STYX.

April 1, 1913.

ROAD CONSTRUCTION: SUPER-ELEVATION AT CURVES.

To the Editor of THE SURVEYOR.

SIR, I read with interest Mr. Twelvetrees' notes on "Road Construction and Maintenance from the Standpoint of the Motor User" in your issue of to-day's date. The note on super-elevation at curves in particular drew my attention. Do you know of any standard work on road construction embodying formulæ for the calculation of the correct super-elevation in proportion to radius of curve? If not, would you, in a future issue of your paper, deal with this matter further?—Yours, &c.,

CHINESE.

March 28, 1913.

[This matter is one of very great interest and we shall deal with it at an early date.—Ed. SURVEYOR.]

DEPUTY ENGINEER AND DEPUTY SURVEYOR FOR MANCHESTER.

Manchester City Council on Tuesday decided that a special sub-committee should be empowered to take the necessary steps for the appointment of a deputy city engineer and a deputy city surveyor, each at a salary of £750 per annum.

It was stated that the work of the city surveyor's department had grown to such an extent that the appointments were absolutely necessary.

Vacuum Road Cleansing Demonstration.—We learn that a demonstration of Messrs. J. & P. Hill's vacuum motor road-sweeping machine will take place on Wednesday next in the City of London. It is proposed to make two trials, one at 11 o'clock and the other at 3 o'clock.

Richmond, Surrey, Baths: Remodelling and Extension.—A complete remodelling of the interior of, and a large extension to the public swimming baths at Richmond, Surrey, have recently been carried out by the borough surveyor, Mr. J. H. Brierley, ASSOC.M. INST.C.E., and the reopening of the buildings took place on the 27th ult. The old first-class bath has been converted into a second-class bath, while the old second-class bath has been enlarged and fitted up as a first-class bath, the expenditure amounting to £3,250. By means of the extension a bath 100 ft. long and 32 ft. wide has been provided. At the shallow end the water is 3 ft. 5 in. deep and the bottom gradually shelves away till, 15 ft. from the other end of the bath, the water is 6 ft. deep. From here to the end, however, there is an upward slope, which gives a depth of 3 ft. 9 in. at the bath wall. The contention is that any considerable depth of water at this point is unnecessary, the natural plunge taking the diver many feet away from the end of the bath; moreover, the upward slope will permit of a saving of 6s. in water every time the bath is filled. Another improvement are the lines of green tiles on the floor of the bath, which are intended to serve as a guide to swimmers in races, a noteworthy point with regard to these being that they are continued up each end of the bath so as to fix each station clearly. Some sixty light-coloured Oregon pine boxes surround the bath, and over these is a gallery with a seating capacity of 300. The new second-class bath is 90 ft. long by 29 ft. wide.

LOCAL GOVERNMENT BOARD INQUIRIES.

The Editor invites the co-operation of Surveyor *readers with a view to making the information given under this head as complete and accurate as possible.*

INQUIRIES HELD.

Barrow T.C. (March 15th. Mr. Edgar Dudley).—£115,000 for the purchase of land at the Risedales for purposes of the public park and of a secondary school, and for the construction of new roads, and £2,250 for the purchase and laying out of land on Barrow Island for the purposes of a recreation ground. —The town clerk, Mr. L. Hewlett, explained that the land for the secondary school site was £395 per acre, £1,200 was allocated for street works, and £472 for 1½ acres of recreation ground, and the surplus land was £145 per acre. The borough surveyor, Mr. A. Race, produced a plan of the proposed school. The inspector thought an adjoining and more elevated site would have been preferable. The borough surveyor stated that the proposed site was considered the best. At first it was intended to purchase only 11 acres of land at about £5 000, but they were eventually obliged to take more. Evidence was also given with respect to the proposed recreation ground at Barrow Island.

Colwyn Bay U.D.C. (April 1st. Major C. E. Norton).—£550 for a chapel at Bronynant Cemetery; £6,300 for new stoking machinery at the gasworks, and additional mains to supply the new districts which are being opened up; and £5,300 for additional generating plant at the electric light works, to meet the growing need for current.—It was pointed out that the load on the gas and electricity works last season was up to the maximum capacity of the machinery installed, so that the increase was essential for the safety of the supply.

Devonport T.C. (March 28th. Mr. W. O. E. Meade-King).—£5,659 for gas undertakings, and £200 for street improvements.—The assistant town clerk explained that the first loan, which was desired for thirty years, was for the purpose of laying new 6-in., 4-in. and 3-in. mains in new estates and five roads. The inspector commented on the high price per yard estimated for laying the mains, but it was explained that the costs of excavation were heavy. The borough surveyor, Mr. J. F. Burns, gave evidence with respect to the proposed loan for street improvements. The loan was asked for twenty years.

Eastbourne T.C. (March 27th. Mr. F. St. George Mivart). £1,200 for the purpose of increasing the accommodation at the isolation hospital.—Dr. W. G. Willoughby (medical officer of health) stated that the money was required to provide larger premises, the necessity for which was due to overcrowding in the nurses' and servants' apartments. The total number of the permanent staff was twenty-one—a matron, eleven nurses, and nine servants—and they required ten additional rooms. The last addition to the hospital was in 1901. Mr. W. C. Field (building surveyor) explained the plans to the inspector.

Ludlow R.D.C. (March 12th. Mr. W. O. E. Meade-King). -£1,500 for the purposes of water supply for Craven Arms.—The clerk, Mr. A. W. Weyman, stated that the council had considered two gravitation schemes, and found they were impracticable; and later, in April, 1911, they asked Messrs. Willcox & Raikes to report, and on October 18, 1911, they reported and furnished a scheme, the subject of the present application.

Preston T.C. (March 19th. Mr. Edgar Dudley).—£4,500 for the purchase of the Starchhouses, and the improvement of the adjoining streets.—The town clerk, Mr. A. Howarth, stated that the corporation had long been desirous of improving this area, and had been in negotiation for the purchase of the property for many years. The Starchhouses were originally used for making size for hand-loom weavers, and were some of the oldest buildings in the town. The property included a triangular block of houses and other premises used as warehouses in Back-lane, Lawson-street and Market-street, with an open space in the centre, on which four houses formerly stood. Provisional agreements had been made for the purchase of the whole of the buildings and land from the several owners at a total cost of £2,650. The total area was 1,520 sq. yds. The land will be all freehold, and not subject to any restrictions. It was intended that the whole area should be thrown into the street and paved with granite setts as there were six streets, most of them narrow, which converged at this point, which was adjacent to the market.

Rhyl U.D.C. (April 1st. Mr. A. W. Brightmore).—£5,600 to construct a new promenade below the sandhills, £300 for a new screen for the sewerage pumping stations, and £480 for additional lavatories at the Marine Lake.—The clerk, Mr. A. Rowlands, said the screen at the pumping station was necessary owing to additional works; the promenade scheme was the completion of work started in 1897, and would link up the east with the west promenades, making one walk along the sea front.

Salford T.C. (March 11th. Mr. W. H. Collin).—£14,820 to cover the cost of the alterations to the old town hall buildings, and the corporation also asked for powers to borrow £794 to cover the additional sum that has been spent on the annexe over and above the amount already sanctioned by the Local Government Board.—Mr. J. Broadbent (the architect) said there had been large additions made to the original plan, which was only a sketch plan. This plan was only to show how the building lent itself to the proposed alterations. It was intended to retain the stipendiary's court as it was and to use the present sessions court as a lay magistrates' court, and it was proposed to leave those two courts exactly as they were before. The necessity for a new jury room, however, made it necessary to alter the plan entirely. Large structural alterations would have had to be made, especially with regard to the dock accommodation in the sessions court if it had been retained for its present purposes. The original plan made no provision for a caretaker's house, and there was no provision made for drainage. The alterations in regard to the mayor's parlour and committee-rooms were also of a more complete character. The new sessions court was to be provided in what was known as the police parade room.

Stratton and Bude (Cornwall) U.D.C. (March 26th. Mr. W. O. E. Meade-King).—£1,240 for the improvement of Belle Vue-road and Golf House-road, and £466 for the erection of two public conveniences.—It was explained that the county council had promised to take over about half the road when completed. All the land had been given by the owner for widening; part was subject to a lease to the Golf House, for which land the council were paying £100, and the Golf House undertook to erect a fence.

Taunton T.C. (March 17th. Mr. H. Ascough Chapman).—£1,722 for the erection of working-class dwellings under a scheme formulated by that body for the provision of twelve houses in String-lane.—The town clerk, Mr. W. H. Bailey, gave evidence, and said there were in the borough 110 courts containing 756 houses with 3,407 inhabitants. Thirty-two of these courts had no through ventilation, and the great majority of the houses were back to back. Of the houses 490 had only two bedrooms, and 76 had only one bedroom. The greater number of the courts were culs-de-sac, and the houses were very old. The medical officer of health, Dr. H. J. Alford, said most of the courts were only 8 ft. wide. In the last three years ninety-five closing orders had been made, and eighteen houses had been demolished. The site was convenient, but not ideal, as the sewage works were not far off, and all the town refuse was carted daily down the adjacent road to the destructor. The borough surveyor, Mr. D. Edwards, stated, in reference to a remark of the medical officer, that the site was low, that sixty-two houses of a better class had been erected in this district on a level only 3 ft. 6 in. higher than the proposed site. The houses were meant for people earning from 18s. to £1 a week. The rent would be 4s. a week, and other new houses were let at not less than 5s. 6d.

Watford U.D.C. (March 19th. Mr. R. H. Bicknell). -£1,000 for improvements in fencing, surface-water drainage, road making, channelling, and laying out of Watford Heath.—It was stated that it was proposed to allocate the expenditure in the following manner: Fencing, £311; roads and paths, £420; drainage, £270; laying out, £99.

Wimbledon T.C. (March 18th. Mr. R. H. Bicknell). —£1,650 for the provision of an open-air swimming bath in Wandle Park.—The borough engineer, Mr. C. H. Cooper, stated that the question of providing more swimming accommodation had been under the consideration of the council off and on for the past three years. Alternative schemes had been proposed the construction of another swimming pond at the present covered baths, and the provision of an open-air bath. As far back as 1907 he reported upon the advisability of providing an open-air bath at Wandle

Park, and in 1911 a committee was appointed and the question was fully gone into. Every site along the Wandle had been considered, and the committee ultimately came to the conclusion that the site in Wandle Park was most favourable. Questioned as to the sufficiency of the water supply, Mr. Cooper said the average dry-weather flow of the Wandle was 19,000,000 gallons a day. The capacity of the proposed bath was 165,000 gallons. If the river water failed them there were two other sources of supply they could tap without having to call upon the Water Board. In the first place there was a bed of gravel about 5 ft. below the surface which was charged with water, so much so that the water rose to something like 2 ft. 6 in. below the surface of the ground. An ample supply could be got from this by means of motive power. The second alternative was to obtain a supply from the Thanet Sands.

APPLICATIONS FOR LOANS.

Barnes U.D.C. — Shean-lane widening, £800; and Lonsdale-road paving, kerbing and channelling, £2,300.

Buxton U.D.C. — £5,000 for works in connection with the baths and St. Ann's Well.

Chelmsford T.C.—£625 for road improvement purposes, and £250 for sewerage works.

Chester T.C.—£11,500 for electricity extensions.

Chorley T.C.—£2,299 for making up certain streets.

Doncaster T.C.—£12,500 for the extension of the electricity undertaking.

Harwich T.C.—£8,100 for a new school.

Huddersfield T.C.—£8,150 for working-class dwellings.

Londonderry T.C.—£13,000 for electrical plant extensions.

Maidenhead T.C.—£300 for works of road improvement.

Maidstone T.C.—£1,900 for the purchase of land for sludge disposal works.

Paignton U.D.C.—£1,600 for the erection of a depot.

Penrith R.D.C.—£350 for a water supply for Newbiggin.

Peterborough T.C.—£1,100 for concrete and asphalt footpaths.

Stoke-on-Trent T.C. £8,000 for the extension of electricity to Fenton.

Taunton T.C.—£2,500 for new plant at the electricity works.

Tipperary U.D.C.—£1,000 for the provision of a burial ground.

Torquay T.C.—£1,900 for the widening of Torbay-road.

Tredegar U.D.C.—£10,000 for the extension of the gasworks.

Watford U.D.C.—£3,148 for the erection of twenty-two workmen's dwellings.

Wellingborough U.D.C. — £225 for a steam disinfector.

Woodford U.D.C.—£1,650 for the erection of a fire station and appliances.

LOANS SANCTIONED.

Croydon R.D.C. — £3,217 for street improvement works.

Eastleigh U.D.C.—£395 for works of street improvement.

Much Woolton U.D.C.—£600 for improving Lode's pond.

Totnes R.D.C.—£1,382 for water supply works.

West Bromwich T.C.—£11,500 for vertical retorts for the gasworks, repayable in twelve years, and £6,500 for extensions of electricity mains, repayment to be made in twenty years.

Winchcombe R.D.C.—£1,110 for sewerage works and £240 for a water supply scheme.

FORTHCOMING INQUIRIES.

APRIL.	£
8.—**Blaydon.** For private street works (Mr. R. H. Bicknell)	1,450
8.—**Eastbourne.** For works of sewerage (Mr. W. O. E. Meade-King)	7,800
8.—**Margate.** For the erection of pavilion and conveniences (Mr. A. W. Brightmore)	5,500
8.—**Southall-Norwood.** For private street works (Major J. Stewart)	1,300
9.—**Hastings.** For works of street widening (Mr. W. O. E. Meade-King) ...	1,382
9. **South Shields.** For the erection of a shelter and sewerage works (Mr. H. S. Stewart)	4,917
9.—**Tenterden.** For sewage disposal purposes (Mr. A. G. Drury)	11,000
9. **Tynemouth.** For the erection of stores (Mr. R. H. Bicknell)	1,200
10.—**Beckenham.** For the extension of Kelsey Park (Mr. Edgar Dudley)	800
10. **Crewe.** For works of street improvement (Mr. F. H. Tulloch)...	847
10.—**Folkestone.** For the purchase of a shelter (Mr. W. O. E. Meade-King) ...	1,905
10.—**Hexham.** For slaughterhouse, street, and park purposes (Mr. R. H. Bicknell)	2,753
10. **Hitchin.** For sewage disposal purposes (Mr. A. G. Drury)	14,100
10. **Southend.** For street improvement purposes (Mr. M. K. North)	2,800
11. **Birmingham.** For sewerage, street, and bridge building works (Mr. A. G. Drury)	14,159
11. **Wednesbury.** For street improvement purposes (Mr. F. H. Tulloch)	1,195
11.—**West Ham.** For street widening purposes (Mr. Edgar Dudley)	4,748

SOME RECENT PUBLICATIONS.*

The Municipal Year-Book for 1913. Price 15s. nett. London: *The Municipal Journal*, Limited.

The seventeenth annual issue of the "Municipal Year-book" contains a mass of information about the local authorities of the United Kingdom, their *personnel* and activities. So complete is the record that it includes authorities of every class, from the Local Government Board itself to such *ad hoc* bodies as hospital or burial boards. In respect of each municipal corporation in England and Wales, a short summary is given showing the statistics, and containing some account of the works which have been carried out, together with a list of the members and chief officers. Section 2 of the work gives somewhat similar information in regard to county councils, while a separate section is devoted to the various metropolitan authorities. The system of local government in the Metropolis is so complicated that the brief account of the various authorities and their duties which prefaces the last-named section will no doubt be much appreciated. Further divisions of the book give some information in regard to each urban district council, and a list of the rural district councils, their clerks and surveyors. Some account, too, is given of local government in Scotland and Ireland. The later sections of the book are devoted to carefully classified and digested summaries of the various municipal services in different districts. Thus, to take an example, the section on sewerage and sewage disposal gives an alphabetical list of places, together with a short account of the systems in vogue in each. There is a mass of other information in the volume which fully entitles it to be called an encyclopædia of local government administration, and local authorities and their officers cannot well afford to be without it. It should be mentioned that the section on town planning has been entirely rewritten, with the assistance of experts, and it now constitutes an excellent short treatise on the practical execution of the Act.

Leeds Sewerage Contract.—At their meeting on Wednesday the Leeds City Council accepted the tender of Messrs. H. Arnold & Son for the construction of the first portion of the high-level intercepting sewer, in connection with the Leeds sewage scheme, at a cost of £99,524.

Classification of Roads. — At a meeting of the Executive Council of the County Councils Association on Wednesday a deputation was appointed to wait on the Prime Minister with reference to the classification of roads and the contributions from the Imperial Exchequer.

* Any of the publications reviewed, or referred to as received, will be forwarded by the St. Bride's Press, Ltd., on receipt of published price

Municipal Work in Progress and Projected.

The Editor invites the co-operation of Surveyor readers with a view to making information given under this head as complete and accurate as possible.

The following are among the more important projected works of which particulars appear below: Buildings—Bristol £28,000. Hythe £10,000. Leeds £28,000. Leicester £23,000; housing and town planning—Blackpool £50,000; refuse collection and disposal—Finchley; roads and materials—Durham £85,000. Edinburgh £10,821. Middlesex £30,800; sewerage and sewage disposal—Dunfermline £90,000. Trowbridge; water, gas and electricity—Leeds £168,000—Particulars of other works projected will be found on our "Local Government Board Inquiries" pages.

BUILDINGS.

Bristol T.C.—It has been agreed to erect a swimming bath at Bishopstown at a cost of about £28,060.

Dawlish U.D.C.—A sum of £1,300 is to be paid for property for conversion into surveyor's offices and a depot.

East Cowes U.D.C.—A letter has been received from the Local Government Board stating that they had had under consideration the report made by their inspector (Mr. Crosthwaite) after the inquiry held by him with reference to the application of the council for sanction to borrow £55 for strengthening the Esplanade sea-wall. The board were advised that the proposed works were not such as they should approve, and they were of opinion that the district council should consult an independent engineer of considerable experience in the designing and construction of sea-walls, with a view to the submission of amended proposals. The engineer should not be connected with any firm interested in any special form of reinforced concrete construction. He should be required to supervise the works during construction, and it should be explained to him that he would be required to accept full responsibility for them. The execution of the scheme should be under the charge of a whole-time clerk of works, who should be particularly careful to supervise the carrying out of any concreting work. The council have decided to send a reply to the Local Government Board stating that the council were not in a financial position to carry out the board's requirements unless the Admiralty were willing to assist, and that the only alternative appeared to be to do such repairs as could be paid for out of the rates.

Exeter T.C.—It has been decided to take joint action with the county council for the provision forthwith of institutions for the treatment of tuberculosis that will be available for the whole community of the city.

Halstead U.D.C.—A contract has been signed with Messrs. G. Sudbury & Sons for the erection of public baths, subject to the Local Government Board sanctioning a loan of £800.

Hythe T.C.—The council have been informed by an expert that, in consequence of damage to the sea-wall, the entire length of 900 ft. will have to be rebuilt, at a probable cost of £10,000. The council decided that plans and specifications of the new wall should be prepared.

Irvine T.C.—A police station is to be erected in Cochrane-street at an estimated cost of £2,000.

Leeds T.C.—It is proposed to erect a new depot in connection with the tramways undertaking, at an estimated cost of £28,000.

Leicester T.C.—Repairing sheds for tramway cars are to be erected at an estimated cost of £23,000.

Newport (Mon.) T.C.—The council in committee have decided that the Joint Committee that a permanent relief bridge over the Esk should be erected to the north of the present bridge. The new structure is to be reserved for tramway traffic, and the old bridge for pedestrians.

Porthcawl U.D.C.—The lord of the manor having given the necessary permission, it has been decided to erect a bandstand on the green on the Esplanade.

Wigton R.D.C.—A scheme has been adopted for an extension of the sea-wall and the protection of existing works which are being undermined and in danger of collapsing.

Winchester T.C.—New offices and stores are to be built at the electricity works at an estimated cost of £1,800.

HOUSING AND TOWN PLANNING.

Barking U.D.C.—The surveyor, Mr. C. F. Dawson, has received instructions to prepare a scheme for building workmen's houses under the provisions of the Housing and Town Planning Act.

Blackpool T.C.—Proposals are being considered for a town planning scheme and promenade extension, at an estimated cost of £50,000.

Boston R.D.C.—It has been decided to erect four cottages at Bicker, and land has been purchased at Wigtoft and Amber Hill for the provision of other dwellings. In compliance with the suggestion of the Local Government Board, the plans have been so amended as to provide that, instead of a parlour, each house should have a scullery and a large room, in addition to three bedrooms. By this means the cost has been reduced by £45 per house.

Cambridge T.C.—The erection of a footbridge and carriage bridge across the river from Cambridge to Chesterton has been referred to the General Purposes Committee, together with the question of the preparation of a town planning scheme which would take into consideration the development of land other than that immediately adjoining the river.

Linton (Cambs) R.D.C.—A contract for £846 has been signed for the erection of six houses in Linton.

Minehead U.D.C.—A scheme has been adopted for the provision of eighteen workmen's cottages.

Oldham T.C.—The borough surveyor, Mr. E. C. Foote, has submitted to the Town's Housing and Town Planning Committee sketch plans showing two alternative designs for small blocks of tenement houses. The blocks were on the dual tenement principle and planned to meet the requirements of the poorest of the poor, or the class of persons who at present chiefly inhabited furnished rooms or common lodging-houses. Mr. Foote submitted another plan of dwelling accommodation for small families with strictly limited means and not much furniture. The type recommended, he explained, was practically the ordinary Oldham cottage, arranged so that one family could occupy the ground floor and another family the upper or first floor, each with separate conveniences. The surveyor estimated the cost at £125 a house. The matter was ultimately adjourned till the next meeting. In the meantime information will be sought as to the probable cost and suitable sites.

Stirling T.C.—A housing scheme, estimated to cost £13,000, has been sanctioned by the Local Government Board for Scotland. The localities to be dealt with include St. Mary's-wynd and Broad-street.

PARKS AND OPEN SPACES.

Maldon T.C.—The surveyor, Mr. T. R. Swales, has received instructions to obtain estimates for the construction of four tennis courts on the promenade.

Manchester T.C.—The Parks Committee have approved an estimate of the cost of providing wooden dressing-boxes on the lake side in Heaton Park for the use of male bathers.

REFUSE COLLECTION AND DISPOSAL.

Aylesbury R.D.C.—The tender of Mr. J. Woodford, at £229, has been accepted for scavenging at Haddenham, and that of Mr. E. Rickard, at £135, for Aston Clinton and Buckland.

Finchley U.D.C.—The Public Health Committee have presented a report recommending the adoption of the Meldrum type of destructor.

Hammersmith B.C.—Last year the removal of dust cost £5,395, and slops £1,300.

Scalby U.D.C.—A sub-committee has been appointed to consider the advisability of the council undertaking the collection of house refuse.

ROADS AND MATERIALS.

Abergele and Pensarn U.D.C.—The council have received intimation that the Local Government Board have sanctioned loans for improvements, including the laying out of Pensarn Promenade.

Abingdon T.C.—The corporation are again treating the roads with Akonia for dust prevention.

Barnard Castle U.D.C.—Wood-street and its back roads are to be made up, at an estimated cost of £228, in accordance with the plans of the surveyor, Mr. H. E. Raine.

Bath T.C.—The Surveying Committee recommend that the widening of Brougham Hayes throughout the whole length up to the railway bridge, including the rounding off of the corner at the junction with the Lower Bristol road, and the removal and rebuilding of the county Weights and Measures office be undertaken at an estimated cost of £1,600.

Bedwellty U.D.C.—A new access road is to be constructed at Argoed at an estimated cost of £1,033.

Bournemouth T.C.—The council on Tuesday considered a report from Mr. Ignatius Bulfin, the manager of the tramways, on a scheme to run a service of trackless trolley cars from the square to Bournemouth Pier and along the undercliff drive to Boscombe. It is estimated the scheme will cost £13,600, and the anticipated revenue shows a nett profit of £1,500 a year. Opposition was offered on the ground that it would destroy the amenities of the sea front, and ultimately the scheme was referred to a committee to consider and report.

Brentford U.D.C.—The surveyor, Mr. J. W. Croxford, has received instructions to prepare an estimate of the cost of widening High-street on the south side, extending from Church-alley, in New Brentford, to the eastern extremity of Messrs. Montgomery & Co.'s timber yard in Old Brentford, to a width of 70 ft., thus affording a roadway, or carriageway, of 50 ft. wide, and footpaths on each side of 10 ft. wide.

Bridlington T.C.—Centre House, Market-place is to be purchased for £600 for a street improvement.

Cardiff T.C.—The Public Works Committee have approached the Finance Committee with a view to arranging with the Trinidad Asphalt Company to asphalt 12,000 sq. yds. of the North-road at 5s. 6d. per yard, to be paid on the completion of the work, and 8d. per yard for five years' maintenance, the latter sum to be paid at the end of that period if the maintenance be to the satisfaction of the engineer. The chairman (Mr. John Mander) said that in his opinion, this process had stood the most severe test by the London County Council on the Thames Embankment.

Chiswick U.D.C.—The tender of Mr. Frederick Brummell at £4,366, has been accepted for the construction of the new road in Burlington-lane.

Derby T.C.—Plans for a new street between Irongate and King-street have been prepared by the borough surveyor, Mr. J. Ward.

Dewsbury T.C.—It is proposed to pave Bradford-road at an estimated cost of £1,732.

Dorking U.D.C.—The surveyor, Mr. W. A. Clegg, has been instructed to prepare a plan showing a widening of Pixham-lane from the Reigate-road to London-road, to enable the council to consider a general scheme of widening.

Durham C.C.—A letter has been received from the Road Board approving the scheme to spend £85,000 over the main roads of the county, and offering £35 000 as a free grant, and a loan of £15,000 free of interest for three years, towards the scheme. The council have accepted this offer.

East Sussex C.C.—The amended estimate for the improvement of the road between Lewes and Newhaven is £31,680, towards which a substantial grant is to be made to the county council. The scheme provides for a road 30 ft. wide from bank to bank or hedge to hedge, with a width of macadam of 18 ft., and 2 ft. wide grass margins.

Edinburgh T.C.—Paving work is to be carried out at an estimated cost of £10,821.

Exeter T.C.—Road widenings are to be carried out at a cost of £1,325.

Falmouth T.C.—The tender of the West of England Stone Company, Limited, at £722, has been accepted for the supply of 2,700 tons of stone of various sizes subject to the company agreeing to supply 300 tons ¼th size at the same price as last year.

Falkirk T.C.—The council have purchased for £575 a property in St. Crispin's-lane for the purpose of an important street improvement. Another proposal which is at present being considered is the opening up of a street from the centre to the south of the town, and with this object in view a large property was recently purchased.

Flintshire C.C.—Application is to be made to the Road Board for a tar-spraying grant of £1,234.

Forfarshire C.C.—It was reported last week to the Dundee District Committee that a road improvement at Coupar Angus is costing £1 000 per mile, or a total of £5 000.

Girvan T.C.—It has been decided to purchase land in Knockenshion-street for the purpose of widening the street strengthening the embankment of the river, and improving the amenities of that part of the town, which possesses historic associations as being the spot where Robert the Bruce held court, and where for hundreds of years the chiefs and vassals of Carrick assembled and administered law and justice.

Greenwich B.C.—The Highways Committee report that a large additional cost will have to be incurred in the annual maintenance of through main roads unless steps are taken to improve the road surfaces by paving them with a more durable material. They recommend the acceptance of the tender of the Val de Travers Asphalte Company for laying 1½-in. compressed asphalt, and natural asphalt matrix in places where the gradient rendered this the more suitable material. The committee added that the chairman of the Road Board had been induced to offer a grant of £8,000 payable by yearly instalments of £800, towards the expense of the proposed work. The Finance Committee's report stated that the cost would be, approximately, £37,000.

Holland (Lincs) C.C.—With respect to the application made to the Road Board for a grant for the work of piling required in Skirbeck Quarter in connection with a scheme of road repair, a letter has been received stating that piling does not come within the province of the Development Fund. The council have asked the board to reconsider their decision.

Hornsey T.C.—For reconstructing certain roads forming a motor-'bus route in the borough the Road Board has consented to grant £1,000 towards the cost of £4,396.

Lewes T.C.—Negotiations have been completed for the improvement of Station-street.

Loughborough T.C.—It has been agreed to proceed with the scheme for the improvement of Steeple-row.

Middlesex C.C.—A proposal of the Highways Committee has been sanctioned to asphalt the whole of the carriageway of the Bath Road in the county. The area affected is 77,000 sq. yds., and the capital cost is estimated at £30,800, to which must be added the cost of maintenance for the next ten years, estimated at £8,662. The Road Board have agreed to contribute £5,454 towards the capital outlay, and also to advance on loan the balance of £25,346 free of interest.

Newquay T.C.—The Duchy of Cornwall having given the necessary land, the council have decided to improve the approach to the town at an estimated cost of £500.

Rochdale T.C.—The Road Board have intimated that they will be prepared to make a grant of from £3,000 to £3,500 towards the cost of a road scheme which might be approved by the town council and afterwards by the board themselves.

Romford R.D.C.—The tender of the Gas Light and Coke Company, Limited, at 4d. per gallon, has been accepted for the supply of 11,000 gallons of dehydrated tar.

Saffron Walden T.C.—The estimates of the borough surveyor, Mr. A. H. Forbes, at £818, has been adopted for kerbing and channelling with tar pavement in Castle-street and West-road, and the work will be carried out subject to a loan being sanctioned by the Local Government Board.

Sheffield T.C.—Akonia is being used on the roads for dust prevention.

Soke of Peterborough C.C.—The county surveyor, Mr. A. C. Wallingford, has submitted a report on the state of the roads in the district in the course of which he says: "Apparently the failure to deal efficiently with the main roads is due to the great lengths of road now allocated to each roadman; these lengths, I understand, average about 7 miles. In order to deal more efficiently and economically with road maintenance and repairs a roadman should have not more than 3 miles of road under his charge, and to this length he should always stick; he then becomes acquainted with the weak spots on this length, and is always at hand to supply the stich that saves nine. The roadman should be of an age between 25-45, and

paid a minimum wage of 17s. per week. He should essentially be able to read and write, in order to properly keep the required sheets, &c. I do not advise the future treatment with tar of any portion of road surfaces which is not in a good condition. The estimated expenditure on the rural main roads for the year ending March 31, 1914, was £4 600, and for the borough main roads £1,700, making a total of £6 300. The offer of the Road Board for the Great North Road (5½ miles) was £7.185 towards a total expenditure of £15,585."

Stoke Newington B.C.—A supplementary estimate of £2,500 has been submitted for strengthening the foundations and laying new wood blocks in Seven Sisters-road, between the 18-in. margin and the kerb on both sides of the road from No. 301 eastward to the New River bridge. With regard to this thoroughfare and Blackstock-road, negotiations are proceeding with the Road Board with a view to a grant or a short-period loan towards the improvements, and also with the Metropolitan Tramways, Limited, as to their portion of Seven Sisters-road.

Taunton R.D.C.—Plans and estimates of the Priors Wood-road improvement, as prepared by the surveyor, Mr. T. G. Crump, have been approved, and have been forwarded to the county council with a request that they will ask the Road Board to grant them 50 per cent of the cost of the improvement (£4,000), and, where necessary, compulsory powers for obtaining the required land; also whether, if the proposed work were carried out, the county council would be prepared to declare the Priors Wood-road to be a main road.

Torquay T.C.—The scheme of the borough surveyor, Mr. H. A. Garrett, for the widening of Torbay-road at the gasworks, at an estimated cost of £1 800, has been approved.

Wallasey T.C.—The Works Committee recommend the adoption of the report of the borough surveyor, Mr. W. H. Travers, on the rekerbing and paving of the tramway track in Seabank-road with 5-in. creosoted red pine blocks, at an estimated cost of £2,090.

SEWERAGE AND SEWAGE DISPOSAL.

Aylesbury R.D.C.—The tender of Messrs. Waller & Son, at £114, has been accepted for a new sewage van and hose.

Blackpool T.C.—Public conveniences are to be provided at an estimated cost of £600.

Crediton U.D.C.—It has been agreed to amend the details of the sewage disposal scheme in accordance with the suggestions of the Local Government Board. The estimated cost is £9,500.

Dunfermline T.C.—A scheme has been approved for the construction of a new outfall sewer to the Forth, at an estimated cost of £90,000.

Guisborough U.D.C.—Main sewerage works are to be carried out at an estimated cost of £344.

Rochester T.C.—The estimate of the city surveyor, Mr. W. Banks, at £1,133, for public conveniences on the Esplanade has been approved.

Trowbridge U.D.C.—The scheme prepared by the surveyor, Mr. H. Lailey, for alterations and additions to the pumping plant at the sewage disposal works has been submitted to the Local Government Board for sanction.

West Bromwich T.C.—The Sewerage Committee recommend the construction of a new 21-in. pipe-sewer between Guns-lane and Cardley Bridge, at an estimated cost of £835.

WATER, GAS, AND ELECTRICITY.

Belper U.D.C.—The water undertaking which was presented to the town in 1900 by Mr. Strutt, at a cost of £37,337, has proved highly remunerative. The income last year was £2,027. In accordance with the deed of gift, half the profits are devoted to the reduction of rates, and the other half is invested for the benefit of the town and its water supply, and up to the end of 1912 a sum of £3,695 had been thus invested.

Dunfermline T.C.—The council have agreed to withdraw their Provisional Order for a water supply for the Rosyth area, an agreement having been arrived at whereby the council will take a supply in bulk from the District Committee, who are to construct a reservoir and lay 20 miles of pipes at a cost of about £200,000. Under the agreement the council will become the water authority for the Rosyth area, which is within the municipal boundaries. The council will thus be saved the expense of promoting an independent scheme.

Greenock T.C.—A deputation of the Gas Committee, who have inspected the gas undertakings of various cities, recently presented a report in which they expressed the opinion that the vertical retort system is a remarkable advance on the horizontal method, and that it would be an immense gain to make the contemplated extension on this principle. To gain the full economy at the earliest possible moment it was recommended that tenders should be asked for a plant of 2 000,000 cub. ft. per day capacity. The report was adopted.

Hammersmith B.C.—The nett surplus on the accounts of the electricity undertaking for the current year is estimated at £7,578.

Leeds T.C.—The Tramways and Electricity Committee have prepared a scheme for considerable extensions of the electricity undertaking, at an estimated cost of £168,500.

Liverpool T.C.—The city lighting engineer, Mr. A. G. Smith, reporting on the year's work of his department, states that satisfactory progress was made during 1912 with the installation of automatic controllers, 3,010 having been fixed, as against 2,020 in the previous year. The number now installed was 7,384, which was 38 per cent of the total installation. Prior to the installation the suburbs were lighted by means of 5,990 lamps, which number had since been increased to 6,692. Notwithstanding this increase, the wages had been reduced by approximately £2,500 per annum, and as this represented about one-third of the total number of lamps throughout the city, it would be seen that an amount of at least £7,500 might be expected to be saved from this source alone when the work was completed. In consequence of the installation of automatic controllers, the lamp-lighting staff had been reduced, and the work at the end of the year was being carried out by eight foremen and 111 lamplighters, a total of 119, as against 152 at the close of the previous year. The nett cost of the lighting of the city was £51,194.

Middlesbrough T.C.—The Gas and Electricity Committee have proposed a scheme for installing a new water-gas equipment.

Redditch U.D.C.—A special sub-committee has reported on the working of the electricity undertaking, and recommends, among other things, the appointment of a works manager at a commencing salary of £250 per annum, and that the charges for public lighting be amended.

Stockton T.C.—The Gas Committee recommend the installation of high-pressure gas lighting in the High-street and contiguous streets, the charge for lamps to be as follows: 18s. per quarter for a 500-candle power lamp, 25s. for a 1,000-candle power lamp, and 35s. for a 1,500-candle power lamp. The extension of the high-pressure gas main from the works to Stockton railway station is also recommended. A report on the lighting of the High-street was also submitted by the electrical engineer, Mr. J. J. Smith, and the question of high-pressure gas and metallic filament lamps will be discussed between the Electricity Committee and the Gas Committee.

Taunton T.C.—New plant is to be purchased for the electricity works at a cost of £2,500.

MISCELLANEOUS.

Aberdeen T.C.—The burgh surveyor has been authorised to construct a further length of iron fencing in Riverside-road, at a cost of £150.

Bridport T.C.—A special committee has been appointed to inquire into the details of a proposed scheme for establishing a market, at an estimated cost of £2 150.

Hastings T.C.—In moving that the thanks of the council be given to the borough engineer, Mr. P. H. Palmer, and his staff for their efforts in connection with the recent storm, the Mayor said the borough engineer estimated that the damage done could be put right for £250.

Newport Pagnell U.D.C.—The Newport Pagnell Fire Brigade had a very useful drill with their new Merryweather "Gem" steam fire engine on Thursday of last week. At the request of the district council the county authorities consented to the making of a hole in the wall of the North Bridge on the Lathbury-road to enable the brigade to get a plentiful supply of water from the river Ouse should a fire occur in that end of the town. From the crown of the bridge to the river is a depth of 27 ft., and yet the steamer behaved admirably, and the test to which she was put was a

marked success in every way. From two lengths of hose the water was thrown to a considerable height, and throughout the machinery worked with much smoothness.

Warrington T.C.—Towards the relief of the rates the gas department has made a grant of £13,000 and the tramways £1,400. Profits of £3 275 on the markets were appropriated to the rates.

PERSONAL.

Mr. E. Hall, borough surveyor of Carnarvon, has had his salary increased by £25 a year.

Mr. E. F. Schofield, engineering assistant to the Burnley Rural District Council, has been granted an increase of salary of £10 per annum.

Mr. W. H. Tillotson, highways surveyor to the Burnley Rural District Council, is to be provided with a motor car, at a cost not exceeding £200.

Mr. F. Read, deputy surveyor of Rhondda, has been appointed surveyor to the Gelligaer Urban District Council, at a salary of £250, rising to £300.

Mr. Arthur Grant, head of the Housing and Town Planning Branch of the Local Government Board for Scotland, has been appointed to the post of assistant secretary under that authority.

Mr. C. J. Yorath, deputy engineer and surveyor to the Acton Urban District Council, has obtained an appointment as city commissioner of Saskatoon, Canada, and will leave England shortly to take up his duties.

Mr. E. B. Barnard, chairman of the Metropolitan Water Board, will deliver an address on "London's Water Supply" at a meeting of the Royal Sanitary Institute, to be held at 90 Buckingham Palace-road, S.W., on Tuesday, May 20th, at 7.30 p.m.

Mrs. Harold Collins, wife of the deputy city engineer of Norwich, made an aerial flight with Mr. B. C. Hucks last week in an aeroplane, and thus achieved the distinction of being the first Norwich lady to make an ascent from the city.

Mr. A. T. Gooseman, deputy engineer of Bootle, has been recommended by the Wigan General Purposes Committee as borough engineer of Wigan. There were 107 applications for the position, which carries with it a salary of £350 per annum, rising to £500.

Mr. Joseph Parry, M.INST.C.E., chief engineer Liverpool Corporation waterworks, will, on Friday evening, May 30th, at a meeting of the Royal Sanitary Institute at Chester Town Hall, open a discussion on "Methods of Purification and Softening of Water."

The *Times* announces the birth last week of a daughter to Mr. and Mrs. Sydney G. Turner, of Richmond, Surrey. Mr. Turner, ASSOC.M.INST.C.E., barrister-at-law, is well known to our readers as the editor of the "Assistants' and Students' Section," which he conducts with such conspicuous success.

Mr. H. A. Garrett, borough surveyor of Torquay, has received a request from the Rothesay Town Council to report on their proposed new sewage scheme, but he has regretfully declined the offer owing to the pressure of his own work. The Works Committee of Torquay have congratulated Mr. Garrett on the honour conferred by the request.

Mr. W. R. May (the present assistant engineer) has been appointed borough electrical and mechanical engineer of Lowestoft, at a commencing salary of £250 per annum, increasing to £280 per annum by annual increments of £10, and Mr. H. H. Saunders has been appointed general manager of the electric light and tramways undertakings at a salary of £220 per annum, increasing by £10 per annum to £250.

Mr. Thomas Duncanson, M.INST.C.E., assistant water engineer to the Corporation of Liverpool, died this week, we regret to state. The late Mr. Duncanson was one of the oldest officials in the service of the Liverpool Corporation. His connection with the waterworks dated from 1867. He was engaged on the Vyrnwy works from 1881 to 1891, in which latter year he was appointed chief assistant water engineer, an appointment he had held ever since. For some time past Mr. Duncanson had been in delicate health, and last week he underwent an operation, but failed to recover. The funeral is fixed to take place to-morrow (Saturday), at 2 o'clock, in Anfield Cemetery.

Mr. W. Calder, M.INST.C.E., engineer to the city of Prahran, Australia, whose appointment as chairman of the Country Roads Board for the State of Victoria is announced in "Minutes of Proceedings," has had nearly thirty years' experience as an engineer. He is a native of New Zealand, and was for five years employed in the Survey Department of the Dominion. He was responsible for much road construction and exploration work in the North and South Islands. Twenty-five years ago he went to Victoria, and has practised his profession there ever since. He was for nine years engineer for the Tewkesbury council, and carried out works which involved an expenditure of £80,000. In 1897 he was appointed engineer to the Prahran City Council, and since then he has constantly been engaged in large municipal undertakings. He has just completed an important scheme of water drainage, which has been adopted by the council; and during the last five years he has carried out loan works upon which £75 000 has been expended. In his new position he will receive a salary of £800 per annum. His resignation of the office of city surveyor of Prahran was accepted with regret by the town council, who resolved to place on record their appreciation of the services he has rendered. A successor is to be appointed at a salary of £450 a year, and applications are to be invited for the position of assistant city surveyor at a salary of £4 a week.

In the list recently issued of the results of the examination of the Institution of Civil Engineers, held in London in February last, the name of Mr. L. G. Dryland, STUD.INST.C.E., is given as having passed the examination for associate membership. We understand Mr. Dryland is a son of Mr. A. Dryland, M.INST.C.E., county surveyor of Surrey.

Croydon's New Schools.—New elementary schools, costing £12,100, erected at Norbury by the Croydon Education Committee, were recently opened by the Lord Mayor of London. Mr. Howard Houlder, chairman of the Croydon Education Committee, who presided, said that the cost of the buildings per head was less than for any similar class of school in the country. In fact, so great was the reputation of Croydon for economical and efficient school building that deputations came from all parts to see what the schools of that borough were like.

The Civil Engineer's Who's Who.—Mr. W. Welburn, M.INST.M. AND CO.E., who has for over thirty-five years been borough surveyor of Middleton, near Manchester, in ordering this new publication adds: "May I also congratulate you on the publication THE SURVEYOR? I have the whole of the volumes."—Mr. H. Gilbert Whyatt, M.INST.C.E., M.R.SAN.I., the borough engineer and surveyor of Grimsby, also writes, in reference to "Who's Who": "I find it most interesting, and sincerely hope that continued success may warrant its publication for many years to come." We are much indebted to both correspondents for their encouraging missives.

FOR OTHER ADVERTISEMENTS
See End of Paper.

URBAN DISTRICT COUNCIL OF ENFIELD.

PUBLIC STREET IMPROVEMENT WORKS.

The Council invite Tenders for Providing and Laying about 4,300 yards super. of Artificial Stone Paving in Derby-road, Ponder's End, and Gordon-hill, Enfield.

Specifications can be seen, Form of Tender, and all information obtained, on application to Mr. Richard Collins, the Council's Surveyor, any day, except Saturday, between the hours of 9 a.m. and 5 p.m.

The Contractor will be required to observe Trade Union hours of labour, and to pay the recognised Trade Union rates of wages in force in the district where the work is to be executed.

Sealed Tenders, endorsed "Tender for Street Works," to be sent in to me not later than noon on Wednesday, the 23rd day of April instant.

The Tenders must be accompanied by a schedule of hours of labour and of prices and wages to be paid for different classes of work, which schedule will be embodied in the Contract.

The Council do not bind themselves to accept the Lowest or any Tender.

(By order)

T. W. SCOTT,
Clerk.

Public Offices, Enfield.
April 1, 1913. (329)

BILSTON URBAN DISTRICT COUNCIL.
TO SEWERAGE CONTRACTORS.

Notice is hereby given that the Urban District Council of Bilston, in the County of Stafford, are prepared to receive Tenders for:—

The construction of about 600 yds. of Pipe Sewers, Manholes, &c., in various streets in Bradley.

The Plans may be seen, and Specification, Bill of Quantities and Form of Tender obtained, on application to the undersigned, Surveyor's Office, Town Hall, Bilston, upon payment of a deposit of One Guinea, which will be returned after a Contract has been entered into to every person making a *bonâ-fide* Tender on the return of all documents entrusted to them.

In the event of a Tender being withdrawn the deposit will be forfeited.

The Council will require security for the due performance of the Contract in a sum not exceeding 20 per cent of the Tender.

Sealed Tenders, on the Form supplied, endorsed "Sewers, Bradley," are to be delivered by registered post at the office of the undersigned, at the Town Hall, Bilston, on or before 9.30 a.m. on Thursday, the 24th day of April, 1913.

The Council will not be bound to accept the lowest or any Tender.

VINCENT TURNER, Assoc.M.Inst.C.E.,
Engineer and Surveyor.

Town Hall,
Bilston. (327)

BRUMBY AND FRODINGHAM URBAN DISTRICT COUNCIL.

The above Council invite Tenders for supplying about 800 tons of Whinstone, more or less, also about 150 tons of Tar-macadam for Footpaths, up to 31st March 1914, to be supplied at such times and in such quantities as ordered by the Surveyor, and delivered at Frodingham and Gunners Stations, G.C.R. Co.

The Council do not bind themselves to take the above quantity, but more or less as required.

The lowest or any Tender not necessarily accepted.

Specification and Form of Tender may be had from the undersigned, to whom Tenders, sealed and endorsed "Tender for Whinstone," must be sent not later than Saturday, 12th April, 1913.

JOE GREEN,
Surveyor.

Council Offices,
New Frodingham,
Lincolnshire. (321)

BOROUGH OF DONCASTER.
SURVEYOR'S JUNIOR ASSISTANT.

The Doncaster Corporation are prepared to receive applications for a Junior Assistant in the Borough Surveyor and Water Engineer's Office, at a salary of £70 per annum, subject to one month's notice on either side.

Applications, stating age (which should not exceed 25 years), qualifications, past experience in surveying, levelling, draughtsmanship, and the routine of a Municipal Surveyor's office, and date on which applicant can conveniently commence duty, accompanied by copies of not more than three recent testimonials, to be delivered to the undersigned before noon of Friday, the 11th April, 1913, endorsed "Assistant."

F. OSCAR KIRBY,
Borough Surveyor, Doncaster.

Mansion House,
Doncaster.
April 2, 1913. (322)

COUNTY BOROUGH OF NORTHAMPTON.

Applications are invited for the post of Temporary Town Planning Assistant in the Borough Engineer's Department. Salary, £2 per week. Applications, endorsed "Temporary Assistant," stating age, qualifications and experience, accompanied by copies of three recent testimonials, to be delivered to the undersigned not later than Monday week, 14th April, 1913.

(Signed)
ALFRED FIDLER, M.Inst.C.E.,
Borough Engineer.

Borough Engineer and Surveyor's Office,
Guildhall,
Northampton.
April 3, 1913. (330)

COUNTY BOROUGH OF NORTHAMPTON.

The Corporation invite applications for the appointment of Chief Engineering Assistant in the Borough Engineer and Surveyor's Department.

Candidates must possess a good general knowledge of municipal engineering, and have had experience in works of Main Sewerage and Sewage Disposal Works, Constructional Ironwork, Electric Tramways, Bridges, Public Baths, &c., and the routine work incidental to the office of a Municipal Engineer.

Preference will be given to candidates between the ages of 30 and 35 years who are Associate-members of the Institution of Civil Engineers and the Institution of Municipal and County Engineers.

The salary offered is £193 per annum rising, upon approved service, by increments to a maximum of £225 per annum.

The appointment will be terminable by three months' notice on either side.

Applications to be made in candidate's own handwriting, stating age and experience, accompanied by copies of three recent testimonials, endorsed "Chief Engineering Assistant," to be addressed and delivered to the undersigned on or before Saturday, the 19th April, 1913.

Canvassing, either personally or indirectly, will be deemed a disqualification.

(By order)
ALFRED FIDLER, M.Inst.C.E.,
Borough Engineer and Surveyor.

Borough Engineer's Office
Guildhall,
Northampton.
April 2, 1913. (323)

CITY OF ST. ALBAN.
APPOINTMENT OF CITY ENGINEER AND SURVEYOR.

The Corporation of St. Albans are prepared to receive applications for the appointment of City Engineer and Surveyor. The gentleman appointed will be required to devote the whole of his time to the duties of his office, to undertake the ordinary duties of a City Engineer and Surveyor, and to perform such work as may from time to time be referred to him by the Council or any of its Committees and not to undertake or engage in any other employment. Commencing salary, £300 per annum, the appointment being determinable by three months' notice on either side. Candidates for the appointment are requested to send their applications, stating their age, qualifications and experience, and enclosing copies of not exceeding three testimonials of recent date, addressed to the undersigned, and endorsed "Appointment of Engineer and Surveyor," not later than Monday, 21st April, 1913 after which no application will be received. Canvassing, either directly or indirectly, will disqualify.

E. R. DEBENHAM,
Town Clerk.

Town Clerk's Office,
St. Albans.
April, 1913. (324)

TAVISTOCK URBAN DISTRICT COUNCIL.

The above-named Council require the services of a Competent Working Foreman.

Applications endorsed "Foreman," in candidate's own writing, stating age, experience and wages required, must be sent to the undersigned on or before Wednesday, the 30th instant.

E. WARRAN,
Clerk.

Tavistock.
April 2, 1913. (325)

TEMPORARY ASSISTANT required, at once, in Borough Surveyor's Office near London. Salary, £2 10s. per week. Experience in Private Street Works essential. Probable length of engagement, 3-4 months. Apply, enclosing copies of testimonials and particulars of experience, to Box 1230, office of The Surveyor, 24 Bride-lane, Fleet-street, E.C. (326)

ARCHITECTURAL ASSISTANT, A.R.I.B.A., desires engagement; 10 years' experience. Good knowledge design and planning of Public Buildings. Surveying and Levelling.—Apply Box 1,231, office of The Surveyor, 24 Bride-lane, Fleet-street, E.C.

THOROUGHLY competent Land Surveyor required at once for few months; must be quick, reliable, neat draughtsman, and used to Building Estate work.—Franklin & Deacon, Architects and Surveyors, 21 Market-hill, Luton, Beds. (328)

Protection of Water Supplies Derived from the Great American Lakes.

Mr. George C. Whipple, in a paper read before the Engineers' Club of Philadelphia, and published in their "Proceedings," gives valuable evidence with regard to the effects of sewage pollution upon water supplies derived from the Great Lakes, and discusses the sanitary protection of such supplies.

The dilution afforded by the waters of the lakes to the relatively small amount of sewage entering them, might, at the first glance, be considered sufficient to safeguard the purity of waters drawn at intakes situated perhaps 2 or 3 miles out from the shore in comparatively deep water. Mr. Whipple, however, gives exact evidence that contamination does occur owing to various causes, such as currents induced by the wind. From the standpoint of the pollution of water supplies the most important currents are the local currents produced by the wind. For instance, if the wind has been blowing off shore for ten hours at the rate of 20 miles per hour in such a direction as to cause the water to flow from the sewer outfall towards the water supply intake, the surface water will be carried 6 miles from the shore during the ten-hour period, assuming that the velocity of the surface current induced by the wind is 3 per cent of the wind movement. This result would, it is argued, be more than sufficient to carry sewage to the longest intake now in use. Float experiments have shown the possibilities. A group of floats was set adrift in Lake Erie when the wind was blowing at the rate of 13 miles per hour. In one experiment, after the floats had travelled 2,500 ft., which was 4·7 per cent of the wind movement, the floats had spread through an angle of 5 deg.; in other experiments, with higher wind velocities, the angle of dispersion was less. The angle of dispersion, we are told, varies according to the velocity of the wind, so that after normal days of variable winds the fan of polluted water may spread over a semi-circle.

Effect of Undertow Currents.

As a result of undertow currents induced by a strong wind blowing on a lee shore, shore water is carried outward and sewage-contaminated water periodically enters the intake. The evidence as to the undertow currents is best obtained from a study of the temperature of water at different depths, at different distances from the shore, and of the temperature of the water drawn from the intakes. A drop in the temperature follows a sudden change in the direction of the wind from on-shore to off-shore. Thus, at Milwaukee the temperature of the water at pumping was 68 deg. on July 20, 1910, on July 23rd it was 62 deg., and on July 27th 52 deg. Greater falls of temperature of water 40 ft. below the surface have been recorded, the drop following a sudden change in the wind from off-shore to on-shore. When the warm surface water is blown away from the shore, cold water flows landward near the bottom.

The undertow currents are of great importance in connection with the dispersion of sewage. During the summer season the temperature of the sewage will be ordinarily not far from that of the surface water of the lakes. If the sewage is discharged at the bottom of a lake at a considerable distance from the shore, it is obvious that when the cold, deep water is flowing shoreward the sewage will be warmer and lighter than the water into which it is discharged. The sewage will therefore tend to rise into the upper strata, and be carried away from the shore by the outward surface current. When the warm shore water is going out at the bottom the sewage will enter water of, approximately, its own temperature, and will have less tendency to rise, and will be carried away from shore by the outward bottom current. Thus, during the summer the movements of the wind, whether towards or away from the shore, tend, at most times, to carry the sewage away from the shore rather than towards it.

Wind Effects.

It is also shown, where sewage is discharged at a breakwater, that an on-shore wind causes the sewage to be held back at the breakwater, while the lake water, blown towards the shore, turns at the obstruction and flows downward and outward; but on the cessation of the wind, or on its change, the now polluted water held back at the breakwater flows out as a surface current, and gives rise to streaks or polluted water which may extend far out into the lake. From systematic analyses of lake water in the vicinity of large towns the foregoing deductions are shown to be correct. In general, they have shown that the dilution of sewage discharged into the lakes is ordinarily very great. It is, however, very variable, and under certain conditions that occur several times a year "the sewage is projected through the lake water for several miles with relatively little dilution." When the path of this sewage stream lies in a direction from the sewer outfall to the waterworks intake, contamination of the water supply may and does occur.

Thus, observations of the number of bacteria in Lake Michigan water, taken at different distances from the shore opposite the mouth of the Milwaukee river, show that there were 1,268,000 bacteria per c.c. at the mouth of the river, 207,000 per c.c. 1 mile east of the river, 2,000 per c.c. 2 miles east, 970 per c.c. 3 miles east, 225 per c.c. 4 miles east, and 45 per c.c. 5 miles east. The water supply intake is, however, 3·5 miles in a straight line north-east of the river, and here the average number of bacteria was 1,182 per c.c. at the surface and 693 per c.c. at the bottom, the largest numbers being 3,720 at the surface and 1,600 at the bottom, and the smallest numbers being 20 at the surface and 50 at the bottom. Again, taking all of the samples collected at points more than 1 mile away from the shore, it was found that when the wind was blowing towards the shore the bottom water contained four times as many B. coli as the surface water, but that when the wind was blowing off-shore the surface water contained eight times as many B. coli as the bottom water.

Daily analyses of water at the North Point pumping station, Milwaukee, show variations of from 5,900 bacteria per c.c. to 330 per c.c. within a few hours, while coli are often present in 0·1 c.c., and are occasionally absent from 1 c.c. on the following day. But stronger proof is afforded by the recorded results of the use of the unpurified lake waters upon the public health as measured by vital statistics.

Unfiltered Water and Typhoid.

A very complete study of the death rates from typhoid fever and other diarrhœal diseases in the cities taking water supplies from the Great Lakes is contained in the bulletins of the Hygienic Laboratory of the Public Health and Marine Hospital Service of the United States. These show that the typhoid fever death rates of the lake cities that do not filter their water are very high as compared with European cities that have safe supplies. Figures relating to twenty-two cities are quoted; of these eleven cities had a higher death rate in 1910 than in 1901, three were practically stationary, but showed a high increase during some of the intervening years, while the remainder, showing a drop in the death rate in the year 1910, also showed a considerable rise in the death rate in some of the years between 1901 and 1910. It is shown, moreover, that intestinal diseases, classed as diarrhœa and enteritis, and infantile diseases are exceptionally prevalent in the lake cities that use unfiltered water.

The broad waters of the lakes cannot be used for water supplies because it is impracticable to extend the intake pipes or tunnels to points where the depth of the water much exceeds 75 ft. The longest intake in use is at Cleveland, the end of which is about 4 miles from the shore, while the shorter intakes do not extend 1,000 ft. from the shore. The various attempts made to improve the quality of the water by extending the intakes do not appear to have prevented the contamination of the water; also, many breaks have occurred in the lake intakes which have permitted polluted shore water to enter the pipes, and outbreaks of disease have followed.

Methods of Protection.

The rest of the paper is devoted to the consideration of the methods of protecting the lake water supplies. Smaller cities appear to suffer more than the larger cities because their intakes and sewer outfalls are closer together.

The abandonment of the lake supply is generally impossible. The extension of the water intake has been shown to be insufficient. The exclusion of sewage from the lake is generally impossible. The

complete purification of sewage and storm water involving sterilisation is too costly. Ordinary sewage treatment is recommended, but though it will reduce the danger of pollution it will not do away with it altogether. The only safe course is therefore to purify the water itself.

Sterilisation by means of hypochlorite is suitable for the lake waters because they contain very little organic matter; but, in the author's opinion, great caution is required in the use of this method. It is of the greatest importance to secure a prompt and intimate mixture of the bleaching powder solution with the water. This is not as easily accomplished as many think, and requires a degree of skill in operation not easily obtained in practice. Failure to apply the chemical properly may easily escape the knowledge of the authorities, and such failure may be calamitous in its results. It is, however, admitted that the effective sterilisation of water can be obtained by this method.

It is argued that the method does not completely protect against water-borne diseases, because at Toronto the addition of a filter after sterilisation had been in use for some time was followed by a considerable fall in the death-rate, showing that disinfection alone had not furnished complete protection. Owing, therefore, to the uncertainties of operation, the author is of opinion that sterilisation should not be looked upon as a means of permanent protection, but rather as a temporary or emergency measure. He considers that the best method of protecting lake water is filtration, and makes a comparison of the two processes worked separately to the advantage of filtration. Further, he is of opinion that, although sand filters are more costly to construct, the cost of their operation is less; while, on the whole, the results are more trustworthy than is the case with the mechanical filter. Cases are quoted of the improper working of sand filters, and of mechanical filters causing outbreaks of typhoid at Ashland, Wisconsin, and at Lorain, Ohio, respectively. Apparently the use of sterilisation as an *additional* safeguard is approved.

Finally, the author considers that where the water supply is filtered, expensive treatment of the sewage discharged into the lake is unnecessary, although it affords an additional factor of safety.

INSTITUTION OF MUNICIPAL AND COUNTY ENGINEERS.

President—Mr. R. J. Thomas, M.Inst.C.E., County Surveyor, Buckinghamshire.

VISIT TO AMSTERDAM AND THE HAGUE, WHITSUNTIDE.

Arrangements have now been completed for the visit of the institution to Amsterdam and The Hague next month.

Ladies are especially invited to attend this meeting.

Messrs. Cook, in whose hands are the details of travelling and hotel accommodation, state that hotel accommodation is already becoming very limited, and it is necessary to definitely secure rooms forthwith. Those who desire accommodation to be reserved for them should send name of hotel selected, and deposit of £1 per passenger, direct to Conducted Tours Department, Messrs. Thomas Cook & Son, Ludgate-circus, London, if possible not later than to-morrow (Saturday); the balance of the fare being payable nearer the date of departure.

Railway tickets to and from London (over 30 miles) will be supplied by Messrs. Cook at a fare-and-a-third rate.

Programme.

Thursday, May 8th.

Leave London (Liverpool-street Station) at 8.30 p.m. via Harwich and the Hook of Holland.

Friday, May 9th.

Arrive at the Hook of Holland and proceed to Amsterdam, arriving 7.30 a.m.

12.45 p.m.—Carriages leave hotels.

1.0 p.m.—Reception at the town hall by the Burgomaster and Aldermen of Amsterdam.

1.25 p.m.—Leave the town hall.

1.30 p.m.—Arrive at the Exchange, where the party will be received by Mr. A. W. Boss, the Director of Public Works, who, with Mr. F. S. Jacob and Mr. P. Lohr, city engineers, will give a description of the drainage and sewerage works of Amsterdam, dealing with the special difficulties presented by the peculiarities of the country, after which the members will proceed to visit works in course of construction (*inter alia*), the sewage pumping stations (electric pumps), the old and new sewage outfall works, tramway garage.

6.0 p.m.—Return to hotels.

Saturday, May 10th.

9.30 a.m.—Carriages leave hotels; visit to the city gasworks. These works are described as an installation with apparatus up-to-date in every detail.

1.0 p.m.—Return to hotels.
Afternoon free.

Sunday, May 11th.

10.0 a.m.—Leave Amsterdam for trip to the Isle of Marken.

6.0 p.m.—Arrive back at Amsterdam.

Monday, May 12th.

Leave Amsterdam by train for Leyden. Take steamer trip; luncheon on board.
Return by train from Leyden to Amsterdam.

Tuesday, May 13th.

8.40 a.m.—Leave Amsterdam for The Hague. On arrival at The Hague, leave luggage at the Consigne. Carriages will convey the party to the abattoirs (these are considered the best example in Europe). The members will be received by Mr. Lindo, the Director of Public Works.

1.0 p.m.—Luncheon.
The members will visit "The House in the Wood," by kind permission.
Drive to Scheveningen.
Dinner at hotel.

10.47 p.m.—Leave The Hague for the Hook of Holland.

11.50 p.m.—Leave the Hook of Holland by steamer for Harwich.

Wednesday, May 14th.

Arrive Harwich and proceed by train to London, reaching Liverpool-street Station at 8.0 a.m.

NORTH-EASTERN DISTRICT.

A meeting of the institution will be held in the North-Eastern District at Newcastle-on-Tyne on May 2nd and 3rd next.

SCOTTISH MEETING.

A meeting of the institution will be held in the Scottish District at Dundee on June 6th and 7th.

ANNUAL MEETING.

The annual meeting of the institution will be held from July 16th-19th.

Thomas Cole,
92 Victoria-street, S.W. *Secretary.*

INSTITUTION OF MUNICIPAL ENGINEERS.

President—Mr. Frank Latham, M.Inst.C.E.I., F.S.E., Borough Engineer and Surveyor, Penzance.

COUNCIL MEETING.

At a meeting of the council held in London on March 26th the following applicants were recommended for admission:—

To Membership.—Messrs. H. T. Evans, assistant county surveyor, Bonner County, Idaho, U.S.A.; W. L. Carter, borough engineer's office, Southend; and K. L. Loomba, assistant to Messrs. Taylor & Wallin, Newcastle.

To Associate Membership.—Messrs. J. J. Griffiths, assistant borough surveyor, Oswestry; and H. B. Rogers, chief assistant, Wells Rural District Council.

Transfer to Associate Membership.—Mr. F. L. Morrison, city surveyor's office, Chichester.

(Under the new by-laws these elections will be ratified at the next council meeting if no written objections are lodged within fourteen days.)

Elected to Studentship.—Messrs. R. E. Brown, city surveyor's office, Wells; and J. H. Clegg, gas engineer's office, Barnoldswick Corporation.

New Members, &c.—From the applicants recommended for admission at the last meeting one member and three associate members were elected.

Competitions.—The council have pleasure in announcing that particulars will shortly be issued of two competitions, in respect to which premiums will be presented, one by the president and one by

Mr. Horace Boot, vice-president. The competitions will be open to all corporate members and students.

Meetings.—A visit to the cement works of Messrs. Martin, Earle & Co., Limited, at Rochester, will take place in April, while several other interesting programmes also are being arranged.

International Road Congress.—Members are requested to note that the Local Government Board will be prepared to sanction the reasonable expenses of highway surveyors attending the congress to be held June 23rd-28th.

NORTHERN DISTRICT.

A meeting of this district of the institution was held at Wallsend-on-Tyne on Saturday last. A short business meeting was first held in the borough surveyor's office, and later visits were made to the Newcastle electric power station, Messrs. Parsons' works, and the new ferro-concrete bridge.

The Corporation of Wallsend entertained the members to tea.

GENERAL MEETING.

A visit will be paid to the International Building Trades Exhibition, at Olympia, London, on Saturday, April 12th, at 3.30 o'clock.

Programme.

3.15.—Meet at the exhibition entrance.
3.30.—Informal meeting within the exhibition.
4.0.—Proceed to inspect the various exhibits.
4.45.—Adjournment for tea, at the kind invitation of Mr. H. G. Montgomery.

Tickets of admission have kindly been supplied by the exhibition authorities.

NORTH-WESTERN DISTRICT.

A meeting will be held at the Victoria Hotel, Manchester, on Wednesday, April 16th, at 7 o'clock, when a paper on "Sewage Treatment" will be read by Mr. R. J. McKenn, manager of the Heywood Corporation sewage works. Members will remember that a very interesting paper was read by Mr. McKenn at the Heywood sewage works in April of last year, and it is to be hoped that the attendance will be as large as it was then. The paper will afford excellent scope for full discussion.

J. W. Gleave,
Hon. District Secretary.

Brantwood,
Coomassie-street,
Heywood.

The following council meetings have been arranged: April 30th, London; May 31st, Manchester; June 28th, London; July 30th, London.

B. Wyand,
Secretary.

39 Victoria-street, S.W.

ILLUMINATING ENGINEERING SOCIETY.

A paper by Mr. A. P. Trotter on "The Specification of Street Lighting," giving an account of the work of the Joint Committee of the Institution of Electrical Engineers, the Institution of Gas Engineers, the Institution of Municipal and County Engineers, and the Illuminating Engineering Society will be presented at a meeting of the last named body at the Royal Society of Arts, 18 John-street, Adelphi, London, on Tuesday, the 15th inst., at 8 p.m.

The paper will not be read. The discussion will be opened after some introductory remarks by the author.

Members of the Institution of Electrical Engineers, the Institution of Gas Engineers, and Institution of Municipal and County Engineers are invited to attend, and they may obtain copies of the paper on application to Mr. L. Gaster, the hon. secretary of the Illuminating Engineering Society, 32 Victoria-street, S.W.

THE SURVEYORS' INSTITUTION.

The next ordinary general meeting will be held at the institution on Monday, when a paper entitled "Reinforced-Concrete Construction" will be read by Mr. P. J. Waldram. The chair will be taken at 8 o'clock.

SOCIETY OF ENGINEERS.

At a meeting of the Society of Engineers, to be held on Monday next, at the Institution of Electrical Engineers, Victoria Embankment, W.C. (south end of Savoy-street, near Waterloo Bridge), a paper on "The Status of Engineers and Engineering, with Special Reference to Consulting Engineers," will be read by Mr. William Ransom, Assoc.M.Inst.C.E.

This essay gained the second premium (the first not being awarded) in the Status Prize Competition last year, and deals with questions affecting engineers in their relations with clients, assistants, contractors and the general public. The author also discusses the training of engineering pupils, the question of registration, and a variety of other matters affecting the remuneration and professional status of engineers.

The chair will be taken at 7.30 p.m.

APPOINTMENTS VACANT.

Official and similar advertisements received up to 4.30 p.m. on Thursdays will be inserted in the following day's issue, *but those responsible for their despatch are recommended to arrange that they shall reach* The Surveyor *office by noon on* **Wednesdays** *to ensure their inclusion in the weekly list of summaries. Such advertisements may, in cases of emergency only, be telephoned (No. 1359 Holborn), subject to later confirmation by letter.*

COUNTY SANITARY INSPECTOR.—April 5th.—Lancashire County Council. £250 per annum.—County Medical Officer of Health, County Offices, Preston.

INSPECTOR OF NUISANCES.—April 5th.—Ketton (Rutland) Rural District Council. £120 per annum.—Mr. R. M. English, clerk.

CLERK OF WORKS.—April 5th.—Briton Ferry Urban District Council.—Mr. H. A. Clarke, Council Offices.

CLERK OF WORKS.—April 7th.—Harrogate Town Council. £104 per annum.—Mr. C. E. Rivers, borough engineer.

CHIEF CLERK.—April 7th.—For borough surveyor's department of Hammersmith Borough Council. £130—£175.—Mr. Leslie Gordon, town clerk.

JUNIOR CLERKS.—April 7th.—For borough surveyor's department of Hammersmith Borough Council. £40—£65.—Mr. Leslie Gordon, town clerk.

SURVEYOR.—April 8th.—Carnoustie Town Council. £140 per annum.—Mr. D. O. Young, town clerk.

CLERK OF WORKS.—April 10th.—Corporation of Bolton. £3 3s. per week.—Mr. S. Parker, town clerk.

SURVEYOR.—April 10th.—Bedfordshire Education Committee. £200 per annum.—Mr. W. W. Marks, clerk of the county council, Shire Hall, Bedford.

DISTRICT ROAD FOREMAN.—April 10th.—Godstone Rural District Council. 30s. per week.—Mr. Geo. E. Crowter, engineer and surveyor, High-street, Godstone.

CLERK OF WORKS.—April 12th.—Bingley Urban District Council. £2 10s. per week.—Mr. A. Platts, clerk.

CHIEF ASSISTANT ENGINEER.—April 12th.—Port of London Authority. £1,200.—Mr. F. Ayliffe, secretary, 109 Leadenhall-street, E.C.

BOROUGH ENGINEER AND SURVEYOR.—April 12th.—Corporation of Ipswich. £350—£550.—Mr. W. Bantoft, town clerk.

SURVEYOR.—April 12th.—Kettering Rural District Council. £130—£170.—Mr. Charles W. Lane, clerk.

STOKER AND DRIVER.—April 14th.—At pumping station of Borough of Dorchester Waterworks. 21s. per week, with house, coal and light.—Mr. A. G. Symonds, town clerk.

CLERK OF WORKS.—April 16th.—Kinsale Rural District Council. £2 10s. per week.—Mr. J. Murphy, clerk, Council Office, The Workhouse.

SURVEYOR OF HIGHWAYS.—April 18th.—Ashby-de-la-Zouch Rural District Council. £100 per annum.—Mr. George Farmer, clerk.

ASSISTANT ENGINEERS.—May 1st.—Indian Public Works and State Railway Departments.—Secretary, Public Works Department, India Office London, S.W.

ASSISTANT ENGINEER.—May 15th.—Board of Trustees for the Improvement of Calcutta. 500—700 rupees per mensem.—Mr. C. H. Bompas, chairman, 5 Clive-street, Calcutta.

MUNICIPAL COMPETITIONS OPEN.

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READING. April 18th. Designs for a boys' and girls' school, for the Reading Education Committee. Competitions limited to local architects. Clerk of the Education Committee.

NORTHAMPTON.—April 21st. Designs for a council school. Limited to local architects. The Clerk, Education Offices.

BARNET. April 29th.—Designs for new municipal offices, for the urban district council. Premiums £25, £15, £10.—The Clerk.

DEVONPORT.—June 14th. Designs for municipal buildings and a guildhall, for the Corporation of Devonport. Premiums of £350, £150, and £100 are offered. The assessor is Mr. Ernest Newton, A.R.A., F.R.I.B.A. Mr. R. J. Fittall, town clerk.

NEWCASTLE-ON-TYNE. June 19th. Designs for laying out portion of the Walker estate, for the corporation. Premiums £50, £30, and £20. Mr. A. M. Oliver, town clerk.

MUNICIPAL CONTRACTS OPEN.

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Buildings.

WINCHESTER.—April 5th. For the erection of new offices, for the corporation.—Mr. Thomas Holt, town clerk.

FELIXSTOWE.—April 5th. For the erection of an accumulator house and store, for the urban district council.—Mr. M. Humphrey, clerk.

HERTS.—April 5th. For the erection of a police station, for the county council.—Mr. U. A. Smith, county surveyor, Hatfield.

DERBYSHIRE.—April 7th.—For alterations to a school, for the Education Committee.—Mr. G. H. Widdows, architect, St. Mary's-gate, Derby.

CARMARTHEN. April 7th. For the construction of a bridge, for the Joint Executive Committee.—Mr. D. Thomas, Ammanford urban district surveyor, 10 Quay-street, Ammanford.

OXFORD. April 7th.—For the erection of a bathing-place, for the corporation. Mr. R. Bacon, town clerk.

READING. April 7th. For the erection of a shed and other works at the cattle market, for the corporation. Borough Engineer.

ANNFIELD. April 8th. For the erection of sixty houses, for the urban district council. Mr. T. L. Watchman, clerk.

HUDDERSFIELD. April 9th.—For alterations to tramway offices, for the corporation.—Mr. K. F. Campbell, borough engineer and surveyor.

DEVON.—April 9th.—For building a school, for the Education Authority.—County Architect, 1 Richmond-road, Exeter.

ARUNDEL. April 10th. For the erection of a timber groyne for the Commissioners of Sewers. Mr. Arthur Holmes, clerk.

GLASGOW.—April 10th.—For the erection of a golf-house, for the corporation.—Mr. J. Lindsay, town clerk.

FIFE. April 11th.—For enlarging a clay-puddle reservoir, and the construction of filters and water tank, for the county council.—Mr. John Macpherson, district clerk, St. Andrews.

WEST RIDING.—April 11th.—For additions to a school, for the Education Committee.—The Clerk, County Hall, Wakefield.

KENT.—April 11th.—For the erection of a cloak-room, for the Education Committee.—Mr. E. L. Turner, Martin' Bank Chambers, Dartford.

WEST RIDING.—April 11th.—For the erection of a school, for the Education Committee.—The Clerk, County Hall, Wakefield.

EARLSTON.—April 12th.—For the construction of a storage reservoir, for the Water Committee.—Mr. T. R. Atkinson, Earlston.

ABERDARE.—April 12th. For the erection of two bridges, for the urban district council.—Mr. D. L. Griffiths, clerk.

LURGAN.—April 12th.—For the erection of fifty-four workmen's dwellings, for the town council.—Mr. F. W. Pollock, clerk.

EASTRY.—April 14th.—For the erection of workmen's dwellings, for the rural district council. Mr. F. S. Cloke, clerk, Sandwich.

YORK. April 14th.—For the erection of two lock-up shops, for the corporation.—Mr. F. W. Spurr, city engineer.

MANCHESTER. April 15th.—For the roofing over of avenue at Hyde-road car works, for the corporation. Mr. Thomas Hudson, town clerk.

DURHAM.—April 15th.—For the erection of a school, for the county council.—Mr. J. Eltringham, architect, General Chambers, West Sunniside, Sunderland.

CARNARVON.—April 16th.—For the erection of a police station and court room at Llandudno, for the Joint Committee.—Mr. A. Bodvel-Roberts, Clerk of the Peace, Carnarvon.

LINDSEY.—April 17th.—For the erection of a school, for the Education Committee.—Mr. S. M. Grant, secretary, 286 High-street, Lincoln.

WILTS.—April 21st.—For the reconstruction of Bulford Bridge, for the county council.—Mr. J. George Powell, county surveyor, Trowbridge.

LAMBETH. April 24th. For the erection of a pavilion, for the borough council.—Mr. B. Penny, town clerk.

Iron and Steel.

SHROPSHIRE.—April 5th. For laying on a water supply, for the Small Holdings Committee.—Mr. F. Crowte, clerk, Shrewsbury.

TEDDINGTON.—April 5th.—For the supply and erection of two destructor furnaces, boiler settings, and flues, with two Lancashire boilers, for the urban district council.—Mr. G. H. Salmons, clerk.

DERBY. April 10th.—For the supply of unclimbable wrought-iron fencing, for the corporation.—Mr. J. Ward, borough surveyor.

WAKEFIELD.—April 11th.—For laying a 5-in. water main, for the rural district council.—Mr. H. Beaumont, clerk.

DAVENTRY. April 14th.—For the supply and erection of a water-softening plant (capacity 10,000 gallons per hour), and a water-level indicator, for the corporation.—Mr. Frederick Willoughby, town clerk.

Roads.

BANFF.—April 4th—15th.—For reconstruction of main road, for the county council. Mr. James Grant, county and district clerk, Banff.

STRETFORD. April 5th.—For paving work in rock asphalt, for the urban district council.—Mr. E. Worrall, surveyor.

STEYNING, EAST.—April 7th.—For the supply of flints, for the rural district council.—Mr. Arthur Flowers, clerk, Shoreham.

DOVER.—April 7th. For the construction of carriageway and footpaths, for the corporation.—Mr. W. C. Hawke, borough engineer.

DUNDEE.—April 7th.—For the supply of 50,000 gallons of refined coal-gas tar, for the corporation.—Mr. J. Thomson, city engineer.

BULKINGTON.—April 7th.—For the supply of stone, for the urban district council.—Mr. H. W. Wilson, surveyor, Attleborough.

RYE.—April 7th.—For haulage and steam rolling, for the rural district council.—Mr. L. Amon, highways clerk.

EAST PRESTON.—April 7th.—For work of steam rolling, for the rural district council.—Mr. Arthur Shelley, clerk, Littlehampton.

STOKE NEWINGTON.—April 8th.—For supplying and laying 4-in. creosoted deal blocks, and for all works in connection with the concrete foundation in Seven Sisters-road and Blackstock-road, for the borough council.—Mr. George Webb, town clerk.

HORNSEY.—April 8th.—For making good a road, for the corporation.—Mr. E. J. Lovegrove, borough engineer and surveyor.

GLAMORGAN.—April 9th.—For works of road widening, for the county council.—Mr. T. Mansel Franklen, clerk, County Hall, Cardiff.

UPHOLLAND.—April 9th.—For the supply of flags, kerbs, broken stone slag, oil, slack, grit setts, road tools, gullies, and hire of steam roller, for the urban district council.—Mr. A. Hunt, clerk.

BENTLEY-WITH-ARKSEY.—April 9th.—For the supply of whinstone, dross, dross rejections, cob dross, and whinstone chippings, for the urban district council.—Mr. R. G. Whitley, 264 Bentley-road, Bentley, Doncaster.

BIRMINGHAM.—April 9th.—For making up certain roads, for the corporation.—Mr. Henry E. Stilgoe, city engineer and surveyor.

HOUGHTON-LE-SPRING.—April 9th.—For the supply of blast-furnace slag, road metal, slag riddlings, and blue limestone for asphalting, for the rural district council.—Mr. D. Balfour, surveyor.

HARWICH.—April 9th.—For making up two roads, for the corporation.—Mr. F. H. French, borough surveyor.

ERITH.—April 9th.—For the supply of 30,000 to 40,000 gallons of tar, for the urban district council.—Mr. J. K. Allerton, clerk.

BERWICK.—April 9th.—For the supply of whinstone road metal, for the sanitary authority.—Mr. W. Weatherhead, clerk.

RAWTENSTALL.—April 9th.—For works of paving and sewering, for the corporation.—Mr. James Whalley, town clerk.

HACKNEY.—April 10th.—For making up certain roads and wood paving work, for the borough council.—Mr. N. Scorgie, borough engineer and surveyor.

WEYMOUTH.—April 10th.—For work of wood paving, for the corporation.—Mr. K. J. S. Harris, borough surveyor.

TANGIER.—April 10th.—For the construction of a sewer and a road, for the Special Committee of Public Works.—Commercial Intelligence Branch of the Board of Trade, 73 Basinghall-street, E.C.

GODSTONE.—April 11th.—For the supply of flints and hire of drivers and horses, for the rural district council.—Mr. G. E Crowther, engineer and surveyor.

RICHMOND (Surrey).—April 11th.—For making up two roads, for the corporation.—Mr. J. H. Brierley, borough engineer.

SMETHWICK.—April 11th.—For paving work, for the corporation.—Mr. A. Hosken, borough engineer and surveyor.

REIGATE.—April 12th.—For the supply of granite macadam, basalt, flints, granite kerb, Kent ragstone, tar paving, artificial stone paving, gravel, concrete beach, pea beach, compo. grit, Portland cement, and Beddington grit, for the corporation.—Mr. Alfred Smith, town clerk.

BONNYRIGG.—April 12th. For cleansing the streets, for the corporation.—Mr. J. G. Forbes, town clerk.

SOUTHBOROUGH.—April 12th. For the supply of basalt, granite, or other suitable stone, for the urban district council.—Mr. F. Hammer, clerk.

WALSALL.—April 12th.—For the supply of granite paving setts, for the corporation.—Mr. H. Lee, town clerk.

WROTHAM.—April 12th.—For the supply of stone, team labour and steam rolling, for the urban district council.—Mr. H. E. Pyle, clerk, 123 London-road, Sevenoaks.

TANGIER.—April 12th.—For the construction of the second section of Casablanca-road, for the Special Committee of Public Works.—Commercial Intelligence Branch of the Board of Trade, 73 Basinghall-street, E.C.

INVERNESS.—April 12th.—For road improvement works, for the Badenoch District Committee.—Mr. A. M. Grant, district road surveyor, County Buildings, Kingussie.

GUILDFORD.—April 14th.—For the supply of granite, for the rural district council.—Mr. J. Anstee, surveyor.

TIVERTON.—April 14th.—For work of steam rolling, for the rural district council.—Mr. A. J. Mildon, surveyor, Ash Thomas, Tiverton.

HARPENDEN.—April 14th.—For the making up of private streets, for the urban district council.—Mr. Chas. S. Tuckey, clerk.

PLOMESGATE.—April 14th.—For the supply of broken granite and flint, for the rural district council.—The Clerk.

HAVERHILL.—April 14th.—For the supply of broken granite or basalt and tar-macadam, for the urban district council.—Mr. John H. Clarke, surveyor.

BRIGHTON.—April 14th.—For the supply of the necessary materials and laying of tarred slag macadam, or other material of quality and durability equal to tarred slag macadam, on Preston-road, for the corporation.—Mr. Hugo Talbot, town clerk.

WANTAGE.—April 15th.—For the supply of hand-picked stones, gravel and chalk for the rural district council.—Mr. J. H. Robinson, East Ilsley.

LEWISHAM.—April 15th.—For kerbing and paving work, for the borough council.—The Borough Surveyor.

BOURNEMOUTH.—April 16th.—For making up a certain road, for the corporation.—Mr. F. W. Lacey, M.INST.C.E., borough engineer and surveyor.

BOLLINGTON.—April 16th.—For paving work in certain streets, for the urban district council.—Mr. S. Knight, clerk.

ARUNDEL.—April 16th.—For the supply of broken granite, for the corporation.—Mr. E. F. Farrington, borough surveyor.

BECKENHAM.—April 16th.—For resurfacing with tar-macadam, or with macadam grouted with pitch or other approved bituminous compound, Wickham-road, Albemarle-road, and Newlands Park-road, for the urban district council.—Mr. F. Stevens, clerk.

OXFORD.—April 17th.—For the supply of York flagging, artificial flagging, blue paving bricks, York kerb, Clee Hill paving setts, reservoir paving setts, unbroken Clee Hill granite, unbroken Hartshill granite, lias lime and Portland cement, for the corporation.—Mr. W. H. White, city engineer.

CROYDON.—April 17th.—For private street works, for the rural district council.—Mr. R. M. Chart, surveyor.

FRINTON.—March 17th.—For work of tar paving, for the urban district council.—Mr. E. M. Bate, surveyor.

BEXHILL.—April 19th.—For making up a certain road, for the corporation.—Mr. G. Ball, borough surveyor.

AUDENSHAW.—April 22nd.—For work of road construction.—Mr. F. Hamer, clerk.

DISS.—For the supply and delivery of granite, for the urban district council.—Mr. Alfred Cooper, surveyor.

Sanitary.

SLOUGH.—April 5th.—For laying 953 yds. of cast-iron socket and spigot pipes, new sewer, and construction of flushing chamber, for the urban district council.—Mr. G. H. Charsley, clerk.

STIRLINGSHIRE.—April 7th.—For the construction of sewers, for the Central District Committee.—Mr. T. Lufton, clerk, Stirling.

HASTINGS.—April 7th.—For laying cast-iron sewers, for the corporation.—Mr. Ben F. Meadows, town clerk.

IRLAM.—April 8th.—For sewerage works, and the construction of ejector chamber, manholes and lamp-holes, for the urban district council.

STOCKPORT.—April 9th.—For alterations to the ejector chamber at the sewage outfall works, for the corporation.—Mr. John Atkinson, borough surveyor.

ST. IVES.—April 9th.—For the construction of sewers and manholes, for the corporation.—Mr. S. Palmer, borough surveyor.

ROYSTON.—April 9th.—For works of sewerage and sewage disposal, for the urban district council.—Mr. H. F. Banham, clerk.

DEWSBURY.—April 11th.—For the supply of disinfecting powder and disinfecting fluid, for the corporation.—Mr. H. Ellis, town clerk.

TADCASTER.—April 12th.—For laying sewers and manholes, for the rural district council.—Mr. Geo. A. Bromet, clerk.

OUNDLE.—April 12th.—For fixing oil engine and air receiver, with pipes and fittings in connection with the sewage ejector at sewage disposal works, for the urban district council.—Mr. Robert Knight, clerk.

TROWBRIDGE.—April 14th—19th.—For the conversion of storm-sewage filters to stand-by tanks, alteration and additions to settling tanks, and the erec-

tion of sewage pumping machinery, for the urban district council.—Mr. H. G. Nicholson-Lailey, surveyor.

EDMONTON.—April 14th.—For the erection of a sanitary convenience, for the urban district council. —Mr. C. Brown, engineer.

TROWBRIDGE.—April 14th—19th.—For the conversion of contact beds to percolating filters, and construction of sewage disposal works, for the urban district council.—Mr. H. G. Nicholson-Lailey, engineer, Town Hall.

NORTH BATTLEFORD (Canada).—April 15th.—For the supply of vitrified tile sewer pipes and junctions, for the town council.—Messrs. Chipman & Power, Mail Building, Toronto.

CHELTENHAM.—April 16th.—For laying stoneware pipe sewers, manholes, lampholes, and connecting houses to sewers, for the rural district council.—Mr. G. MacIlquham, clerk.

Stores.

TEDDINGTON.—April 5th.—For the supply of forage, granite, flints, sewage precipitant, cement, tar-paving, coal, coke, smith's work, team labour, gullies, pipes and tools, for the urban district council. —Mr. G. H. Salmon, clerk.

DUNDEE.—April 5th.—For the supply of goods for the works department, for the town council.—Mr. Jas. Thomson, city engineer.

CORNWALL.—April 5th.—For the supply of materials, haulage and team labour, for the county council. —Mr. A. E. Brookes, county surveyor, Truro.

WAKEFIELD.—April 7th.—For the execution of private street works, for the corporation.—Mr. J. P. Wakeford, city surveyor.

STOKE-ON-TRENT.—April 9th.—For the supply of goods, for the Gas Committee.—Mr. E. B. Sharpley, town clerk.

RUGBY.—April 12th.—For the supply of stone, tools, cotton waste, engine oils, paraffin, cleaning material and horse provender, for the urban district council.—Mr. J. H. Sharp, surveyor.

Miscellaneous.

WORKINGTON.—April 12th.—For the supply of best quality of Portland cement, for the corporation. —Mr. H. Bowman Williams, borough and waterworks engineer.

TENDERS FOR MUNICIPAL WORKS OR SUPPLIES.

The Editor invites the co-operation of Surveyor *readers with a view to making the information given under this head as complete and accurate as possible.*

* Accepted. † Recommended for acceptance.

ABERAVON.—For the erection of arcade and municipal offices, and ferr - concrete construction, for the corporation.—Mr. J. Roderick, engineer, surveyor, and water engineer :—

Contract No. 1.—Building.

J. Allen, Limited, Cardiff	£8,194
J. Davies, Aberavon	8,051
W. Thomas & Co., Cardiff	7,778
D. Davies & Son, Cardiff	7,561
M. Cox, Port Talbot *	7,495

Contract No. 2.—Ferro-Concrete Floors, Columns, &c. (Hennebique System).

Lambrick & Co., Burton-on-Trent	£2,855
Playfair & Toole, Southampton	2,848
J. Allen, Limited, Cardiff	2,575
F. Bevis, Limited, Portsmouth	2,537
Perry & Co., London	2,319
G. L. Morgan, Pontypridd	2,253
Hobrough & Co., Gloucester	2,206
W. Thomas & Co., Cardiff *	2,079

Contract No. 3.—18 Lock-up Shops.

S. Hoskins, London	£3,099
Harris & Sheldon, Birmingham	2,506
— Bartlett, Bristol	2,369
W. Thomas, Cardiff	2,314
— Parnall, Bristol	2,276
D. Davies, Cardiff	2,015
J. Allen, Cardiff	2,007
J. Davies, Aberavon	1,993
Cardiff Steam Joinery Co.*	1,800

AYLESBURY.—For sewage disposal work at Waddesdon, for the rural district council :—

W. Wright, Cheshunt	£258
W. E. Lee	218
Crook & Judd	192
R. J. Jewell	190
J. Holland *	175

BATH.—For the construction of a new sewer in the Bath-road, consisting of 400 yds. of 9-in. glazed pipe, with manholes, lamphole, and flushing tank :—

G. Offer, Devizes	£330
Parsons Brothers, Westbury	329
F. Rendell & Sons, Devizes	315
W. E. Chivers & Sons, Devizes	308
L. Maslen, Devizes†	275

BOLTON.—The Streets Committee of the corporation have accepted the following tenders :—

Local Bricks.—Bolton Brick Company.
Street Gully, Grids, &c.—J. Marsden & Co., Limited.
Street Gullies Complete.—Ryder Brothers.
Inspection Covers and Frames, Stable Grids, &c.—Bolton Moor Foundry Company.
Cement.—Otto Trechman, Limited.
Pea Gravel and Sand.—The Earl of Bradford.
Coal.—P. Thomas.
Flags and Kerbs.—Lovick & Co., H. Heyes & Co., Brooks & Crooks, Exors. of R. Siddall, Exors. of M. Hardman, J. Philipson, Cocker, Brotherton & Co., Walton Brothers, and W. Jackson.
Limestone.—Buxton Lime Firms Co.
Granite Chippings.—Shap Granite Company.
Engine and Cylinder Oil.—Wood & Co.
Rape Oil and Chalk.—Priestley & Co.
Rape Oil.—J. Orrell.
Riddles, Shovels, Spades, Buckets, &c.—Graveson & Sons.
Petroleum and Picks.—E. Higson.
Riddles and Scoops.—Fisher, Raworth & Co.
Stoneware Pipes.—J. Crankshaw.
Joiner's Work.—N. Fairbrother.
Plumber's Work.—R. Gibbons.
Saddler's Work.—W. Clegg.

BRAINTREE.—For laying a sewer, for the rural district council.—Mr. E. H. Bright, engineer :—

F. Siggers, High-street, Kelvedon	£127
Easy & Rayment, High-street, Kelvedon	109
W. Ketley, Chelmsford *	97

BROMLEY.—The following tenders for the removal of dust in the various parishes have been accepted by the rural council :—

Farnborough.—A. E. Smith, £57.
St. Mary Cray.—W. P. Taylor.
North Cray.—W. Thwaites, £38.
Keston.—E. Price.
West Wickham.—A. Coote.
St. Paul's Cray.—J. F. Smith, £38.
Orpington.—A. E. Smith.
Chelsfield.—J. West & Sons.
Hayes.—E. Price.

Sand and Tar-painting.—T. Wood & Son, Crockenhill, for all parishes, except Chelsfield, Farnborough, Hayes, Keston, Mottingham, and West Wickham, for which that of F. W. Corke, North Cray, was agreed to.

CROYDON.—Accepted for treating road surfaces with Tarvia, for the rural district council.—Mr. R. Chart, junr., highways surveyor :—

Taroads Syndicate, Limited, Victoria-street, Westminster, S.W.

DESBOROUGH.—For the construction of sewerage, sedimentation tanks and percolating filters, for the urban district council :—

T. Panter & Sons, Desborough	£2,078
A. E. Palmer, Glenfield	1,977
Johnson & Langley, Leicester	1,818
J. J. Shardlow, Leicester	1,754
T. Hickman & Sons, Market Harborough *	1,536

EASTRY (Kent).—The following tenders for road materials, cartage and team labour have been accepted by the rural district council :—

Flints.—Betteshanger, H. E. Blunt, 6s. per yard; Eastry, H. E. Blunt, 5s. 10d.; Ham, H. E. Blunt, 5s. 9d.; Great Mongeham, G. W. Bass, 5s.; Northbourne, A. O. Mess, 5s. 6d.; Ripple, A. O. Mess, 5s. 6d.; Sholden, G. W. Bass, 5s. 6d.; Staple, H. E. Blunt, 5s. 9d.; Sutton, H. E. Blunt, 5s. 6d.; Woodnesborough, A. C. Arter, 6s. 3d.; Worth, H. E. Blunt, 5s. 7d.

The parishes of Eythorne, Little Mongeham, Tilmanstone and Waldershare will be supplied from the council's own pits.

Section 2: Ash, sections 1 and 2, R. Brett, 6s. 5d. per yard in each case; Barfrestone, H. E. Blunt, 5s. 6d.; Chillenden, A. C. Arter, 5s. 10d.; Elmstone, Wingham Agricultural Company, 5s. 9d.; Knowlton, A. C. Arter, 5s. 10d.; Nonington, A. C. Arter, 5s. 6d.; Preston, Wingham Company, 6s. 3d.; Stourmouth, Wingham Company, 6s. 4d.; Wingham, Wingham Company, 5s. 9d.

Granite.—No. 1 district, London Granite Company, 800 tons Quenast, 12s. 11d. per ton; No. 2 district, London Granite Company, 500 tons, 12s. 11d. free on Sandwich Quay.

Steam Rolling.—Section 1, H. E. Blunt, flints, 6d. per yard; granite, 8d. per ton and 2s. 6d. per hour. Section 2, Wingham Agricultural Company, 6d. per yard, 9d. per ton, 2s. 6d. per hour.

Re-cartage.—Betteshanger, Eythorne, Little Mongeham, Northbourne, Tilmanstone and Waldershare, C. Foad, 7d. per yard; Eastry, Ham and Worth, W. Bean, 6d.; Great Mongeham, Ripple, Sholden and Sutton, W. Brett, 7d.; Staple, Chillenden, Goodnestone and Knowlton, H. Davison, 7d.; Woodnesborough, T. Cornes, 7d.; Ash, A. G. Bradley, 5½d.; Barfrestone and Nonington, W. G. Groombridge, 7d.; Elmstone, Preston, Stourmouth and Wingham, A. J. Lilliott, 6d.

Supply of Horse, Cart and Man per Hour (prices for one and for two horses).—Betteshanger, Northbourne, Little Mongeham, Eythorne, Waldershare and Tilmanstone, C. Foad, 9d. and 1s. 3d. per hour. Eastry, Ham and Worth, W. Bean, 9d. and 1s. 3d.; Sholden, Great Mongeham, Ripple and Sutton, W. Brett, 9d. and 1s. 3d.; Staple, Chillenden, Goodnestone and Knowlton, H. Davison, 10d. and 1s. 2d.; Ash, A. G. Bradley, 9d. and 1s. 3d. Barfrestone and Nonnington, W. Groombridge, 10½d. and 1s. 4d.; Elmstone, Preston, Stourmouth and Wingham, A. J. Lilliott, 9d. and 1s. 3d.

HINCKLEY.—Accepted for the supply and delivery of 36-in. cast-iron pipes in connection with the new main outfall sewer, for the urban district council.—Mr. E. H. Crump, engineer and surveyor :—

Stanton Ironworks Company, Limited, £1,455.

KILRUSH.—For the supply of engines and pumps for sewerage scheme, for the rural district council :—

Worthington Pump Company, Limited, Queen Victoria-street, London	£1,552
Hayward-Tyler & Co., Limited, Queen Victoria-street, London	1,275
Tangyes, Limited, Birmingham *	1,150
British Westinghouse Electric and Manufacturing Company, Limited, Trafford Park, Manchester	955

LIVERSEDGE.—For the construction of sewage disposal works, for the urban district council:—

Sewage Works Extensions.—Contract No. 1.

T. Obank & Sons, Thackley, Bradford	£17,934
B. Firth, Wakefield	14,517
Yorkshire Hennebique Contracting Company, Limited, Leeds	14,197
Garforth Brothers, Mirfield	13,198
Edwards & Co., St. Sepulchre Gate, Doncaster	13,000
E. Naylor & Sons, Girlington, Bradford	12,857
J. W. Boothroyd, Almondbury, Huddersfield	12,610
A. Graham & Sons, Huddersfield	11,700
Ward & Tetley, Bradford	11,687
Parker & Sharp, York	11,606
J. Byrom, Limited, Bury	11,600
S. Drake & Sons, Liversedge	11,190
C. Bushby & Sons, Leeds	10,525
G. Horsfall & Son, Liversedge	9,989

Contract No. 2.—Penstocks and Valves.

J. Stone & Co., Deptford, London	£978
Ham, Baker & Co., Limited, Langley Green, Birmingham	525
Whitehead & Poole, Limited, Radcliffe, Manchester	502
J. Blakeborough & Sons, Brighouse	479
Heywood & Porteous, Limited, Gomersal	438
J. Wolstenholme & Son, Radcliffe, Manchester	419
Ames-Crosta Sanitary Engineering Company, Limited, Victoria-street, Nottingham	387
W. E. Farrer, Limited, Birmingham	371
F. Bird & Co., Oxford-circus, W.	370
Adams-Hydraulics, Limited, York*	380
Sandix Engineering Company, Limited, Bond-street, Leeds	305

Contract No. 3.—Steel Sewage Trough and Steel Bridge Troughing.

J. Booth & Sons, Bolton	£143
J. Butler & Co., Leeds	121

NOTTINGHAM.—For the construction of a sewer from the junction of North-gate and Radford-road to the junction of Marshall-street and Mansfield-street, Sherwood, for the corporation.—Mr. A. Brown, city engineer:—

J. D. Nowell & Sons, Water Orton, near Birmingham	£26,426
J. J. Shardlow, Leicester	18,740
Johnson & Langley, West Bridge, Leicester	17,964
Lane Brothers, Mansfield	17,400
T. Smart, Nottingham	16,608
W. Wall, Nottingham	15,700
Firth & Co., Derby	14,955
A. Bow & Son, Nottingham	14,200
E. Bentley & Son, Tooting, London, S.W.	13,653
A. H. Price & Co., Castle Boulevard, Nottingham	12,820

ORMSKIRK.—For the supply of granite-macadam and chippings, limestone chippings, grit setts and kerbs, granite cubes, and flagging, for the urban district council.—Mr. H. W. Chadwick, surveyor:—

Penmaenmawr Welsh Granite Company, Penmaenmawr, Wales.
R. Briggs & Son, Clitheroe (for limestone chippings).
Catheral & Co., Buckley (for tiles).

OYSTERMOUTH.—The following tenders have been accepted by the urban council:—

Road Material.—Bennett Brothers, and J. K. Clement.
Fodder.—J. H. Griffin.
Haulage.—R. Todd.

PONTYPRIDD.—For the construction of 9-in. and 12-in. stoneware surface-water drain, for the urban district council:—

T. J. Davies & Co., Penarth	£286
S. J. Hill, Pontypridd	282
W. H. Evans, Cardiff	256
D. Bussell, Pontypridd	244
H. Murray, Pontypridd	243
S. Brooks, Pontypridd (withdrawn)	233

Surveyor's estimate, £250.

SHOEBURYNESS.—Accepted for the erection of five wooden shelters, for the urban district council.—Mr. F. Feather, engineer and surveyor:—

H. H. Mann, Shoeburyness, £225.

STAINES.—For the supply of broken road stone and Tarvia compound, for the rural district council.—Mr. G. W. Manning, surveyor:—

Broken Road Stone.—British Macadams, Limited*; Clee Hill Dhu Stone Company; Cliffe Hill Granite Company, Limited; H. L. Cooper & Co.; Croft Granite Company, Limited; Dosthill Granite Quarry Company, Limited; Ellis & Everard*; Enderby and Stoney Stanton Granite Company, Limited; Field & Mackay, Limited; Groby Granite Company, Limited; London Granite Company, Limited*; Mountsorrel Granite Company, Limited; United Stone Firms, Limited; Whitwick Granite Company, Limited.
Tarviated Macadam.—Bristowe & Co., Limited, 21s. 3d. per ton.
Flints.—Wills & Packham, Limited.
Tarvia.—Bristowe & Co., Limited, 5½d. per gallon.

WOODFORD.—Accepted by the rural district council:—

W. & F. Archer.—For the supply of brooms for a period of one year from 31st March, at 24s. per dozen.
W. & C. French.—For general team labour and road watering (higher roads), for the year ending 31st March, 1914, at 9s. per day.
C. Birch.—For team labour and road watering (lower roads), 8s. 6d. per day.
For the supply of materials for the year ending 31st March, 1914:—
Rowe & Mitchell.—Small granite, ¾-1 in., 9s. 11d., ¾-2½ in., 11s. 6d., dust 9s. 5d. per ton.
T. Crowe & Sons.—Tar 3¾d. per gallon, creosote oil 4d. per gallon.
Forbes, Abbott & Co.—Pitch 2s. 10d. per cwt.
W. & C. French.—Gravel and hoggin, 5s. 6d. per cubic yard.
W. Whiteway & Co.—Shingle and sand, 6s. 4d. per cubic yard.

WILTS.—For work to be done at a farm, including new buildings, alterations and repairs, for the county council.—Mr. J. G. Powell, county surveyor:—

Parsons Brothers, Westbury	£502
Linzey & Son, Trowbridge	491
D. Earle, Melksham	485
Bigwood & Co., Melksham	450
Isley & Co., Trowbridge	443
Syms & Son, Calne	440
G. J. Norman, Swindon*	412

YSTRADGYNLAIS.—For the supply of about 375 tons of 8-in. cast-iron pipes and laying same, together with sluice valves and fittings, for a new supplementary main, for the rural district council:—

J. Riley, Cheltenham	£4,314
Bounds & Baker, Ystradgynlais	4,280
W. Morgan, Ystradgynlais	3,945
J. W. Thompson, Neath	3,917
Hill Brothers, Swansea	3,907
T. Walker, Clydach, near Swansea	3,892
T. J. Davies & Co., Penarth	3,865
G. Stow, Aberdare	3,839
Parkinson & Hodgens, Swansea	3,692

MEETINGS.

Secretaries and others will oblige by sending early notice of dates of forthcoming meetings.

APRIL.

7.—Institution of Civil Engineers (Students' Meeting): Mr. A. T. Walmisley, M.Inst.C.E., lectures on "Production of Steel Sections and their Application in Engineering Structures."
7.—Society of Engineers: Mr. William Ransom, Assoc.M.Inst.C.E., on "The Status of Engineers and Engineering, with Special Reference to Consulting Engineers." Institution of Electrical Engineers. 7.30 p.m.
7.—Surveyors' Institution: Mr. P. J. Waldram on "Reinforced Concrete Construction." 8 p.m.
8. Institution of Civil Engineers: Meeting at Institution of Mechanical Engineers: Further discussion on papers by Mr. William Carstairs Reid on "The Yield of Various Catchment Areas in Scotland," and Mr. Edward Sandeman on "The Measurement of the Flow of the River Derwent, Derbyshire." 8 p.m.
9.—Institution of Automobile Engineers: Colonel R. E. Crompton, C.B., on "The Wheel and the Road." Institution of Mechanical Engineers. 8 p.m.
12.—Association of Engineers-in-Charge: Annual Dinner, Holborn Restaurant.
12.—Opening of Building Trades Exhibition, Olympia, by Lord Mayor of London.
15.—Joint Meeting of the Illuminating Engineering Society, the Institutions of Gas and Electrical Engineers, and the Institution of Municipal and County Engineers: Mr. A. P. Trotter, on "Standard Clauses for a Specification of Street Lighting."
15.—Illuminating Engineering Society: Mr. A. P. Trotter on "The Specification of Street Lighting." Royal Society of Arts. 8 p.m.
16.—Institution of Municipal Engineers: North Western District Meeting at Manchester.
17.—Roads Improvement Association: Annual General Meeting, 15 Dartmouth-street, S.W. 4.30 p.m.
19.—"Municipal Engineers' Day" at Olympia.
21.—Institution of Civil Engineers (Students' Meeting): Mr. A. T. Walmisley, M.Inst.C.E., lectures on "Production of Steel Sections and their Application in Engineering Structures."
21.—Institute of Sanitary Engineers: Mr. Frank R. Durham on "House Drainage on the Continent." 8 p.m.
21.—Royal Institute of British Architects: Messrs. F. W. Jackson and Bernard Dicksee, on "Modern Steel Construction." 8 p.m.
23.—Royal Sanitary Institute: Ordinary General Meeting, 4 p.m.
30.—Institution of Civil Engineers: London Students' 38th Annual Dinner, Trocadero Restaurant. 7.45 p.m.

MAY.

8-14.—Institution of Municipal and County Engineers: Visit to Amsterdam.
14-18.—Royal Institute of Public Health: Annual Congress in Paris.
19.—Institute of Sanitary Engineers: Dr. H. R. Kenwood on "Micro-Organisms and Public Health." 8 p.m.
23-24.—Surveyors' Institution: Meeting at Oxford.

JUNE.

6-7.—Institution of Municipal and County Engineers: Meeting at Dundee.
23-28.—International Road Congress in London.

APPOINTMENTS OPEN.

Official and similar advertisements received up to 4.30 p.m. on Thursdays will be inserted in the following day's issue, *but those responsible for their despatch are recommended to arrange that they shall reach* The Surveyor *office by noon on* **Wednesdays** *to ensure their inclusion in the weekly list of summaries. Such advertisements may, in cases of emergency only, be telephoned (No. 1339 Holborn), subject to later confirmation by letter.*

ASSISTANT required. Must be a neat, quick and capable Draughtsman, who thoroughly understands his work, good at figures, Surveying and Levelling. State age, experience, and salary required (must be moderate), with testimonials. None need apply who do not possess these qualifications.—Box 1,229, office of The Surveyor, 24 Bride-lane, Fleet-street, E.C. (311)

ENGINEER, Architect and Surveyor (A.M.I.C.E.), in charge of a large Garden Suburb near London, has vacancy for a pupil. Moderate premium. Write, Box 1,225, office of The Surveyor, 24 Bride-lane, Fleet-street, E.C. (305)

CALCUTTA IMPROVEMENT TRUST.

Wanted, by the Board of Trustees for the Improvement of Calcutta, for the Engineers' Department, an Assistant Engineer, on a salary of Rs.500/- per mensem, rising by annual increments of Rs.50/- to Rs.700/-, plus a Conveyance Allowance of Rs.50/- per mensem. (The value of the rupee is 1s. 4d.) Candidates must possess sound theoretical and practical training in sewerage and waterworks; preference will be given to men who have gained their experience in a first-class English Borough or City Engineer's Office, and who have passed the Examination of the Institution of Municipal and County Engineers or Institution of Municipal Engineers, or who possess equivalent qualifications. The appointment would be subject to six months' notice on either side. The work is expected to last not less than 15 years. The candidate appointed will have to contribute to a Provident Fund, and serve under the Leave and Service Rules of the Board, which closely resemble those of Government services. Copies of these rules can be seen in London by selected candidates when interviewed. A first-class passage from London to Calcutta will be allowed and a return passage if discharged within three years. Salary will commence from date of sailing. A strict medical examination by a doctor selected for the purpose will be required. Application in duplicate, with copies of testimonials, and giving concise dated details of experience, age, whether married or single, and present appointment, also period in weeks after appointment by which a candidate could set sail, must reach the undersigned on or before 15th May, 1913.

C. H. BOMPAS,
Chairman.

Calcutta Improvement Trust,
5 Clive-street, Calcutta. (285)

THE RURAL DISTRICT COUNCIL OF GODSTONE.

HIGHWAYS AND BRIDGES DEPARTMENT.

The above Council desire the services of a competent and experienced man to act as District Road Foreman over a portion of the Rural District, at a wage of 30s. per week.

Applicants must have had experience under a Highway Authority, and be capable of managing a small Stone Quarry.

Applications must be made upon printed Forms, upon which a list of the duties appear, to be obtained from Mr. Geo. E. Crowter, Engineer and Surveyor, High-street, Godstone, Surrey, upon the receipt of a stamped and addressed foolscap envelope.

The application must be sealed, and marked on the outside "Appointment of Road Foreman," and delivered to the undersigned not later than first post on Thursday, the 10th day of April, 1913.

Canvassing, either directly or indirectly, will disqualify any application.

EVELYN ALSTON HEAD,
Solicitor.

East Grinstead,
Sussex.
March 31, 1913. (314)

ASHBY-DE-LA-ZOUCH RURAL DISTRICT COUNCIL.

APPOINTMENT OF SURVEYOR OF HIGHWAYS.

The above Rural District Council invite applications for the appointment of Surveyor of Highways.

The district comprises 20 parishes, with an area of 31,860 acres, and 90½ miles of roads.

Salary £100 per annum, inclusive of all travelling and other expenses, except books, stationery, and postages.

Security (by Guarantee Society) in the sum of £100 will be required.

The person appointed is to devote the whole of his time to the duties of the office and to reside in Ashby-de-la-Zouch. He must be able to ride a bicycle.

The use of part of an office will be provided.

Applications, stating age and qualifications, with copies of recent testimonials, to be sent to me not later than Friday, the 18th April, 1913.

Canvassing the District Councillors is prohibited, and will disqualify.

By Order of the Council,
GEORGE FARMER,
Clerk.

Ashby-de-la Zouch.
April 2, 1913. (318)

KETTERING RURAL DISTRICT COUNCIL.

APPOINTMENT OF SURVEYOR.

The Council invite applications for the post of Surveyor of Highways, which consist entirely of District Roads.

The District comprises 29 parishes, area 47,353 acres, length of roads 111 miles, estimated population 13,000. There is a separate Sanitary Inspector.

The salary will be £130 for the first year, rising (if the services are satisfactory to the Council) by annual increments of £10 to £170.

Applicants must be Motor Cyclists, and the Council will make an allowance towards the upkeep of £25 per annum.

The person appointed must have a thorough knowledge of Road Making, including Steam Rolling and the management of a Steam Roller. He must be competent to keep all such Books and Accounts as may be necessary or required by the Council, to prepare Plans, Quantities, Specifications, and estimates, and generally to perform the duties appertaining to the office. He will be required to reside in Kettering (where an office is provided), to devote the whole of his time to his duties, and to give security in an approved Guarantee Office for £200. The appointment will be terminable by one month's notice on either side.

Applications, in candidates' own handwriting, on forms to be obtained from me, with copies of not more than three recent testimonials, must reach me not later than the first post on Saturday, the 12th April instant.

Canvassing any members of the Council, directly or indirectly, will disqualify.

(By order)
CHARLES W. LANE,
Clerk.

George-street,
Kettering.
April 2, 1913. (316)

APPOINTMENTS WANTED.

REPRESENTATIVE, with good connection in London and districts with Surveyors, Architects, Builders, Plumbers, Builders' Merchants, and H.M. Government, desires re-engagement.—W. J. B., 6 Clonmel-road, Fulham.

TENDERS WANTED.

METROPOLITAN BOROUGH OF STOKE NEWINGTON.

TENDERS FOR CREOSOTED DEAL PAVING.

The Council of the above Borough invites Tenders for Supplying and Laying 4-in. Creosoted Deal Blocks, and for all Works in connection with the Concrete Foundation in Seven Sisters-road and Blackstock-road.

Specifications and Forms of Tender may be obtained on application to the Borough Surveyor.

Tenders, endorsed "Tender for Wood Paving Works," to be delivered to the undersigned not later than 4 o'clock p.m. on Tuesday, April 8th, 1913.

The Council does not bind itself to accept the lowest or any Tender.

GEORGE WEBB,
Town Clerk.

Town Hall,
Milton-road,
Stoke Newington, N. (313)

DISS URBAN DISTRICT COUNCIL.

TO GRANITE MERCHANTS.

The above named Council invite Tenders for the Supply and Delivery of Granite.

Specification and Form of Tender may be obtained upon application to the undersigned.

The Council do not bind themselves to accept the lowest or any Tender.

ALFRED COOPER,
Surveyor.

The Terrace,
Diss.
April 2, 1913. (317)

The Surveyor

And Municipal and County Engineer.

Vol. XLIII. APRIL 11, 1913. No. 1,108.

Minutes of Proceedings.

Thin Road Carpets.

The article by Major W. W. Crosby, State Engineer to the Maryland Highway Commission, which appears in another part of the present issue, consists of two parts: first, a review of the conditions leading up to the use of thin road carpets of a bituminous or oily character, and, secondly, the conclusions to which Major Crosby has come as the result of his experience of such work. It is important to observe that the article does not deal with the carpeting principle generally, nor with such carpet layers as are put down in the form of block pavements; nor does it include in its scope such surface layers as are really the top courses of composite crusts, or are what Major Crosby calls "sheet pavements." On the other hand, the kind of carpet referred to has an appreciable thickness, and we understand that Major Crosby is not considering such thin films as those often used in this country, which are, in many cases, effective and unbroken long after the naked surface stones show through them. The limited scope of this article is a feature highly to be commended, making it possible to follow the reasoning without straying mentally from the point, and to consider the writer's conclusions without the use of "ifs and ans." The kind of carpet referred to is possibly more limited in scope in this country than it is in the United States, unless it be that our practice is the better; but a considerable mileage of the thicker of the films formed with sand or chips is in the class of carpets under discussion. One of the reasons why the mileage of thinly carpeted roads is not greater than it is, in England, is that on porous road crusts which contain little clayey matter the surface tarring is usually most effective when very little of the tar remains on the surface, and that only for a short time. Again, the thin film which is formed on impervious and clayey crusts lasts long enough as a rule to be very useful during the principal dust season, which usually consists of a series of short droughts connected by spells of wet or showery weather in which heavy rainstorms or sharp showers frequently occur. Where definite carpets are formed and maintained they would often be more useful if the crust stood up better under heavy wheel loads and severe shocks, for it is one of the drawbacks to the use of lasting films and carpets, and even unduly durable crust surfaces, that they do not permit of the smoothing out of the crust by surface wear, and they check the tendency for humps to be rolled down by certain classes of vehicles in wet weather. We should be glad to have Major Crosby's opinion of a view which we have frequently expressed—namely, that there is a wide field for a system of crust maintenance which consists in preserving the surface during the summer by tarring or carpeting, nicely proportioned to the traffic, allowing the carpet, film, or tarry surface to wear out, and giving the road a period of recuperation during which the crust is smoothed out by the traffic, partly by consolidation when it is wet, partly by rolling out under wheels when it is plastic, and partly by wear of the surface when it is dry — during this period small constant repair to be in full force. Other measures which may be taken in order that water-bound crusts may be kept in the running as economic competitors with newer methods need not be mentioned here, but it is, perhaps, significant that Major Crosby refers to the *apparent* necessity of using an excess of water in order to keep down dust by watering. Our readers will find that several of Major Crosby's conclusions suggest that the application of the carpeting principle in the United States is affected by conditions which are of less importance or are less general in this country. With some of these conclusions they may be inclined to disagree on general grounds, but we are sure that the article will be regarded as an important contribution to the study of the subject.

* * *

Land Valuation Board Appointments.

We publish this week two further letters on this subject, and inasmuch as we feel that the time has arrived when this correspondence must be concluded, we now desire to direct attention to one or two of the more salient points which have been brought to light. It will be remembered that the correspondence opened with a letter from "A Disgusted Parent," which appeared in our issue of February 28th last, the substance of his complaint being that his son, who had technical qualifications, had been appointed as a "surveyor" and then wholly engaged in canvassing and clerical work. This complaint was partly endorsed by "Site Value" in his letter published on March 14th, who made the further criticism that many young architects and surveyors, having accepted these appointments as "surveyors," find that they have no

chance of promotion unless they are willing to become valuers. We must confess that this appears only natural to us, inasmuch as the department is after all a valuation department and the practical surveying work is therefore merely accessory to the main function of the office. That the officials of this department are not all discontented with their lot is shown by the letters—and careers—of "Valuation Assistant" and "Mancunian," the former of whom points out that the salaries paid do not compare unfavourably with those which obtain among municipal engineers, and that the appointments, though nominally temporary, are exceedingly likely to be permanent in fact. A new point was raised by "Property Owner," who was alarmed at property being valued by inexperienced valuers, a point which, in our opinion, was completely answered in the letter from "Valuation Assistant" which appeared on March 21st.

The letter from "Site Value" which we published last week introduced a very unfortunate element into the discussion, and we cannot help feeling that it would have been better if personal charges of favouritism, whether direct or indirect, had been omitted. This week an opportunity is afforded to "Valuation Assistant" and "Mancunian" to reply on this, and there the matter must end. What is the practical result? It appears that there are a certain number of discontents, but there is no evidence that they represent any very large proportion of the whole staff. The original complaint of "A Disgusted Parent" remains unanswered, and the treatment meted out to his son certainly seems to call for some inquiry. It appears incidentally that applicants were originally asked to state the salary they required — in our view a very undesirable and unsatisfactory method of making appointments; and that increases of salary are partly dependent upon the ability of the official to qualify as a valuer by passing the recognised examination of the Surveyors' Institution—a fairly good practical test of worth. We are indebted to all our correspondents for their letters, a perusal of which will, at all events, secure that any prospective applicant for one of these posts will not enter the service without some knowledge of the conditions with which he may expect to meet.

* * *

Sewer or Drain?

A case of very considerable importance to metropolitan local authorities (*Kershaw* v. *A. J. Smith & Co., Limited*) was decided in the High Court last week on appeal from a decision by a stipendiary magistrate. The question at issue was as to the liability of a property owner for the abatement of a nuisance due to the defective condition of the main pipe taking the drainage of his house. It appeared that in 1884 an application had been made to the vestry of the parish of St. John, Hampstead, for permission to drain twelve houses by a combined operation, and an order for such drainage was accordingly made. Seven houses were shown on the application as draining towards E. road, and five towards H. road. In March, 1912, it came to the knowledge of the local authority that a nuisance existed in the drain of one of the houses, and an examination of the whole system revealed that there had been such serious deviations from the order of 1884 as would undoubtedly make this pipe a "sewer" in law. The council thereupon, under sec. 83 of the Metropolis Management Act, 1855, served a notice on the original builder, who was still alive, calling upon him to alter the work so as to conform to the order of the vestry, and on his making default in complying with this notice, the council executed the work themselves and charged him with the cost. The council, having done this, served a notice on the respondents under sec. 85 of the Act, calling upon them to abate the nuisance in their "drain." The respondents contended that before the work done by the council the pipe had undoubtedly been a "sewer," in law, since 1884, and they quoted the dictum of one of the judges in the case of *Shoreditch* v. *Phelan*, "Once a sewer always a sewer." The Court held (Justice Pickford, however, dissenting) that the procedure followed by the borough council had operated in law to re-establish the pipe in question as a "drain," and that consequently the owner was liable for the abatement of the nuisance.

The case is of importance inasmuch as it will help local authorities to resist many attempts to saddle them with the expense of repairing pipes which, though in fact private drains, are alleged to be "sewers." In any case where the original wrongdoer can be found the procedure followed by the Hampstead Council in this case can be adopted, and to this extent the epigrammatic statement "once a sewer always a sewer" would appear to be no longer accurate.

* * *

Wayside Advertisements and Michelin Tyres.

While there are many rural districts in which through motor traffic is unwelcome on account of the burdens it throws upon the local ratepayers, there can be no disagreement between motorist and ratepayer with regard to the disfigurement of our highways by roadside advertisements. It is quite a mistake to assume that the greater use now made of our roads must lead to their abasement and disfigurement. As we recently pointed out, the proper management of railways has not been found incompatible with their development in harmony with the scenery through which they pass, and it is even more important that all things should be done decently and in order on country roads, which, besides providing the resident population with a readily accessible means of obtaining pleasure and recuperation, play no small part in attracting American and Colonial gold to this country. It is therefore much to be regretted that otherwise reputable trading firms should seek to exploit the roadside for purposes of advertisement, and we are glad to note that the customers of one of the chief offenders view their action in this matter with growing resentment. There are three ways of combating the evil—namely, the application of the by-laws, the keeping of a "black list" of traders not to be patronised, and, lastly, the keeping of a "white list" of unoffending traders whose wares are to be given preference whenever possible. An opportunity of adding to the "white list" now occurs as the result of the praiseworthy action of the Michelin Tyre Company, which, the *Automotor Journal* reports, has "started out on a veritable campaign of destruction of its own roadside hoardings," and has removed no fewer than 1,500 of them since last December.

* * *

Do Slovenly Methods Pay?

It must not be overlooked that wholesale traders are by no means the only offenders in the matter of roadside advertisement, as local authorities not only allow the exhibition of very disfiguring advertisements of local amusements and retail shops, but are further to blame in that they do not enforce the by-laws respecting the throwing of things on to the highway, and do not provide, at reasonable distances apart, proper accommodation for road plant and materials used in maintenance. The work of surveyors is much hampered for lack of the last-mentioned provision, the machinery for obtaining which is now available under the head of "widening." All these matters hang together, for anything which makes it seem

less worth while to do things really well, anything which tends to abase the road, tends also to bad economy, and, it may be added, to belittle the status of those responsible for road maintenance. Further, it is important that we should remember that what seems contemptible or rough will be treated by its users with contempt or roughness. An untidy and rough-looking road may be efficient, but it does not *seem* to demand considerate treatment. The genial hussy who comes to our door with clothes-pegs is very efficient, strongly booted, and ready of tongue, but she does not seem to demand, and does not usually get, the same courteous attention as the village matron in spotless calico and with neatly-braided hair. If roadside footpaths are made and maintained neatly, and roadside margins kept as fair strips of turf, drivers of vehicles are likely to injure them much less than they do when they are ragged and uneven, and seem to be regarded as unimportant; and, generally, the "tone" of driving depends a good deal upon the note which is struck by the road. The influence of things done decently and in order is subtle, but it is very real. By lowering the tone of the road, wayside advertisements tend to the chipping away of footpaths and the cutting up of margins, and they have the further effect of driving away the better class of custom from the countryside in districts of great natural beauty or rural charm. A few months ago a certain boarding-house, situated on a beautiful common, was to be recommended as a place for visitors to stay at. It is not to be recommended now, for a very hideous hoarding, which shuts out about 6 square miles of scenery as viewed from the adjoining road, has been erected hard by the house for the display of advertisements, most of them of local enterprises. This kind of thing does not pay, and no doubt the various local authorities which send announcements of local attractions to the Press will soon be adding the phrase, "No disfiguring advertisements allowed in the neighbourhood."

* * *

Reinforced Concrete.

At an ordinary general meeting of the Surveyors' Institution held last Monday evening, Mr. Percy J. Waldram submitted a paper on "Reinforced Concrete," into which he succeeded in introducing many points of novelty in regard to a subject which has received great attention of late at the hands of technical writers. As might have been expected, Mr. Waldram avoided that aspect of the subject which is part of the special province of the constructional engineer, and his paper was quite frankly written from the point of view of the surveyor. Thus, he deliberately refrained from entering into any mathematical discussion, save to emphasise the fact that the full development of the reinforced concrete industry must inevitably be considerably hampered by the incubus of tedious and intricate calculations. It is indeed a fortunate circumstance that most of the necessary calculations for ordinary work are capable of reduction to the graphic or diagrammatic form, so that the time of the designer may be economised and his accuracy increased.

Having dealt with many practical points which must be borne in mind in the actual work of reinforced concrete construction, Mr. Waldram proceeded to sum up the chief arguments in favour of the use of that material, and to indicate some of its disadvantages; and from these general considerations he deduced a list of cases in which it would be likely to prove both efficient and economical. Perhaps the most interesting part of the paper was that which dealt with the application of reinforced concrete to rural housing. It is evident that the cost of a cottage built entirely in this material would be prohibitive; but the analogy which Mr. Waldram drew between an old house having a timber skeleton filled in with wattles and plaster or clay, and a cottage having a reinforced concrete framed skeleton, was very ingenious, and is, in our opinion, worthy of the fullest consideration.

* * *

The L.G.B. and the Limerick Appointments.

With respect to the county surveyorship of Limerick, to which allusion was made last week, the county council have received a letter from the Local Government Board of Ireland offering no objection to the proposed appointment of two county surveyors, but at the same time stating explicitly that they consider the salaries of £300 a year inadequate. "The Board estimate," the letter continues, "that the travelling expenses of a county surveyor for half the county would amount to £100 a year, and an inclusive salary of £300 a year would not appear sufficient to induce a thoroughly capable man to apply for the position. The board would suggest to the county council to offer an initial salary of £400 a year in each case, rising by increments of £20 every two years to a maximum, say, of £500 a year." The members of the county council received this communication with mixed feelings, being on the one hand satisfied that their proposal to appoint two surveyors had met with approval, and, on the other, embarrassed with the official suggestions that the salaries they offer are insufficient. In the circumstances they have forwarded the names of the thirteen candidates to the Local Government Board, and requested that authority to deal with them. The board will doubtless accept this responsibility without demur, and in accordance with the statute regulating these matters will ask the Civil Service Commissioners to examine the candidates and duly certify their fitness or otherwise for the office. Next they will—still pursuing the line of strict legality—return the county council's compliment by referring the matter back to them for decision. The council will, therefore, have the last word, except, it would appear, with respect to the question of salary, on which, happily for the officers to be appointed, the Local Government Board have the power of authoritative "suggestion."

* * *

"The Surveyor" Conference.

We give elsewhere the text of the five propositions to be submitted for discussion at The Surveyor conference at Olympia on Saturday, the 19th instant. Briefly No. 1 enumerates that every highway authority entrusted with the charge of important roads should have an adequate engineering staff; No. 2, that county surveyors should have facilities for enabling surveyors of small districts to obtain through their county surveyors advice and assistance in road difficulties; No. 3, that highway surveyors' reports, made for the purposes of comparison in as uniform a style as possible, should be freely prepared and disseminated, and that such surveyors should be enabled and encouraged by their authorities to inspect suitable work in other districts; No. 4 asks for special attention to the drainage from roads of subsoil water as distinguished from surface drainage; and No. 5 asks the Road Board's assistance towards the definition by some authoritative body of the terms "asphalt" and "bitumen" in their relation to road engineering. We should be pleased to hear at once from those who may be able to speak to one or more of these motions, with an indication of whether they are for or against. Finally, we should like to make it clear that we are not to be considered as advocating any of the principles involved in the motions. We have formulated them merely for the purpose of discussion; acceptance or disapproval of them is entirely for the conference.

Storm Water Discharge.

By R. O. WYNNE-ROBERTS, M.INST.C.E., F.R.SAN.I., Consulting Engineer, Regina, and T. BROCKMANN, DIPL.ING.(BERLIN), Civil Engineer, Regina.

It is palpable that rain falling on the surface of the earth will be absorbed in some proportion to the permeability of soil, &c. Very little rain will run off sandy ground, but if the ground is hard clay or close-grained rock more will flow over the surface and be drained away. If the ground is already saturated, most of any rain falling upon it will flow off by gravitation to the lowest point. In the case of intense rainfall the ground is unable to absorb the same proportion of water as it would if the rain fell in gentle showers, and consequently a larger percentage of it is drained away.

Following this method of reasoning, it will be observed that, in the case of towns with well-paved streets and yards, and houses built closely together, the storm-water discharge will naturally be expected to be greater than where the streets are constructed of more absorbent material, or where the streets are not made at all. Where the buildings are further apart and the degree of permeability is greater the discharge to be dealt with will be less.

Mr. Wallington Butt, in a paper on the subject of "Calculation of Storm-water Discharge," which he read in 1907, rightly stated that the extent to which a town area has been built upon is in some measure also an indication of the impermeable area; in other words, the density of the population bears some relation to the area of impermeable surface in that district.

Mr. Wallington Butt at the same time submitted a diagram which he considered would assist to ascertain this factor, and this diagram is now reproduced for our present purposes. It is well, however, to point out that the limitation of this diagram is a population of 100 persons to an acre. Some towns have a much greater density of population than this—for instance, in Manhattan, New York, it approaches 1,200 persons per acre; but where it exceeds, say, 100, it can be assumed that the area in question is entirely built upon, and the factor will be almost unity.

It is, of course, essential that the drainage area should be divided into smaller districts, the number of houses in each district counted, and allowing a certain number of inhabitants to each house, the population per acre is ascertained, and the diagram Fig. 4 will give the coefficient of impermeability.

The following comparison of German and British standards will be useful:—

German classification of areas	Equivalent British standard in population per acre.	Coefficient of impermeability.
(*a*) Area densely built upon	75	0·80
(*b*) Area less densely built upon, with larger yards	55	0·60
(*c*) Area having houses with larger gardens and yards	45	0·50
(*d*) Area openly built upon, detached villas &c.	25-35	0·30-0·40
(*e*) Rural districts, with gardens, meadows, &c.	15	0·20
(*f*) Parks, forests, &c	5	0·10

RETARDATION.

In addition to the foregoing factors, which influence the manner in which storm water is discharged from any area, there is still another.

If the time required for the storm water to flow from the upper end of any sewerage system to any other given point is longer than the duration of the storm, then the water from the furthermost limits will reach the latter point when the water from the vicinity of that point has already been drained off, and thus the whole area, in such a case, will not be contributory simultaneously. In other words, the water from the remotest parts of the drainage area, owing to the distance it has to travel to the point in question, has been retarded from being discharged at the same time as the water from the parts near the lower point, hence the term "retardation." Mr. Baldwin Latham, one of the leading British engineers, stated that, although rain fell in Manchester for 151 hours and 10 minutes, it took 1,008 hours for the water to flow off through the sewers, and this he attributed to an "extenuation of the flow."

To arrive at an appreciation of the influence of retardation we may consider the subject in the following manner:—

Let L denote the length of a sewer, and V the mean velocity of the flow of water in the sewer, then if we consider a small quantity of storm water entering the upper end of the sewer, the time it will take to reach the given point or outlet will be $\frac{L}{V}$. If D denotes the duration of a storm, then the total time T from the commencement of the storm to the moment when the storm water will practically cease to flow through the sewer will be—

$$T \text{ equals } D + \frac{L}{V}$$

That is, the time for discharge, whether the water flows in an open watercourse or in a close sewer, will be greater than the actual duration of the storm. But this fact does not warrant the sectional dimensions of the sewer being diminished, for such

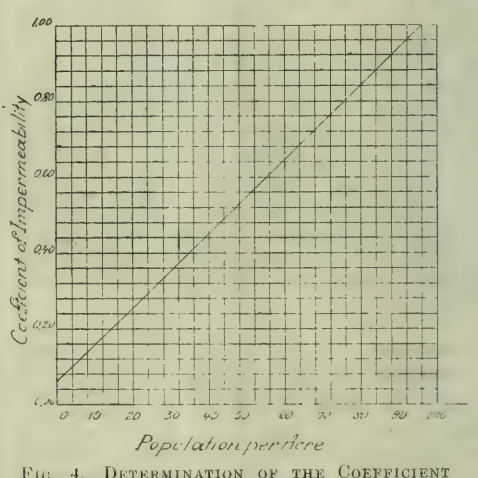


Fig. 4. Determination of the Coefficient of Impermeability.

a reduction is possible only when the duration of the storm is less than the time required for the water to be discharged through the sewer, that is, when D is smaller than $\frac{L}{V}$ or when L is greater than V × D.

With storms of great intensity and of small duration, retardation will take place even in short lengths of sewers, but when the storm continues for hours retardation will have no influence, even if the sewers are of considerable length. It will depend upon the duration of the maximum precipitation assumed and on the velocity of flow in any particular sewer whether or not retardation will take place.

If the drainage area is within that part of a city which is built upon, then V will be determined solely by the inclination given to the sewer. The time required for the water from the roofs, yards, and paved streets to drain into the sewers will be so short in comparison to the period which the storm water will take to reach the outlet that it can be ignored. In the case of rural districts, or openly built upon areas of a city, it will be necessary to allow a minute or so for the water to reach the sewers.

If an area such as is represented by Fig. 5 is considered, the value of V × D for the upper lengths of each sewer can be computed, and then the points B, C, D, E will indicate the limits of the area in which retardation will occur, and must be taken into account.

In most cases the duration of a storm which will give rise to the maximum rate of flow will be not less than 20 minutes, or 1,200 seconds.

V is usually greater than 2·3 ft. per second, therefore in sewers shorter than 2,500 ft. to 3,000 ft. in length retardation may be considered as exceptional.

The question will now doubtless be asked, What will be the effect or influence of retardation on the discharge of storm water?

Such influence may be made clear in a simple manner if we consider a rectangular area E, F, G, H in the accompanying figures.

The line A B represents the main sewer which drains the area bounded by the rectangle E, F, G, H. At the commencement of a storm of duration D, the water from the vicinity of B will be the first to reach the outlet, and this is represented by the triangle H C B, which is shaded in Figs. 6 and 7. During the storm the adjoining area will be drained as indicated in Fig. 8. When the storm ceases, then the water from the vicinity of B will cease to flow, and this is indicated by the unshaded triangle

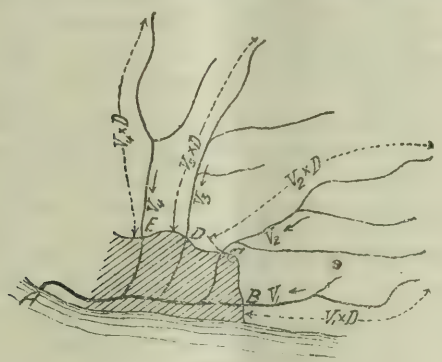


Fig. 5.

H N G in Figs. 9 and 10; the length of the shaded part is equal to V×D. When the point C of the shaded part has reached the upper limit of the drainage district, then the extent of the figure representing the discharge will gradually diminish until the last portion of the storm water is drained away, as shown in Fig. 11.

Let q denote the quantity of storm water discharged per unity of drainage area.
A denote the extent of the drainage area.
a denote the contributory area,

then the ratio $\frac{q \times a}{q \times A} = \frac{a}{A} = R$, the factor by which $q \times A$ has to be multiplied so as to obtain the actual quantity of storm water discharged. This factor is called the factor of retardation.

Example.—Let L equal 12,000 ft., V equal 2·3 ft. per second, D equal 1,200 seconds.

$$\text{Then } R = \frac{a}{A} = \frac{V \times D}{L} = \frac{1,200 \times 2{\cdot}3}{12,000} = 0{\cdot}23 \text{ of the area.}$$

By the foregoing discussion and diagrams it is manifest that, in addition to rainfall intensity, the configuration, extent and shape of the drainage area, as well as the velocity of flow in the sewers, are the essential factors which may cause retardation.

DRAINAGE AREA CONFIGURATION.

It is manifest that the permeability of a surface must be a question of degree, for even dense clay will absorb water if it is given time. If the drainage area is very flat and even, rain water will naturally remain on the surface for a longer period, and will be gradually absorbed, evaporated or drained away. The time taken to flow off the surface depends on the slope and general configuration. In a district which consists of hills and dales the water will run off quickly. Configuration also constitutes an important element in the laying out of storm-water sewers.

EXTENT.

The extent of a drainage area, as far as retardation is concerned, is a matter of importance, so far as it is a function of its length; for it will be agreed that the time required for the water to concentrate at any given point will depend on the distance it has to travel, and, according to statements already made, the intensity of a storm will vary inversely in proportion to the length of the sewers.

SHAPE.

The shape of a drainage area is another factor which has to be considered, for if the area is long and narrow it will be observed that the period of concentration will be greater than if the area is compact.

VELOCITY OF FLOW IN SEWERS.

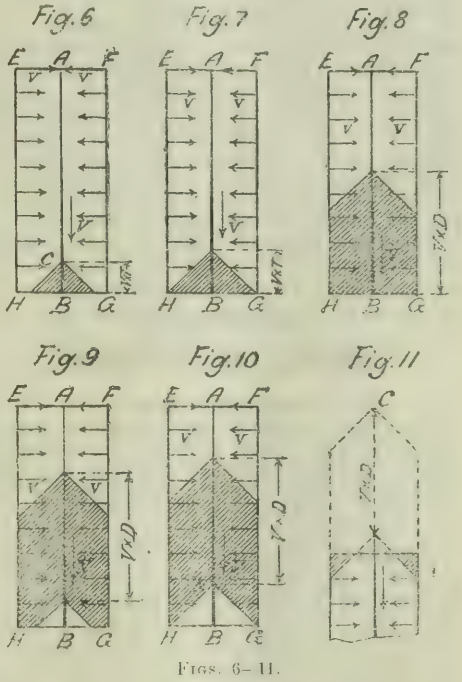
The factor of retardation is controlled by the velocity of flow in the sewers, inasmuch as the latter directly determines the time of concentration—that is, T equals $\frac{L}{V}$. If the sewers are laid with steep grades, a larger drainage area will be contributory, in a given time, than if the grades were made flatter. High velocities tend to eliminate retardation, while low velocities cause retardation to take place sooner.

GENERALLY.

It is a matter of considerable importance that protection should be afforded the public against flooding, for, apart from the disagreeableness of such an occurrence, it is also a menace to the health of a community. There is, however, a limit to which the engineer is justified in expending large sums of money in the construction of sewers of such dimensions as to be absolutely safe against flooding or gorging.

If the greatest rainfall intensity ever observed in any district is assumed as the basis for calculating the dimensions of sewers, it may be found that the sewers will be of such inordinate sizes that they will rarely be used to their full capacity, and be so costly as to be financially impossible.

To adopt lower rainfall intensities will mean the facilitating of the execution of such works; but this



Figs. 6–11.

may also incur some liability caused by occasional floods. The question, therefore, for the engineer to consider carefully is the disadvantages that may arise by the adoption of lower rainfall intensities as compared with the increased cost of larger sewers.

In Germany about 70 litres per second per hectare represents the lower limit, but this, according to observations made in Berlin, for instance, is exceeded about five times each year. To exceed 150 litres per second per hectare is recommended only in exceptional cases.

In districts such as Basel, where the annual rainfall (840 mm.) is considerably greater than in Berlin (597 mm.), a greater rainfall intensity is assumed; for instance, Burkli-Ziegler considered 125 litres to 200 litres per second per hectare as suitable for Switzerland.

Both Hawksley's and Burkli-Ziegler's formulæ were intended to include all circumstances which tended to diminish the discharge. Subsequent to their investigations, it was realised that the influence of the different conditions of impermeability of the surface deserved more attention, and consequently other engineers introduced a separate coefficient to

cover that point. Following this slight development of the problem, however, German engineers have more fully developed the important features of the factor of retardation. Many capable American engineers have endeavoured to construct a formula which will be generally applicable for computing the discharge of storm water, but they have met with very little success, because they tried to combine the heterogenous factors affecting such discharge.

Mr. Lloyd Davies and Mr. Wallington Butt stated that the maximum discharge is attained when the duration of the storm equals the time of concentration. As the intensity of a storm varies inversely with its duration, in the case of sewers having great lengths the intensity will consequently be considerably reduced.

In many instances, however, it is not a storm of long duration and low intensity, but a storm of short duration and a great intensity which will cause the maximum rate of flow in sewers, even if only a fractional portion of the area is contributory. For example, in a district having an irregular shape, where the area near the outlet constitutes the major part, then during severe storms the water from that portion will concentrate quickly at the lowest point, while that from straggling and remote parts will require more time to reach the same place. If, in such a case, the intensity is derived from the time of concentration, then it will be too low.

It also often occurs that rainfalls of high intensity and short duration cannot be ignored, as they may happen when the sewers are already filled by the run-off of the preceding rainfall.

In an important case it is highly desirable to ascertain which kind of rain will give rise to the maximum rate of flow. A rainfall of high intensity will generally be assumed, and the discharge ensuing is to be considered in its different stages. This can be effectively done only by constructing flow areas as has been suggested by the late Prof. Frühling, of Dresden. Such flow areas can be drawn on squared paper; the horizontal lines—abscisse—will represent the time in minutes, and the vertical lines—ordinates—will represent the volume of storm water in cubic feet.

The method suggested by the late Prof. Frühling will be explained in the next issue.

(To be concluded.)

MUNICIPAL WORK IN NORWICH.

CITY ENGINEER'S REPORT.

The annual report of Mr. Arthur E. Collins, M.Inst.C.E., city engineer of Norwich, mentions that contract drawings, details and quantities have been prepared and tenders invited for the proposed new fish market at Mountergate-street. Designs for cottages at the sewage farm have been prepared, and one showing six cottages built as a terrace has been submitted for the approval of the Local Government Board. An amended design has also been prepared for a foreman engineer's house at Trowse pumping station yard. Tenders for the latter have been invited.

Several small-scale schemes have been prepared for the proposed enlargement of the city asylum. At the present time a scheme for the building of nurses' and attendants' homes, and the conversion of the present mess rooms into hospital wards with dormitories over is in hand for submission to the Commissioners in Lunacy.

Rough plans, elevations and estimates, it is added, have been prepared for the proposed municipal offices to be erected in St. Peter-street, on the fish market site.

The cost of street lighting in the twelve months covered by the report amounted to £7,203, the amount expended in respect of gas and electric lighting being £3,208 and £3,995 respectively.

Mr. Collins states that the Travis hydrolytic tanks have been regularly at work, and have given him entire satisfaction. The plant for the treatment of sludge is now installed, and is expected to be soon at work. Some 1,000 yds. of new concrete distributing carriers have been constructed, these replacing channels dug in the soil which were much subject to destructive scour by the effluent.

Norwich, which has an area of 7,905 acres and a rateable value of £466,158, has an estimated population of 123,900. There is a total length of streets and roads of 135½ miles, and courts and yards number 676.

THE ROAD BOARD.

GRANTS TO HIGHWAY AUTHORITIES: TENTH LIST.

During the months of January, February and March, 1913, the Road Board, with the approval of the Treasury, have made advances amounting to £237,199 from the Road Improvement Fund to county councils and other highway authorities as follows:—

For road crust improvements	£178,098
For road widenings and improvement of curves and corners	9,106
For road diversions	500
For reconstruction and improvement of bridges	4,995
For construction of new roads and bridges	44,500

The total grants up to March 31, 1913, are as follows:—

For road crust improvements	£913,400
For road widenings and improvement of curves and corners	88,008
For road diversions	24,259
For reconstruction and improvement of bridges	44,477
For construction of new roads and bridges	60,578

Advances by way of loan have also been arranged to the sum of £140,060. In addition, further advances amounting to about £1,579,438 have been indicated to highway authorities towards works of road construction and improvement.

County.	Improvement of road crusts.	Widenings, corners and diversions.	New roads and bridges and reconstruction of bridges	Total.
England.	£	£	£	£
Berkshire	909	—	—	909
Cheshire	15,168	—	—	15,168
Dorset	107	—	—	1 7
Essex	—	452	470	922
Hastings Co. Borough	—	1,382	—	1,382
Leeds Co. Borough	9,311	—	—	9,311
London (Area of the Metropolitan Police District)*	21,600	—	30,000	51,600
Monmouth	4,600	400	—	5,000
Norfolk	15,343	—	-	15,343
Nottingham		—	13,500	13,500
Oxford	7,512	—	—	7,512
Plymouth Co. Borough	—	2,000	—	2,000
Salop	418	—	—	418
Southampton	9,753	52	—	9,805
Suffolk (East)	4,500	—	—	4,500
Suffolk (West)	5,000	—	—	5,000
Sussex (East)	8,877	—	—	8,877
Sussex (West)	—	300	—	300
Warwickshire	—	500	—	500
Westmorland	200	—	—	200
Wiltshire	34,700	—	—	34,700
Yorkshire (North Riding)	7,589	861	—	8,450
Wales.				
Anglesey	—	86	—	86
Breconshire	—	335	—	335
Denbigh	—	26	—	26
Glamorgan	—	467	1,000	1,467
Merioneth	1,000		—	1,000
Pembroke	—	2,084	—	2,084
Scotland.				
Aberdeen	2,291	—	—	2,291
Banff	2,306	—	—	2,306
Berwick	—	189	3,111	3,300
Dumfries	2,191	-	-	2,191
Fifeshire	961	89	—	1,050
Inverness	2,996	—	1,324	4,320
Lanark	8,006	383		8,389
Midlothian	5,000	—	—	5,000
Nairn	22	-	—	22
Peebles	761	-	—	761
Perth	567	-	—	567
Renfrew	1,150	—	—	1,150
Ross and Cromarty	1,168	—	—	1,168
Ireland.				
Cavan	735	—	—	735
Down	263	—	90	353
Kildare	124	—	—	124
King's County	1,170	—	—	1,170
Westmeath	1,800	—	—	1,800

* This amount of £51,600 is part of a total sum of £280,000 now in course of distribution in Greater London, and is made up as follows:—Battersea, £7,500; Ealing, £1,100; Hampstead, £1,000; Holborn, £1,000; Hornsey, £1,000; Poplar, £10,000; Croydon, £30,000.

The Interim Report on the Tests of Road Material at Sideup has been published, and can be obtained from Messrs. Waterlow & Sons.

Royal Sanitary Institute.—"The Open Spaces Policy and its Local Aspect" will be the subject of discussion at a sessional meeting of the Royal Sanitary Institute to be held at Pelham-road schools, Wimbledon, to-morrow (Saturday), at 10.30 a.m.

Road Carpets.

By MAJOR W. W. CROSBY, State Engineer to the Maryland Highway Commission.

A locality or country fortunate enough a few years ago to possess a considerable mileage of well-built macadam roads—such, for instance, as the States of Massachusetts, Maryland, New Jersey, and as England, Ireland, Scotland or Wales—now finds itself in a rather peculiar position.

Before the advent of the motor vehicle the maintenance of these water-bound macadam roads was easily and satisfactorily accomplished by simple methods at a cost of from £10 to £50 per annum, and when properly maintained such roads were easily constructed, agreeable to their users and abutters, and advantageous from every point of view. Then, as motors began running over these roads, an early notice given of their effect was the rise and offensive distribution of dust. Comment expressed the idea that the road metal was fast being removed from the road, and distributed in finely divided condition over the adjoining property. Shortly afterward the loosening of the road metal appeared, and, when sufficiently loosened to so permit, it was found frequently to have been piled in windrows along the sides or edges of the road crust, leaving pot-holes or ruts in its former location.

The necessity for preventives against the dust, the loosening of the road metal and its dislodgment was quickly apparent, and experimentation began. Water sprinkled on the dust temporarily prevented its distribution, but its effects were not lasting, and, aside from the expense and inconvenience of sprinkling as often as found to be necessary for satisfactory results, certain disagreeable concomitants seemed unavoidable. Excess in application was an apparent necessity, and the resulting mud was in many cases seriously objectionable. The effort was then made to reduce the mud nuisance to a minimum, and at the same time to prolong the effects of sprinkling, by the addition of hygroscopic salts, such as calcium chloride, to the water. In many cases improvement resulted, but it was found that with motor traffic beyond a certain amount, even this treatment did not prevent the loosening and dislodgment of the road metal.

At the same period, oily liquids were tried in place of water, probably with the idea that they would so weight and otherwise affect the dust as to prevent its distribution, and at the same time be longer in evaporating from the road. In some cases the results of oiling were disastrous. The dust, it is true, was prevented from forming clouds and being blown about by every passing breeze, but in place of this there was formed on the road a greasy mixture which was thrown up on to goods by horses or the wheels, or tracked by the feet of persons into dwellings. It spotted everything it touched, and it seemed in many cases that "the last state" of that road "was worse than the first." Further, it soon appeared that where motor travel was at all heavy this oiling had not been effective against pot-holing or rutting.

In other cases the oiling had been attended with most satisfactory results. The dust was suppressed, the road metal prevented from loosening, and the pot-holing and rutting consequently avoided. It even seemed that the road surface had really been improved in some ways. It was smoother (perhaps, in a few cases, injuriously so under certain weather conditions), less noisy, less glaring in unshaded spots on bright days, and more resilient, apparently, to horses' feet. But further, and what to many appeared to be the most important result, it seemed that, coincidentally with the other good results, the wear on the metal forming the road crust had been reduced materially or even obliterated by the formation over it of a carpet composed of the adhesive portions of the oil (or tar) and the sand, stone chips, or fine material such as the dust, found or spread on the road surface. This carpet took the wear and thus protected the road metal. As long as the carpet remained intact no surface wear of the stones composing the macadam was possible, and little or no dust was formed from the carpet itself that could not be absorbed or held by it for a considerable period. Further, the presence of an appreciable carpet prevented the loosening of the stones of the road crust if it did not actually increase their bond, and thus the resistance to pot-holing and rutting was increased materially.

The advantages of a proper carpet were readily apparent, and a way out for the localities in the peculiar situation first referred to was opened. Previous to its discovery they had faced the prospect of being obliged to meet great increases in their annual expenditures for maintenance with the almost certain knowledge that when the motor travel should have increased beyond a certain figure there would be nothing left for them to do but to reconstruct their roads, probably with paving at a high cost, or they had to face such immediate reconstruction if the increase in maintenance charges seemed sufficiently imminent and formidable.

LIMITS OF CARPETING SYSTEM.

With the possibilities held out by "carpeting" the roads came, of course, the questions of what the limits of such treatment were then, of the possibility of their extension, of the proper methods and materials for success within such limits, the causes of failures or dissatisfaction where such had occurred in practice with carpets, &c. &c.

It was soon proved that there were limits to the successful adoption of carpeting methods for the improvement of macadam roads, or for adapting the latter to withstand otherwise destructive travel. If, as the name implies, a "carpet" is an appreciable thickness of cementitious material mixed with a mineral or other aggregate, it naturally follows that there may be travel conditions just too severe for support without damage by ordinary macadam and yet not severe enough to warrant the construction of a "carpet" on the surface of the latter. In such cases the simple treatment occasionally—say, annually—of the macadam with a proper oil, tar or pitch compound has proved entirely satisfactory and economical. In such cases no appreciable thickness of carpet is formed on the macadam, and the stones of the latter still continue to take the wear though they do not then loosen and become displaced as they would without the pitch application. Of course, in these cases a carpet could be used, but until the amount of travel justifies its use, it often would be unnecessary and not economical under the local conditions.

On the other hand, if we differentiate between a mixture of pitch and grit made *in situ* and a, perhaps, similar mixture made previous to placing on the road surface and then spread and rolled into place, by referring to the latter as a "sheet pavement" and limiting the application of "carpet" to the former result, it seems that, at present at least, there are limits to the successful applications of carpets to roads carrying heavy travel. For instance, if the travel comprises a very large number of hard-tyred vehicles carrying extremely heavy loads, it has been found that a carpet will not prove economical though a sheet pavement may. The trouble seems to be that the particles composing the carpet are not of sufficient mass to resist disintegration under such stresses, nor to be able to resist lateral displacement before or after fracture under such loads, or that the proportions of the different sizes of particles forming the aggregate are not right.

Again, it is found that if the proportion of horse-drawn to motor vehicles is too large, a carpet is in danger of destruction from being perforated or picked to pieces by the caulks of the horses' shoes. Perforations allow water to penetrate and to weaken the bond to the macadam, and continual picking at the carpet by the caulks breaks it to pieces unless the rolling and compressing action of motor and other wheels is sufficient to off-set both.

The determination of the exact limits, in terms of travel units, to the successful use of carpets is not yet established. It is affected by climatic and other local conditions, by the character of the pitch employed, by economic factors, &c., and because of the importance of the economic factors and the comparative newness of the problem, even the approximate determination must be deferred for the present.

The possibilities of extending these limits when once approximately determined will naturally be clearer then; and such possibilities may be increased.

of course, by the improvement of materials and methods now being developed.

MATERIALS AND METHODS.

The questions of the proper materials and methods to be used in order that successful carpets may be had within reasonable limits for such work are many and varied, and in so many cases the decision is so largely affected by local considerations that generalisation is difficult. However, it may be said that the writer's experience with many hundred year-miles of this work leads him to state as follows:

(1) A 12-ft., water-bound, limestone macadam will not successfully support travel aggregating 400 units* per average day of ten hours, and where 60 per cent of the total travel is that of motors.

(2) Such a road surface can be made to sustain such travel with physical satisfaction by a carpet made with proper pitch.

(3) An 18-ft., water-bound, trap-rock macadam is incapable of sustaining, without serious deterioration in a few months, travel aggregating 2,500 units per average day of ten hours, and where 90 per cent of the total travel is that of motors.

(4) The surface treatment of such a road surface with a proper cut-back asphalt or a proper compound of tar will enable it to sustain such travel with physical satisfaction.

(5) The use of sand on top of the pitch is open to grave objections, and the value of its use before spreading the pitch is questionable, clean stone chips of small gravel, free from particles that will not pass a ½-in. mesh, being preferable.

(6) With the use of a proper pitch, no material advantage is had by closing the finished carpet to travel for a period after its construction, provided the adhesion of tyres to the surface is prevented by watering, spreading an excess of grit, or other means.

(7) The construction of a carpet on a macadam adds immaterially to the supporting power of such macadam, except as it may increase its ability to protect the foundation by shedding water.

(8) The successful thickness of a carpet is that but slightly in excess of the height of the larger sized particles of the grit used, and the maximum successful thickness is not over 1 in., but generally nearer ½ in.

(9) Better results are secured from applications of the pitch hot and under pressure than from cold gravity applications.

(10) Where the quantity of pitch to be applied is to exceed one-third of a gallon per square yard, better results will be obtained by making two or more applications of it.

(11) For pitch carpets, a pitch compound, to be satisfactory, should show at least the following characteristics:—

(*a*) It should flow freely, though not excessively so, under the conditions of applications.

(*b*) It should show, after evaporation at 105 deg. Cent. for twenty-one hours (20 grammes in 3½-in. dish) a percentage of residue neither above nor below certain limits, dependent upon local conditions, and this residue should show a penetration of not less than 10 at 4 deg. Cent., nor more than 200 at 25 deg. Cent. (No. 2 needle, 100 grammes 5 sec.).

(*c*) The naphtha soluble portions of the residue above mentioned should, when evaporated on glass, show themselves to be decidedly adhesive.

(*d*) The amount of "free carbon" present in tar compounds should be less than a maximum percentage of the fraction distilling between 225 deg. and 300 deg. Cent., the figure for this maximum being dependent upon local conditions.

(12) The best grit for carpets is clean stone chips or pea gravel, free from more than 20 per cent of fine materials, that will pass a ½-in. screen.

(13) For the sake of uniformity in spreading, the mechanical application of the grit is preferable to manual application, even at the expense of some waste of material.

Failures frequently teach more than successes. And under their consideration may perhaps be most impressively discussed their causes.

(14) A poor foundation frequently explains the failure of any pavement or road crust. The best carpet can do no more to remedy a poor foundation than by aiding to prevent water reaching the latter.

(15) Complaints of excessive slipperiness on carpeted roads are often heard, and these are most frequent perhaps where old macadam roads have been so treated. With the smoother surface of the carpet, less crown than ordinarily supplied on a macadam is necessary or desirable for drainage purposes. But as the carpets were applied to these old roads, in many cases without the reshaping of the macadam, the completed work has excessive crown. This is conducive to sideslip—the thing objected to. Where the cross-section is planned for the presence of a carpet and the proper crown so provided, carpeted roads are not objectionably slippery unless a pitch is used which becomes too hard at low temperatures. (See 11*b*.)

(16) A carpet will not prove satisfactory that varies greatly from a uniform thickness or composition. If potholes and ruts exist in the old road it is useless to attempt to remedy them by simply carpeting the surface. The necessary repairs must first be made and the carpet applied, the results being directly proportionate to the surface condition of the road carpeted.

(17) A carpet must have appreciable thickness, and, within limits, the greater the travel the thicker the carpet needed. Successful carpets, even with light travel, can seldom be made with less than ¾ gallon pitch per square yard.

(18) A pitch compound which does not "set up" or harden rapidly and sufficiently to a certain degree (see 11*b*), will not produce a satisfactory carpet, nor will a pitch that is too greasy in character. The former will be objectionable, as were certain oil treatments referred to, and the greasy pitch will produce a carpet that will shift about under traffic, add to the effort required for hauling over it, and probably emulsify in wet weather into intensely disagreeable mud. A layer of this mud on the surface of even a good macadam road frequently seems to be the cause of the whole road "going to pieces," or of its "bottom dropping out" during an open winter.

(19) "Cut-back" pitches, far from being objectionable when properly compounded, are frequently most desirable for carpeting work, but their composition should be most carefully limited. Many failures have been due to the use of compounds improperly made by the addition of the wrong light fractions to poor or even good, hard pitches.

(20) One of the most frequent causes of failure of carpets comes from lack of proper adhesiveness on the part of pitch compound. A greasy pitch compound is seldom sufficiently adhesive, nor is one which fails to pass the setting-up test. Unless the adhesion of the carpet to the base is good, the carpet will be worn loose, and then easily destroyed, as its body by itself is light.

(21) The cohesiveness of the carpet body depends, of course, largely on the adhesiveness of the pitch compound. But the adhesion may be practically destroyed (and the cohesion of the carpet body also) by the use of the pitch compound on a dirty or dusty surface, or with materials containing too great a proportion of fine material. The presence of moisture may with some pitch compounds also produce a similar effect. Ordinarily, however, the presence of a moderate amount of moisture has not nearly so bad an effect as the presence of a small amount of fine stone dust ("flour"), or similar material. Indeed, with some materials drenching the road surface with water previous to applying the pitch compound is reported to be advantageous. Many failures in carpeting have been traceable to the use of the old worn-out dust from the road surface in place of suitable clean, fresh grit.

(22) Some apparent failures with carpets have been so classified simply because of impatience on the part of those in charge of the work. It frequently happens that a first attempt does not produce the result desired or anticipated, and a failure is recorded when a second attempt would have produced entire satisfaction. New carpets sometimes seem to scale or flake badly from the old road surface. Prompt patching, followed (where a properly light application was first made) by a second coat, frequently results in a most satisfactory surface.

The successful use of carpets for the protection or improvement of macadam roads has been so great that its development for other situations has followed. The noisiness of brick pavements, and even of stone block, the slipperiness of brick, stone and wood-block pavements, and many of the inherent defects of concrete as a pavement, have often been reduced or cured by the use of a proper carpet, and the satisfaction with, or advisability of, each of the

* For explanation of "Factors" used, see "A Simplification of Traffic Censuses for Purposes of Comparison," The Surveyor, March 19th, 1911, p. 364.

surfaces mentioned thus greatly increased, to say nothing of any economy in the use of the carpet by the resulting prolongation of life in the more expensive pavement. From the experience of the writer, he believes that, especially in cases where considerable well-built water-bound macadam exists, but now needs protection from motor traffic, the system of carpeting such roads or streets is most worthy of deep consideration, and that those authorities such as the British Road Board, who apparently have carefully and earnestly applied themselves to this subject, have acted wisely.

INSTITUTION OF MUNICIPAL ENGINEERS.

NORTHERN DISTRICT MEETING AT WALLSEND-ON-TYNE.

At the meeting of the Northern District of the institution, held in the Town Hall, Wallsend-on-Tyne, on Friday, March 28th, there were present Messrs. J. W. Moncur (in the chair), J. Davison (Morpeth), G. Gregson (Durham), T. Gregory (Newburn), J. W. Holbrook (Houghton-le-Spring), J. T. Pegge (Durham), G. W. Ayton (Chester-le-Street), J. H. Mole (Chester-le-Street), Jas. Jameson (Ponteland), Lionel Simpson (Barnard Castle), T. S. Dight (Durham), J. R. MacMillen (Earsdon), Leonard Tait (Morpeth), M. T. MacMillen (Whitley), W. T. Weir (Howden-on-Tyne), R. Harper (Chester-le-Street), H. H. N. Smith (Wallsend), John Blench (Wallsend), E. C. Tomkins (Middlesbrough), J. Scott Weir (Jarrow-on-Tyne), M. G. Martinson (Newcastle), W. Johnson (Wallsend), J. Jackson (Wallsend), R. E. Womphrey (Wallsend), G. Hollings (Wallsend), H. Atkinson (Newcastle), R. Davison (Morpeth), A. J. Rousell (Whitley), Robt. McKallar (Wallsend), T. Harker (Chester-le-Street), W. Bean (Longbenton), J. L. Holbrook (Houghton-le-Spring), W. B. Thomas (Southwick), T. H. Bryce Hennibique (Newcastle), H. Beaty (Ashington), Councillors Alderman Geo. Elliott (Wallsend), Alderman John Hanlon (Wallsend), T. G. Morpeth (Wallsend), Thos. Anderson (Wallsend), R. M. Anderson (Wallsend), G. Hill (Wallsend), J. Hall (Wallsend), A. Taylor (Wallsend), Hugh Murphy (Willington), W. S. Kirkley (Wallsend), H. W. Clothier (Wallsend) and John Robinson (hon. district secretary).

At the conclusion of the meeting a visit was paid to the Newcastle electric power station at Carville, and to the ferro-concrete bridge over Burns Close, after which the members and their friends were entertained to tea by the Mayor and Corporation.

The Chairman (Mr. Moncur), in proposing a vote of thanks to the Mayor and Corporation for their kindness, expressed the great satisfaction that it had given everyone to visit Wallsend. He considered that Wallsend was one of the most progressive and rising towns of the times. Thanks were also due to Mr. Cusworth and Mr. Jackson, of the Newcastle Electric Power Company, for their kindness in showing the members round the power station; to Mr. Little, manager of the tramway company, for placing special cars at their disposal; and to Mr. Atkinson for attending and explaining the construction of the Hennebique ferro-concrete bridge over Burns Close.

Mr. John Davison (Morpeth), in seconding the vote of thanks, said that the meeting had been one of the most instructive they had held for some time.

Mr. Geo. Elliott, the Mayor of Wallsend, in responding, said it was a great pleasure both to himself and his colleagues to entertain the members, and to have the opportunity of exchanging views with them. The outside public seemed to think that Wallsend was a town of little importance. They themselves, however, thought the town was of very considerable importance. The Newcastle electric power station was the largest power station in the country, and the corporation were very proud of their ferro-concrete bridge, which would be the means of developing the town very considerably. The population of Wallsend in 1871 was 4,000, in 1881 6,000, and in 1912 45,000. They were most ambitious to be made a county borough, and they were pretty well assured that when they made application the county council would not oppose them. He hoped the members and their friends would carry away pleasant recollections of their visit.

Mr. Little, of the tramway company, said that it had given them great pleasure to put special cars at the disposal of the members, and he trusted that the visit had been a pleasant one.

Mr. Jackson, assistant manager to the Newcastle Power Company, said that they gladly welcomed the members to their works, the development of which had been very rapid. They commenced in 1889 with a small power station at Newcastle. This, in 1900, was found to be too small, and a power station was built at Wallsend which again, in 1904, was augmented by the present large power station at Carville, and they were continuing to extend by building other power stations throughout the Northern Counties.

Mr. George Gregson (Durham) proposed a vote of thanks to Mr. Hollings for the trouble he had taken in drawing up the programme and assisting to entertain those present. He was sure that Wallsend Corporation were to be congratulated upon having such an able surveyor.

Mr. G. Hollings, in acknowledging the vote of thanks, said that it was a pleasure to welcome the institution, especially when he was so warmly supported by the Mayor and Corporation.

A NEW SYSTEM OF STREET REFERENCE.

The difficulty so often experienced not only by strangers in but, as often as not, by the residents of large cities and towns in ascertaining the locality of a particular thoroughfare has resulted from time to time in the production of quite a crop of maps and handbooks which, while excellent in their way, are, in a good many instances, not without their drawbacks. The trouble incidental to the consultation of a map, in particular, is best appreciated by anyone who has attempted the feat on a windy day. Directories, of course, can be referred to for the desired information, but these are too frequently not available when required, and the assistance of a passer-by, with the attendant risk of misdirection, is then the only alternative.

It would seem, however, that a solution of the problem is likely to be provided by a system, remarkable alike for its ingenuity and simplicity, which has been brought to our notice by Mr. W. O. Aves, 91 Dyne-road, Brondesbury, N.W. In this all the thoroughfares of London, in their sequence from a central point to their suburban limit, are tabulated under a number, and thus shown—at least to the Londoner—immediately convey to the eye their approximate topographical position. All branch streets running from them are indexed under the same number, and the number of the corner building in the thoroughfare by the side of which it turns off is also given. All rear and subsidiary streets are also indexed by the same governing numbers, so that in all cases the better-known main arteries are used as the key reference. As an example of the directness of the method, and the connecting reference with main thoroughfares which the system affords, the 600 streets of one important urban district require but 37 key references, and the introductory issue proposed for "London, within and beyond," to contain entries of at least 20,000 streets and buildings, will necessitate only from 750 to 800, and yet cover every thoroughfare of any considerable length.

The inventor has constructed a mechanical arrangement for attachment in public positions in co-operation with the borough authorities, from the officials of which he has already received several most encouraging letters commenting on the utility of the system. This takes the form of a metal box about 10 in. by 12 in., having a glass front and containing a revolving scroll upon which is printed the index, another scroll containing a list of the thoroughfares. The device is quite easy of operation, and the cost of its installation should not exceed a few shillings in each case.

An Appreciation. — Mr. Walton Maughan, of Coventry, consulting engineer, technical author, and hon. examiner for the Institution of Municipal Engineers, writes us: "Congratulations *re* your 'Coming-of-Age,' 'Special Roads,' and 'Annual' issues. The Surveyor was largely instrumental in my becoming 'a surveyor,' as is shown by a treasured copy of the 'Nineties,' from which I cut an advertisement for a pupil when, as a very humble railway clerk, I had saved up enough to article myself to a member of *the* profession."

Office Conversations.

MORE OR LESS IMAGINARY.

[Contributed.]

X. The Annual Estimates.

Can I go into the estimates now? Well, we can make a start anyway; I suppose you've all the figures ready, Mr. Cheale? That's good. Let me see, it's the first time you've had a go at 'em, isn't it? Yes, it is unlucky that Mr. Smith should have been taken ill at such a time, but it can't be helped, and I daresay we can manage it together all right. We'll take highways first. Now, what 've you put down for materials? First item: Six hundred tons of granite? Hum—you're sure that 'll be enough? You think so? Oh, that's not the least little bit of use. Certainty's the only thing in these cases. Yes, I'll have a look at the details. They seem right enough. Bit short on the Landon-road, aren't you? No? Well, I suppose you know best, as you've just been over the ground. First item, then: Eight hundred tons of granite. Eight hundred, I said. Six? Six is your figure? Quite so, and it's mine, too, but then we must *have* six. Five hundred or four hundred and fifty 'd put us in a hole, wouldn't it? We should be short on every job, and then there'd be the deuce to pay.

* * * *

Six? Yes, I know; but can't you see that if we ask for six we shall only get five, or possibly even four hundred and fifty? Committees have a kind of unwritten law to the effect that they must always knock down the surveyor's estimate. They don't know anything about the work? Of course not, and that's the very reason they do it. To accept the figures would, they think, be a confession of ignorance. Mr. Climson's a very worthy man, and makes an excellent chairman of the Highways Committee, but he's tarred with the same brush as the rest of 'em, and I'd stake my reputation—and I have one, mind you, Mr. Cheale, which is more than everyone can say—that he'll do what he always has done, and that is cut my figures down just to show he knows something. "A hundred and twenty tons for Landon-road" (I can hear him saying)? "Why, Mr. Stockforth, I was over the road only yesterday, and it's in really excellent condition. Surely you have overestimated"—and so on, and so on. To come to the point. If I ask for six I get five—if I ask for eight I get something over six, which leaves me fifty tons or so to play with. I can, nay, I shall, demur at every attempt to cut my figures; and then when I have had my say, and things are getting a bit hot, I can gracefully give way. "Well, gentlemen, knock off a hundred tons and I'll do my best, only don't blame me if the roads are not quite up to the mark next winter."

* * * *

The roads will, I needn't say, be well up to the mark, for I shall get all I want and a bit more. Tricky? Yes, and one has to be tricky in this world. After all, I'm responsible for the maintenance of the highways, and I can't maintain 'em without material. So I must get what I require, by hook or by crook. I'm saving the ratepayers' money, whereas if I allowed myself to run short the roads 'd be starved year after year, and then the council 'd have to meet reconstruction expenses and all that sort of thing. Councillors are very much like children, Mr. Cheale, as you'll find out when you get into more direct touch with them. They want humouring and coaxing. Rough measures aren't of the least use. Let 'em think they're having *their* way and get your own—that's how *I* do it. But all this is beside the mark. Eight hundred tons, that's the requirement, and now for the other items. To save time, before we go any further, just add 33 per cent to all the figures for materials. We can then safely stand a 25 per cent reduction, and anything below this—say, 20 per cent or thereabouts—'ll be to our direct advantage. Learning something? Yes, and you'll find it jolly useful when you get a chief appointment. And remember one thing—I may as well get it off my chest now—never play the new broom. Make no clean sweeps. Keep your end up; but go steady. Do your weeding quietly, but unobtrusively. Try the root and branch game and you'll find yourself left with nothing. I know a man—but there, I'll tell you that another day.

* * * *

I'm really afraid I can't do with a ton less, gentlemen. Eight hundred's the rock bottom figure. You see, the estimates have been cut down year after year, and a hundred tons one year and a hundred and fifty another, and so on, means a lot. The roads have been starved in many cases, and—— In very good condition, Mr. Chairman? Quite so—I agree; but—— Then how can they be starved? That's just where *I* come in, gentlemen. With a minimum of material I've managed to provide for a maximum of wear; but the breaking point's been reached. Judicious surfacing and patching can do a lot, and I'm proud to say that there's not a bit of bottoming showing anywhere; but it can't last. Why, I'll warrant there's not an inch of stone above the foundation in places! And I needn't tell you the new traffic's playing havoc with the best lengths we've got. Yes, eight hundred tons is little enough—a ton less means a score of weak spots. Landon-road? Oh, an excellent piece of road—on the surface. If any of you gentlemen can spare an hour to-morrow, I shall be pleased to meet you and show you exactly the condition of the road. I'll have a man with a pick, and we'll open up a bit here and there—just a few small trial holes. It's solid fact, and I tremble to think what 'd happen if we had another week or two of that heavy motor traffic that we had last June. The road 'd simply fall to pieces.

* * * *

Of course I'm in your hands, sir. If the committee decide to cut my figures down I must do the best I can, only don't blame me if anything goes wrong. Seems a large amount? It *is* a large amount—I agree entirely—but it's no more than is absolutely necessary. Knock off a hundred tons? Try my best without? Really, Mr. Chairman, I don't know what to say. You see—— You'll accept responsibility? Yes, but—you'll excuse me saying so—it's bound to reflect on me in the end. I've the responsibility, after all, and I can't shift it, and if I don't keep the roads up to the mark the blame must fall on my shoulders. I should like to meet you on the matter, but—— Look here, gentlemen, say fifty—take off fifty tons, and I'll do my best. Really, it's a serious thing for me or I'd give in at once. Must cut it down by a hundred at least? Well, if you say "must," there's an end of it, and I must alter the figure to seven hundred. But, gentlemen—I really must ask you this—should I by chance require a few tons more during the year, I trust you'll see your way to grant them. As I've said, I'll do my best; but should I run short—— Thank you, Mr. Chairman. The next item is——

* * * *

Ah, good morning Mr. Smith. Glad to see you back, and hope you feel fit again. You've had a rough turn. Yes, it was awkward just at estimate time; but I've managed all right. Cheale didn't do so badly, only he cut things a bit fine. How did I get on with the committee? Oh, about the same as usual. Added thirty-three to Cheale's figures, and got only about twelve and a-half knocked off; so we haven't done so badly. Much trouble? No; the same rigmarole. Talked to 'em, you know—gave way gracefully when I saw I'd been obstinate enough—— There, I needn't tell *you*—you haven't been deputy here for the past five years without knowing as much about it as I do. Now, I want the roads really well done this year. They're all in good condition, and they're to be kept up to it. We've plenty of material, thank goodness, and we needn't fear the heaviest traffic. Tell Gunn I would like to run round the district with him before he starts any work; but there, it's early days to talk about starting. You'll have to hop around now, Mr. Smith. Things are sadly in arrear. I've done my best; but two men's work is a bit too much. Really, Mr. Smith, I wish you'd get over that irritating habit of smiling at the wrong time. You can't help it? I know you can't help it, but it's beastly annoying all the same. By-the-by,

d'd you hear that Jubber's bringing his action? Yes, he is, and the council's going to brief counsel. It's going to be an expensive job, and all for the sake of a few pounds. Who'll win? Good heavens, Mr. Smith; why the lawyers, of course! Surely you never heard of either of the parties to an action getting anything out of it?

CORRESPONDENCE.

For every ill beneath the sun
There is some remedy or none;
If there be one, resolve to find it;
If not, submit, and never mind it.
—Anon., *circa* 1843.

LAND VALUATION BOARD APPOINTMENTS.

To the Editor of The Surveyor.

Sir,—May I again trespass upon your valuable space to point out to "Site Value" the error of his ways? I would again emphasise the fact that he is not in a position to voice the feelings of the department *generally*, and that his remarks would be more to the point if limited to his own colleagues. I indignantly repudiate the allegation that I have ever been the recipient of special favour, and wish to state that previous to my taking office I was not acquainted personally or indirectly with any member of the staff. It would be just as fair for me to countercharge "Site Value" with incapability or slothfulness, and thus account for his retaining the position which causes him so much discontent.

He points out a case in which a junior draughtsman was promoted over the head of a senior draughtsman, and rather sneeringly suggests that I should condone this action. Well, under some circumstances I should. I presume "Site Value" considers seniority from a "term of office" point of view. I do not, and am glad to see that the "waiting for the next man's shoes" principle, which crushes the energy out of the more ambitious lower down the ladder, does not apply. If a man of the come-day-go-day type, who waits behind the door with his hat on until it strikes five, is passed by a man with an interest in his work, well and good.

I am sorry for "Site Value's" staff dinner. They must look a cheerful crowd sitting there and "winking their other eye." I would suggest that he allows us to send one or two of the more facetious men from our division to entertain them, and the attendance would jump up from 50 to 98 per cent.

I grant that we are in the dark somewhat as to our future, but at the same time I contend that we are as justified in assuming that justice will be accorded to those who do their duty as otherwise. His reference as to what appeared in the *Times* is absolutely ludicrous and points to colossal ignorance, but certainly not on the part of the valuer referred to. Remarkable though it may appear, I have several times measured the height of a building only, and then returned to the office and ascertained the cube. I fancy I hear "Site Value" gasp! Marvellous, isn't it? Of course, there are such things as ordnance maps with buildings shown on, and areas can be thus obtained. There, the mystery is solved!

There are several other points in "Site Value's" letter upon which our opinions differ, but I fear that my remarks are already too lengthy to deal with them now. I would, however, respectfully submit the suggestion to you, Sir, that as a large number of the staff have come from municipal offices and still continue to take your journal, it would be well if you could devote a small space weekly to valuation matters and points of interest. Trusting this will have your consideration in the near future.—Yours, &c.,

Mancunian.

April 4, 1913.

To the Editor of The Surveyor.

Sir,—With reference to the above, will "Site Value" kindly state the grounds for his maintaining that 80 per cent of the whole staff are not satisfied with their present positions in the department? Does his whole staff include the permanent valuers and the clerks, in which case about 55 per cent at least must be deducted, leaving at the very outside about 35 per cent of discontented ones?

Now, referring to one of the divisions in the Midlands, there are seven or eight districts, the average number of valuers and valuation assistants in each district being about nine. There have only been two departures in my own district—viz., one to a better position at Somerset House and the other to Jamaica. When the staff dinner came round it afforded us an opportunity to exchange our views on matters of increases of salary, prospects, &c., and I then learned that the number of departures in the other districts were in concordance with those of the district in which I was engaged.

It is rather out of order for "Site Value" to say that "Mancunian" and I probably received our present positions through favouritism. I entered the department knowing nobody connected therewith, and if I have since been favoured, which I doubt, all the more to my credit.

The increases of salary seem to be governed by the passing of the Surveyors' Institution examinations. At the last batch of increases an assistant who had passed the final examination in the valuation subdivision received a £25 increase, those who had passed the intermediate £15, and those who would not attempt the examination, but preferred to grumble and be discontented with their lot, were left in the cold (very few in our division), as they well deserved to be.

It seems rather strange that "Site Value" should be kept on door-knocking, as he terms it, after twenty months' service, while other assistants are probably valuing on their own account after a much less period. Is it therefore to be wondered at that the most respected district valuer should reply when asked, man to man, by "Site Value" as to the prospects of the department, "Absolutely hopeless"? Another assistant asking the same question would perhaps have received the reply, "It rests with yourself."—Yours, &c.,

Valuation Assistant.

April 7, 1913.

THE KENSINGTON SEWER FATALITY.

To the Editor of The Surveyor.

Sir,—Since the publication of my letter in your last issue I have had the opportunity of hearing the principal evidence at the coroner's inquiry, which confirms in every detail the statements I made in my previous letter. What struck me was the fact that no scientific evidence was given to prove the nature of the atmosphere in which the men were working. A small leakage in the gas main accidentally occurred through a fracture, and in order to locate the escape the men entered the sewer. Had the leak not occurred the men would not have been in the sewer. This fact evidently shut out all evidence as to, or consideration of, the prevention of similar occurrences in the future; but it is, I believe, clearly understood that such accidents are preventable through the use of the already existing ventilator.—Yours, &c.,

R. Harris Reeves.

Walton-on-Naze.
April 8, 1913.

ASPHALTS AND BITUMENS.

To the Editor of The Surveyor.

Sir,—Referring to my letter on this subject, appearing in current issue, in which I contended that oil residuums were inferior to properly refined and fluxed natural asphalts as road binders in their ability to withstand all climatic conditions and preserve the integrity of the road, I would now like to suggest that surveyors when up for the approaching Building Trades Exhibition at Olympia should pay a visit to Addison-road, Kensington—which is hard by—for confirmation of this fact, as it is recognised to-day that a comprehensive knowledge of the various causes of failures of bituminous pavements should be one of the most valuable assets of road engineers in charge of their construction and maintenance.—Yours, &c.,

Cecil Nathan.

3 London Wall-buildings, London, E.C.
April 7, 1913.

The Civic Engineer's Who's Who.—Mr. W. Welburn, M.Inst.M. and Co.E., who has for over thirty-five years been borough surveyor of Middleton, near Manchester, in ordering this new publication adds: "May I also congratulate you on the publication The Surveyor? I have the whole of the volumes."—Mr. H. Gilbert Whyatt, M.Inst.C.E., M.R.San.I., the borough engineer and surveyor of Grimsby, also writes, in reference to "Who's Who": "I find it most interesting, and sincerely hope that continued success may warrant its publication for many years to come." We are much indebted to both correspondents for their encouraging missives.

Assistants' and Students' Section.

Conducted by SYDNEY G. TURNER, Assoc.M.Inst.C.E.

All communications in regard to this page must be addressed to The Editor, St. Bride's House, 24 Bride-lane, Fleet-street, E.C. *Envelopes must be marked "Assistants' Section" in the top left-hand corner. Correspondents are invited to submit questions for consideration and answers to the questions which appear. For the contributions considered to be the most meritorious, one or more premiums in books will be awarded monthly. Diagrams must be drawn to scale on separate sheets, ready for reproduction.*

QUESTIONS.

This week answers are invited to the following questions:—

314. Concrete Roof.—It is desired to construct a semi-circular barrel roof in concrete of 50-ft. span, reinforced with expanded metal. Show the dimensions of the supporting walls, which are to be 15 ft. high from the top of the footings. The roof is to be ribbed with an extra thickness of concrete over the piers. (H. V. A., *Clapton.*)

315. Surveying: Theodolite.—If the graduated plate of a theodolite is not correctly centred, how may the error arising therefrom be eliminated? Prove that the method adopted does eliminate the error referred to. (T. W. P., *Bexhill-on-Sea.*)

317. Strength of Beam.—A rolled steel I beam of British Standard Section, 12 in. by 6 in., and weighing 54 lb. per foot, is capable of sustaining a load of 15 tons uniformly distributed over a span of 20 ft. What would be the safe load uniformly distributed which could be placed on either half of the lower flange? ("Pupil.")

320. Water Tower Design.—Design a small water tower to hold 8,000 gallons, top water level being 30 ft. above ground level, tank of cast-iron, framework of tower of steel. Show full calculations, including wind pressure allowances. (W. H. B., *Bocking.*)

321. Paving.—What is the correct method of setting out a paved road? Show how to work out the heights and cross-fall for a road 54 ft. wide, to be paved with a camber of 1 in 48 (channels each side are level. (P. G., *Chichester.*)

322. Retaining Walls.—Given similar dimensions, which of the two walls in Figs. 1 and 2 has greater stability? Give proofs. (D. G. B., *Darlington.*)

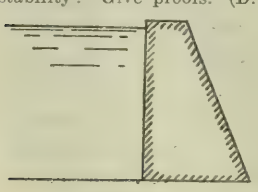


Fig. 1.

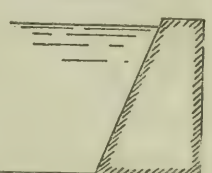


Fig. 2.

[The Editor is at all times glad to hear from readers who desire to submit questions regarding matters of general interest, points of daily practice, &c., for insertion in the "Assistants' and Students' Section." Questions which are published are taken into consideration, as well as other matter, in awarding the Monthly Premium.]

REPLIES TO QUESTIONS.

319. Hydraulics.—Fig. 1 illustrates a cast-iron pipe line leading from a reservoir.

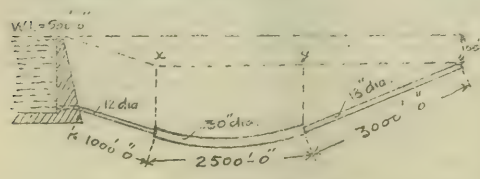


Fig. 1.

With the data given (1) calculate the discharge at the extremity of the pipe; (2) find the diameter of a single line to displace the system shown; (3) find the piezometric heights x and y at the junctions of the pipes. (E. A. B., *Leicester.*)

Let v = velocity of flow at point of discharge

Then $v \times \left(\frac{18}{30}\right)^2 = \frac{9v}{25}$ = velocity in 30" pipe

and $v \times \left(\frac{18}{12}\right)^2 = \frac{9v}{4}$ = " 12" pipe

Taking the general expression for loss of head as $\frac{4fl v^2}{2dg}$, and assuming f to be ·01, we get

$$\text{Head lost in 12" pipe} = \frac{4 \times \cdot 01 \times 1{,}000 \times \left(\frac{9}{4}v\right)^2}{2 \times 1 \times 32 \cdot 2} = 3 \cdot 1444\, v^2$$

$$\text{Head lost in 30" pipe} = \frac{4 \times \cdot 01 \times 2{,}500 \times \left(\frac{9}{25}v\right)^2}{2 \times 2 \cdot 5 \times 32 \cdot 2} = \cdot 0805\, v^2$$

$$\text{Head lost in 18" pipe} = \frac{4 \times \cdot 01 \times 3{,}000 \times v^2}{2 \times 1 \cdot 5 \times 32 \cdot 2} = \cdot 1242\, v^2$$

Also, head lost by sudden enlargement at entrance to 30-in pipe

$$= \frac{\left(\frac{9}{4}v - \frac{9v}{25}\right)^2}{2g} \cdot 0554\, v^2$$

And head lost by sudden contraction at entrance to 18-in. pipe

$$= \frac{0 \cdot 3\, v^2}{2g} = \cdot 0046\, v^2$$

Neglecting loss of head at entry from reservoir, the total loss of head is

$$3 \cdot 1444\, v^2 + \cdot 0805\, v^2 + \cdot 1242\, v^2 + \cdot 0554\, v^2 + \cdot 0046\, v^2$$
$$= 3 \cdot 409\, v^2$$

This equals 100 ft.

$$\therefore\ v^2 = \frac{100}{3 \cdot 409} = 29 \cdot 3358$$

whence $v = \sqrt{29 \cdot 3358} = 5 \cdot 41$

$$\text{Hence discharge} = \frac{5 \cdot 41 \times \pi \times 1 \cdot 5^2}{4} = 9 \cdot 56 \text{ cub. ft. per sec.}$$

Or expressed in gals. per min.

$$= 9 \cdot 56 \times 60 \times 6 \cdot 25$$
$$= 3{,}585 \ = \text{Ans. (1).}$$

Let d = diameter of uniform pipe to give the same flow.

$$\text{Then velocity of discharge} = \frac{9 \cdot 56}{\pi\, d^2/_4} = \frac{12 \cdot 172}{d^2}$$

$$\therefore\ \text{Head lost} = \frac{4fl v^2}{2dg} = \frac{4 \times \cdot 01 \times 6{,}500}{2 \times d \times 32 \cdot 2} \times \left(\frac{12 \cdot 172}{d^2}\right)^2$$
$$= \frac{598 \cdot 15}{d^5}$$

This as before equals 100 ft.

$$\therefore\ d^5 = 5 \cdot 9815$$

And $d = 5\sqrt{5 \cdot 9815} = 1 \cdot 43$ ft. = Ans. (2).

Piezometric height at x =

600 − head lost in length of 12" pipe

$$= 600 - 3 \cdot 144 \times v^2 = 600 - 3 \cdot 144 \times 29 \cdot 33$$
$$= 600 - 92 \cdot 225$$
$$= 507 \cdot 775 \text{ ft.} = \text{Ans. (3).}$$

Piezometric height at y =

600 − (head lost in 12" pipe + head lost at sudden enlargement + head lost in 30" pipe)

$$= 600 - (3 \cdot 144 + \cdot 0805 + \cdot 0554)v^2$$
$$= 600 - 3 \cdot 2803 \times 29 \cdot 33$$
$$= 600 - 96 \cdot 211$$
$$= 503 \cdot 789 \text{ ft.} = \text{Ans. (4).}$$

(J. S., *Teddington.*)

Drain Rods.—Probably the largest order for drain rods ever placed was recently received by Messrs. Cakebread, Robey & Co., Caroba Works, Wood Green. The order was for 12,000 rods, exceeding a total length of 6 miles, and was for a department of His Majesty's Government. The rods are to be fitted with Messrs. Cakebread, Robey & Co.'s well-known patent "Ferret" locktast joint. Messrs. Cakebread, Robey & Co. are exhibiting some of these rods at the Building Exhibition, Olympia.

NEW MAGISTRATES' COURTS AT HENDON.

New petty sessional courts for the Edgware Magisterial Division of Middlesex are in course of erection at Hendon, N.W. The courts, of which we give an illustration this week, have been designed by Mr. H. T. Wakelam, M.INST.C.E., M.S.A., the county architect.

The buildings afford the following accommodation —viz., first and second courts, with a third court for cases arising under the Children's Act, 1912; magistrates' retiring rooms, &c.; clerks' offices (public and private); waiting rooms for witnesses; warrant officers' room; solicitors' room; office for the county divisional inspectors of weights and measures; caretaker's quarters, and accommodation for about twenty prisoners—male and female.

The building is Classical in style, and is in the hands of Mr. Albert Monk, contractor, Edmonton, N., who is making rapid progress with the work.

Petty sessional courts have already been erected at Acton, Uxbridge, Enfield and other places from

New Magistrates' Courts at Hendon.

(Mr. H. T. Wakelam, M.Inst.C.E., M.S.A., Architect.)

designs prepared by Mr. Wakelam, who, we understand, has also plans in hand for new buildings of the kind at Ealing.

Housing at Glasgow: City Engineer's Scheme.—A special committee of the Glasgow Town Council have, in accordance with the decision of the corporation, reconsidered a minute in which they approved generally of plans submitted by the city engineer, Mr. A. B. M'Donald, showing a scheme for the erection of 240 houses of the cottage type on 15 acres of corporation land at Riddrie. They have had before them a further and detailed report by the city engineer. Mr. M'Donald proposes that 80 of the 240 houses be of three apartments, with scullery and bathroom, fitted for hot and cold water, built in blocks each consisting of four dwellings, and that 160 be of four apartments, with scullery and bathroom, fitted for hot and cold water, and built in terraces each containing 10 houses. The buildings are to be two storeys in height, built of brick, faced externally with roughcast on the upper floor and red facing brick on the ground floor. The ceilings are to be 9 ft. 6 in. in height for the ground floor and 9 ft. for the upper floor. Each house will have an average garden area of 130 square yards. The estimated cost is £60,295, and the estimated rental—80 houses of three apartments at £15 15s. and 160 of four apartments at £18—is £4,140. The buildings are calculated to be redeemed in 60 years and the site in 80 years by equal instalments.

DANGERS IN DUST.

A NOVEL SUGGESTION.

Mr. W. C. Easdale, in an address to the Kingston Brotherhood on Sunday afternoon last in connection with the National Health Week, cited figures showing a great reduction in the death-rates of London and Kingston-on-Thames during recent years, and he claimed that this was due to the energetic administration of the Public Health Acts by the local authorities. He considered that local authorities, and particularly their officials, deserve a much greater measure of public support in their arduous work. He knew from experience that public health officials were very keen on their work, and extremely anxious to show satisfactory results.

After pointing out the dangers which lurk in dust in the form of disease germs, the speaker strongly advocated the vacuum principle, but he recognised that the cost of machines now on the market was prohibitive to a very large number of people. In a flight of imagination he ventured to prophesy that at some future time, when the dangers of disease dissemination in dust were more fully appreciated, every town would have its municipal vacuum plant with pipes laid on to every house, shop, and factory, and connections, with taps, in every room. The use of the vacuum tubes would be made compulsory for removing dust, just as drains have to be used to remove liquid wastes. The housewife would have her length of flexible hose with coupling at one end to attach to the connection on the vacuum pipe, and the usual brass nozzle at the other end to collect the dust from the carpets, furniture, walls, and all other parts of the house. There would be connections to the vacuum mains in the roads and streets, and the roadmen would have hose-pipes and nozzles to collect the dust from the roads in the same way. The same thing would apply to shops and factories, and all the dust thus collected would be drawn away direct to the refuse destructor and immediately burnt in the furnaces. The speaker considered that if such a scheme were carried out it would result in enormous benefit to public health, and might even prove to be more economical than present methods.

Electric Supply of London.—This was the subject of a paper read on Wednesday evening by Mr. Frank Bailey, M.INST.C.E., M.I.E.E., joint managing director, City of London Electric Lighting Company, at a meeting of the Royal Society of Arts.

Law Notes.

Edited by J. B. REIGNIER CONDER, 11 Old Jewry Chambers, E.C., Solicitor of the Supreme Court.

The Editor will be pleased to answer any questions affecting the practice of engineers and surveyors to local authorities. Queries (which should be written legibly on foolscap paper, one side only) should be addressed to "The Law Editor," at the office of The Surveyor, *accompanied by the writer's name and address, but correspondents who do not wish their names to be published should also furnish a "nom de plume." Where necessary, copies of local Acts or documents referred to should be enclosed.* **All explanatory diagrams must be drawn and lettered in BLACK ink only, and in such style as to be fit for direct reproduction—i.e., without re-drawing or amendment.** *Unless these conditions are complied with we cannot undertake to reply to queries.*

Building Line: Rebuilding: Public Health Act, 1875, sec. 155.—An interesting point under sec. 155 of the Public Health Act, 1875, was decided in *Attorney-General at the relation of the Lyc and Wolfescote Urban District Council* v. *Parish* (Chancery Division, Mr. Justice Joyce, December 20th). The defendant, on January 19, 1912, deposited plans for the rebuilding of an old house. The council considered the plans on January 22nd, and on February 5th passed a resolution under the section for the adoption of a building line setting back the frontage of the building some 6 ft. or 7 ft., and disapproving the plans for failure to comply with that building line and also with certain by-laws. On February 15th notice of disapproval was given to the defendant's architect, who, on February 26th, replied that the house would be built in accordance with the by-laws, but that the defendant could not agree to the building line. On the same day the new house was begun, and the clerk drew the architect's attention to the fact that he was not observing the building line. On March 12th the council's surveyor gave the defendant formal notice not to proceed with the building. This was followed, on March 15th, by an interview between the defendant's solicitor and the clerk to the council, at which the former asked for compensation if the building line was complied with. The clerk, however, on behalf of the council, declined to offer any compensation. The defendant completed the building on April 27th without observing the building line. This action was then commenced, claiming a mandatory order for the removal of the building. The section, it will be remembered, provides that when the local authority prescribe a building line on the rebuilding of an old house, they shall pay or tender compensation to the owner for any loss or damage he may sustain, the amount, in case of dispute, to be settled by arbitration. Mr. Justice Joyce dismissed the action with costs. In the course of his judgment he said that in order to succeed in any legal proceedings under the section it must be shown that the proceedings of the authority had been perfectly regular, it being a case of interference with private property. That the Attorney-General might maintain such an action it must appear that the proceedings of the authority had been *bonâ fide* and reasonable. The order must be properly communicated to the owner—that is, he must have plain and definite notice of what the authority prescribed, and it must be given in proper time, that is, before the rebuilding commenced. As to tendering compensation, without laying down any general rule, it appeared to him to be natural and rational that it should be tendered, or whatever was necessary should be done, at the same time that the notice was given of the prescription of the building line. At any rate, the tender ought to be made before the owner began to rebuild. Therefore, he said, without deciding that it was a necessary point of law, that the notice should refer to the section and mention the provisions as to compensation. The owner was entitled to be told what power to interfere with his property the council were affecting to exercise. In this case the resolution adopting the building and street lines was quite general, and had no reference to any particular case. The letter giving notice that the plans were not in accordance with the building line was not a proper notice of an order under the section. He doubted whether there was any regular prescribing pursuant to the section. He thought no sufficient or explicit notice was given to the defendant, that the conduct of the council was unreasonable, and that the defendant was entitled to compensation certainly before there was any order to pull down.

Disused Watercourse: Public Footpath: Sewer.—"W. S." writes: Some years ago an old corn mill, run by a water wheel, was supplied with water taken from a stream which was, of course, diverted along an artificial watercourse or drain to the water wheel. About forty or fifty years ago the mill was demolished and all the building material, along with part of the watercourse, carted away. The remaining part of the watercourse, which ran open, became filled up with stones and gravel, and has been used as a public footpath for at least thirty years. About a dozen years ago the rural district council, in sewering the village, laid a sewer along this footpath (formerly the mill race or watercourse) and built manholes thereon. "A" has purchased the plot of ground where the old mill formerly stood, and is seeking to assert his alleged rights and to restore the artificial watercourse, which action the council, of course, naturally resent, as it will mean serious interference with their sewer. I should be glad to know what steps the council should take in case "A" begins the work which he has threatened to do.

Inasmuch as the disused watercourse has been used as a public footpath for thirty years, it has probably become a highway, and in that case the owner of the soil cannot use it or deal with it in any way so as to interfere with its use as a highway. If he proceeds with the work the most effectual remedy would be an action for an injunction, with the concurrence of the Attorney-General.

The Duties of a Town Clerk.—"K. W." writes: Is it in order for the town clerk to charge his council extra fees for preparing contracts for council works or agreements between his council and surrounding councils? The town clerk is a part-time official receiving a fixed salary as town clerk, and is a partner in a firm of solicitors. If the preparation of agreements, &c., does not form a part of the routine work of a town clerk, for which he is paid his annual salary, what constitutes the duties of a town clerk?

A town clerk has various statutory duties to perform in connection with registration matters, the election of councillors, election petitions, returns of receipts and payments of the corporation, keeping the records of the freemen's roll, summoning meetings of the council, &c. He is not entitled to any remuneration in addition to his salary in respect of any of his statutory duties. (*Jones* v. *Carmarthen Corporation*, 8 M. and W., 605.) But if the terms of his appointment so provide, he may be entitled to make the usual charges for other work, such as bringing and defending actions (*Thomas* v. *Swansea Corporation*, 2 Dowl. (N.S., 470); or settling disputes where no action results (*Reg.* v. *Prest*, 16 Q.B.D., 32). I cannot find a case in which a town clerk has been allowed to charge for preparing contracts, &c., but if the terms of his appointment so provide, I think upon the analogy of these cases he would be entitled to do so.

House Drainage.—"A. R." writes: The district council have recently laid down proper sewers, and have called upon the owners of the houses to connect thereto, and nearly all have done so. One or two, however, decline, alleging that it is the duty of the council to do the work. The present drainage consists of old stone drains, and discharge into the stream which runs through the village. In one case two cottages are connected to one drain, and the owners hold this is a sewer vested in the local authority. I shall be glad to know if the council can compel the owners to do the work.

If the drains are in themselves sufficient for effectual drainage, the authority can only alter them at their own expense under sec. 24 of the Public Health Act, 1875. But if the drains are not sufficient the expense can be recovered from the owner under sec. 23. The drain of the two cottages is a sewer from the point of junction, unless the cottages are premises within the same curtilage.

Sewers in New Road.—"Max" writes: A plan has been deposited with the council for the making of a new road through a building estate. The council are asking for a separate sewer to take the surface water, and have referred back the plans. The owners contend that they are not called upon to provide a separate system of drainage under sec. 150 of the Public Health Act, 1875. Does this section apply to new roads? I shall be glad to have your advice on this matter. Are there any cases bearing on this question?

The council cannot compel an owner to construct a sewer at all except by exercising their powers under sec. 150 of the Public Health Act, 1875, or (if adopted) the Private Street Works Act, 1892, which section and Act respectively apply to new roads. The Act of 1892 expressly authorises the provision of separate sewers for sewage and surface water, where necessary, for bringing a street into conformity with other streets. There is no such provision, however, in sec. 150 of the Act of 1875.

The Surveyor
And Municipal and County Engineer.

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LOCAL GOVERNMENT BOARD INQUIRIES.

The Editor invites the co-operation of SURVEYOR *readers with a view to making the information given under this head as complete and accurate as possible.*

INQUIRIES HELD.

Blackburn T.C. (April 2nd. Mr. Edward Leonard).—A further sum of £40,000, for the completion of the public halls on the Blakey Moor site and the alterations to the town hall. The corporation have already been empowered to borrow £80,000 for this work, but the total cost of the scheme, as it now stands, will be £120,000. By the alterations to the town hall which are now in progress it is intended to bring all the corporation offices under one roof. Since the first plans were prepared it has been found necessary to provide larger offices for the different staffs, owing to the increased duties which have devolved upon them in recent years, and the total cost of the structural alterations will be £40,000. The halls on Blakey Moor, which are estimated to cost nearly £80,000, will be in line with the new sessions courts. An increase of over £8,000 on the original estimate is due to improvements in the plans and to the fact, mentioned at the inquiry, that since 1901 the cost of labour and materials has gone up by 12½ per cent. The building will comprise three halls—one to accommodate 3,500 people, another 1,280, and the third 550.

Dursley R.D.C. (March 20th. Mr. W. H. Collin).—£6,800 for the purpose of erecting thirty-eight workmen's dwellings.—The question having been raised whether the houses could be built for the money, Mr. A. W. Probyn, of Gloucester, the architect, said he staked his reputation on his figures as far as prices of material went in November, but there had been a rise in the cost of material since. He did not, however, suggest any alteration of the plans, at any rate until the tenders were in. He produced to the inspector a tender of a Gloucester firm which was within his figures.

East Dereham U.D.C. (April 1st. Mr. Courtenay Clifton).—£1,500 for the purchase of land adjoining the waterworks and the extension of the waterworks.—The clerk, Mr. B. H. Vores, stated that the loan applied for was to cover the cost of the purchase of just over 7 acres of land hitherto rented by the council and let for allotment purposes. The purchase price of the land, which adjoined the waterworks, was £300. A portion of the area was required for the erection of three new precipitation tanks. The water of the district contained a considerable amount of iron, and in order to dispose of the sediment the council adopted Clarke's process of treatment. The extra three tanks would enable 75,000 gallons a day to stand for thirty-six hours. The loan was also to cover the cost of a borehole pump and a suitable covering for the precipitation tanks to prevent the falling in of leaves and debris.

Reading T.C. (March 23rd. Mr. Edgar Dudley).—£670 for the widening and improvement of Woodcote-road.—The borough surveyor, Mr. John Bowen, stated that Woodcote-road was very irregular in width, and varied considerably in direction. The average width between boundary fences was about 33 ft., but the minimum width, at a sharp and dangerous bend near Richmond-road, was only 19 ft. It was intended to open out the bend, and to widen the other part of the road to 40 ft. There would be no kerbing or channelling, but gully pits of brickwork built dry would be constructed to assist in draining the road. He was of opinion that the price asked for the land was fair, and he considered the improvement not only desirable, but necessary. The land was freehold, and was subject to no restrictions.

Rochdale T.C. (April 1st. Mr. H. Ascough Chapman).—£13,260 for street improvements in Manchester-road, Milnrow-road, Oldham-road and Whitworth-road.—The town clerk, Mr. W. H. Hickson, said the corporation proposed to substitute granite setts for macadam on certain portions of these main roads, and they believed it would be more economical to do so. The cost of maintaining and scavenging macadamised roads worked out at 1s. per yard, and the cost of scavenging granite-paved roads was $\frac{1}{16}$d. per square yard less. If they took the present loan for twenty years and added 3½ per cent it would cost £923 per annum for sinking fund and interest, which worked out at 1s. 0·71d. per square yard. After deducting the saving in scavenging they got the cost at 11·55d. for granite, as compared with 1s. per yard for maintaining macadam roads. Then at the end of twenty years the setts would still be good for use on secondary roads. Mr. C. J. Roberts, solicitor, said he thought the money should come out of the rates and not be borrowed. The present municipal debt was over £2,500,000, and had increased by about £1,000,000 in ten or a dozen years. The borough engineer, Mr. S. S. Platt, said it would mean about 9d. in the £ if they rated for that expenditure.

Skipton R.D.C. (March 23rd. Mr. F. H. Tulloch).—£940 for works of sewerage at Eastby.—Mr. H. A. Johnson, of Bradford, engineer, explained that the scheme would comprise earthenware pipe sewers, laid in straight lines and gradients with manholes at all turns and at changes of gradient. Replying to a question as to the advisability of its being a separate scheme, Mr. Johnson said it was only proposed to take in the sewage from the houses, and surface water from the back yards where it could not be avoided. It was the intention as far as possible to keep out all surface water and road water from the new sewers. The sewers previously sanctioned for Embsay were of ample size to accommodate Eastby. It would be much more costly to have separate outfall works for Eastby than to join Embsay.

Southport T.C. (April 2nd. Mr. Edgar Dudley).—£60,000 for the purposes of sewerage and sewage disposal for Birkdale and Ainsdale.—It is also proposed to provide a refuse destructor at Birkdale and carry out certain works at Halsall outside the borough boundary. An objection was raised by the Marquis de Casteja as to the proposal to discharge surface water into Fine Jane's Brook, which bounded a large area of agricultural land in the district of Halsall. The town clerk, Mr. J. E. Jarratt, said that if the corporation entertained the suggestion of the Marquis de Casteja it would involve them in the serious difficulties which presumably caused the Local Government Board to override previous proposals for the sewage disposal of the district. Evidence was then given by Mr. Midgley Taylor, who said he considered that the corporation had a perfect right to use any watercourse within the watershed for the disposal of surface water. Mr. Greaves Lord, who appeared for the Marquis de Casteja, contended that Fine Jane's Brook was an artificial watercourse, constructed for the purpose of draining four meres and turning them into agricultural land. The result of putting a burden on the brook might be to ruin this work of reclamation.

Totnes T.C. (April 2nd. Mr. H. R. Hooper).—£1,470 for the purposes of water and sewage works in the borough.—The town clerk, Mr. G. E. Windeatt, stated that the council proposed to spend £623 for

sewage mains for the Queen's Park estate, and the work would be done in sections. There was no contribution from the estate, and the corporation thought that this was a good way to increase the assessable value of the town, as it was being developed for residential purposes. About 100 houses would be built on the estate, and the average rental would be £25. The inspector asked for details of the capacity of the pumps, &c., at the sewage pumping station, but these were not available. He also said that constant flushing would be necessary, and elicited that no provision had been made for it. He added that he was not altogether satisfied with the particulars. This was a scheme for putting more into the low-level sewers, which had to be pumped, and they had no knowledge of the flow, storage, or capacity of the pumps; nothing had been given to him to show what they had got that would be sufficient to deal with this extra sewage. There was no system of flushing nor ventilation, so that the scheme seemed to be incomplete in its present state. The town clerk said that he would send the particulars required, and the inspector said that it would make a difference in the estimate, and that it would be for the council to consider what they were going to do. The mayor (Mr. E. Windeatt) pointed out that he believed that when the town laid on the sewage scheme they provided for a total of 5,000 inhabitants, so that it ought to be ample for the present requirements.

APPLICATIONS FOR LOANS.

Aldershot U.D.C.—£11,038 for sewerage and surface-water drainage works.

Bakewell R.D.C.—£1,200 for water supply extension.

Barnoldswick U.D.C.—£728 for a site for a new fire station.

Beckenham U.D.C.—£1,350 for road improvements.

Bootle T.C.—£4,375 for electricity extensions.

Carlisle T.C.—£7,500 for additional plant for the electricity undertaking.

Clacton U.D.C.—£675 for street works.

Darwen T.C.—£700 for the provision of a bowling green.

Dewsbury T.C.—£1,732 for street improvements.

Doncaster T.C.—£1,970 for gasworks extensions.

Dover T.C.—£500 for a public convenience and other buildings.

Dudley T.C.—£1,000 for the King-street improvement scheme, and £400 for the purchase of a new steam roller.

Dungannon U.D.C.—£500 for artisans' dwellings, in addition to £4,200 already sanctioned.

Durham T.C.—£1,500 for screening and dredging apparatus at the sewage works.

Essex C.C.—£10,000 for an asylum chapel, and £3,314 for school extension.

Exeter T.C.—£1,325 for the purchase of land for road widening purposes.

Halstead U.D.C.—£800 for the completion of the public baths.

Horbury U.D.C.—£2,877 for street improvements.

Leicestershire C.C.—£13,000 for a new isolation hospital.

Maidenhead T.C.—£1,325 for the purchase of premises in Queen-street.

Morley T.C.—£10,000 for mechanical filter plant at Withens reservoir.

Omagh U.D.C.—£3,000 for the erection and furnishing of a new town hall.

Oundle U.D.C.—£1,000 for the improvement of the Kingscliffe water supply.

Stockport T.C.—£900 for a new rotary converter at the electricity works.

Stoke-on-Trent T.C.—£1,665 further loan for the Burslem central schools.

Torquay T.C.—£2,900 for a gas supply scheme.

Turton U.D.C.—£8,364 for the enlargement of the Eagley sewage works.

West Bromwich T.C.—£3,700 for the construction of two additional vertical gas retorts.

Weymouth T.C.—£4,500 for repairs to the pile pier.

Widnes T.C.—£4,400 for the improvement of Deacon-road.

LOANS SANCTIONED.

Athy U.D.C.—£1,000 further loan for artisans' dwellings.

Bournemouth T.C.—£2,150 for surface-water drainage works.

Chirbury (Salop) R.D.C.—£729 for the Marton water scheme.

Cork T.C.—£6,000 for street works.

Dewsbury T.C.—£550 for a road improvement.

Diss U.D.C.—£400 for an engineer's cottage at the waterworks.

Dumfries T.C.—£4,000 for workmen's houses.

Exeter T.C.—£2,360 for the enlargement of the sanatorium.

Glastonbury T.C.—£2,250 for new gas mains and services, and £2,045 for meters and cookers.

Hollingbourne R.D.C.—£450 for improving the outfall sewage works.

Mayfield (Staffs) R.D.C.—£314 for the Waterfall and Calton water scheme.

Metropolitan Water Board.—£670 for the construction of a sewer.

Oundle U.D.C.—£300 for additions to the isolation hospital.

Wakefield T.C.—£1,238 for sewerage works.

Warmley R.D.C.—£2,500 for sewage disposal works.

FORTHCOMING INQUIRIES.

APRIL.

	£
14.—**Romford.** For the purposes of a housing scheme (Mr. C. H. Eyles)	3,860
15.—**Bradford.** For the purposes of a refuse tip (Mr. Edgar Dudley)	1,650
15.—**Bridlington.** For electricity purposes (Mr. T. C. Ekin)	5,000
15.—**Coventry.** For the electricity undertaking (Mr. H. R. Hooper)	20,000
15.—**Frinton-on-Sea.** For outfall sewer extension (Mr. A. W. Brightmore) ...	400
15.—**Gosport.** For sewage outfall extension purposes (Mr. P. M. Crosthwaite) ...	4,000
15.—**Milton.** For works of sewerage (Mr. R. H. Bicknell)	600
15.—**Neath.** For road widening and paving (Mr. M. K. North)	1,675
15.—**Shoeburyness.** For street improvement purposes (Major J. Stewart)	350
15.—**Whittington.** For sewage disposal works (Mr. A. A. G. Malet)	7,500
16.—**Chesterfield.** For street improvement purposes (Mr. Edgar Dudley)	2,062
16.—**East Cowes.** For water supply purposes (Mr. P. M. Crosthwaite)...	986
16.—**Godalming.** For the water undertaking (Major J. Stewart)	410
16.—**Grimsby.** For the electricity undertaking (Mr. T. C. Ekin)	16,000
16.—**Petersfield.** For hospital purposes (Mr. W. W. E. Fletcher)	2,700
16.—**Rothwell.** For sewage disposal purposes (Mr. A. A. G. Malet)	9,000
16.—**Stockport.** For the electricity undertaking (Mr. H. R. Hooper)	24,500
17.—**Bournemouth.** For bridge, road, and cliff protection works (Mr. P. M. Crosthwaite)	11,800
17.—**Chester.** For the purposes of the lunatic asylum (Mr. H. R. Hooper)	39,894
17.—**Lincoln.** For refuse destructor and electricity purposes (Mr. T. C. Ekin) ...	20,173
17.—**Newton-in-Makerfield.** For sewage and gas purposes (Mr. A. A. G. Malet) ...	11,950
17.—**Portsmouth.** For hospital extension purposes (M. W. W. E. Fletcher)	4,600
17.—**West Bromwich.** For road and sewer purposes (Mr. M. K. North)	2,110
18.—**Cambridge.** For the purposes of a recreation ground (Mr. Edgar Dudley) ...	1,875
22.—**Conway.** For hospital purposes (Mr. F. St. George Mivart)	3,108
22.—**Lymm.** For the provision of steam disinfector and a laundry (Mr. J. R. Hutchinson)	500

Municipal Work in Progress and Projected.

The Editor invites the co-operation of Surveyor *readers with a view to making information given under this head as complete and accurate as possible.*

The following are among the more important projected works of which particulars appear below: Buildings—Folkestone £6,000, Retford £6,000; housing and town planning—Swansea; roads and materials—Bethnal Green, £3,000, Swansea £54,000, Widnes £4,400; sewerage and sewage disposal—Bradford £72,000, Kirkcaldy, Oakengates £15,000; water, gas and electricity—Rochdale £6,000; miscellaneous—Bournemouth.—Particulars of other works projected will be found on our "Local Government Board Inquiries" pages.

BUILDINGS.

Boston T.C.—The new town bridge, which is to be erected by Messrs. Goddard, Massey & Warner, of Nottingham—Mr. W. Webster, of London, being the engineer—will cost £5,600, towards which £2,000 will be contributed by Holland County Council. The Road Board were appealed to for a grant, but refused assistance, stating that the bridge was not of "national importance." The work will occupy three months.

Cheriton U.D.C.—The surveyor, Mr. O. A. Sherren, has received instructions to prepare the plan of a public mortuary.

Coventry T.C.—The extensions to the city hospital, Coventry, are being supplied with Shorland's double-fronted patent Manchester stoves with descending smoke flues, patent Manchester grates, and exhaust roof ventilators by Messrs. E. H. Shorland & Brother, Limited, of Failsworth, Manchester.

Folkestone T.C.—The borough surveyor, Mr. E. A. Nichols, has received instructions to prepare a scheme for a shelter in the Marine Gardens, at a cost of about £5,000. It is also proposed to provide two shelters on the east cliff, at a cost of about £1,000.

Gainsborough R.D.C.—Recently the council refused to adopt a Model set of building by-laws sent to them by the Local Government Board, on the ground that they were totally unintelligible. The result was a conference between the council and Local Government Board officials. Mr. Gamble at the meeting recently reported upon the conference. A gentleman from the legal department of the Local Government Board and one of the architects fully explained the by-laws, and as a result of the interview considerable alterations were made. The Local Government Board representatives gave the council's deputation to understand that they were one of the first rural councils to tackle the question of new buildings, and appeared to have no desire to push them in the matter, but rather to assist them to draw up good, workable by-laws. Mr. Gamble added that the Local Government Board officers regarded a rural council anxious to draw up building by-laws as rather a *rara avis*. The new by-laws were referred to the committee to report upon.

Hastings T.C.—Two houses are to be purchased in Havelock-road, at the price of £1,500, for conversion to a central fire station. The necessary alterations are estimated to cost £700.

Holme Cultram U.D.C.—The Silloth sea wall continues to give trouble. It was reported at the last meeting that the council had only £1,000 in hand of the £5,600 loan sanctioned for an extension scheme, and that further repairs had become necessary. In the circumstances an Urgency Committee has been appointed to deal with the matter.

Manchester T.C.—The Parks Committee have agreed to provide a shelter and refreshment rooms near the lake at Heaton Park at a cost of £1,100.

Newport (Mon.) T.C.—The Parliamentary Committee have instructed Mr. Ward, the corporation architect, to prepare plans for extending the present town hall and the erection of new law courts on a site opposite the police station in Dock-street. The site is the property of the corporation.

Omagh U.D.C.—Sketch plans of the proposed new town hall, as prepared by Mr. Robinson, the architect, have been approved, and the council have agreed to proceed with the scheme, at an estimated cost of £3,000.

Retford T.C.—The plans of a new hospital estimated to cost about £6,000 have been agreed to.

Stafford T.C.—A six-bed ward block is to be erected at the isolation hospital, at a cost of £904.

HOUSING AND TOWN PLANNING.

Dungannon U.D.C.—The tender of Messrs. P. McKenna & Sons, Armagh, at £4,079, has been accepted for the erection of twenty-four artisans' dwellings.

Edmonton U.D.C.—The Finance Committee have reported in favour of the suggestions of the Housing and Town Planning Committee with respect to a rearrangement of the staff in the engineer's department, in accordance with which an assistant whose duties will in part be to carry out the whole of the referencing and surveying details in connection with the housing and town planning scheme, will be appointed at a salary of £140 a year. The total extra expenditure under the rearrangement will be £25 a year.

Fife C.C.—A letter has been received from the Local Government Board intimating that they had issued an order authorising the preparation of the Crombie town planning scheme, and stating that the Board of Agriculture would like careful consideration given to their idea for small holdings in the area.

Glasgow T.C.—By a large majority the scheme has been rejected for the erection of cottages at Riddrie, at a cost of £60,000, on the ground that it was not necessary, a sufficiency of houses being already available.

Lymm U.D.C.—It has been referred to the Housing and Town Planning Committee to consider the adoption of a housing scheme, and to report to the May meeting of the council.

Nottingham T.C.—A proposal has been made for dealing under the Town Planning Act with a large area of land in the portion of the city lying in and around the valley of the Daybrook and extending from east to west from Mansfield-road across the Hucknall-road to Nottingham-road.

Stalybridge T.C.—The chairman of the Highways Committee at the council meeting on Monday last stated that the committee had decided to open out plots of land in the centre of the town and let them for the building of decent cottage property. The charge for this land would be such that if cottage property could be built to pay in any part of the borough, it could be built on this land.

Swansea T.C.—Tenders are to be invited for the building of fifty houses, with minimum accommodation of three bedrooms and one living-room.

PARKS AND OPEN SPACES.

Crewe T.C.—It has been agreed by the Park Committee to provide a municipal bowling green for the Queen's Park, at an estimated cost of £400. The town council have already in the park lawn tennis courts, which are very largely patronised.

Retford T.C.—Negotiations have been completed for the purchase of a playing field in commemoration of the Coronation, towards which the corporation have promised to contribute £350.

ROADS AND MATERIALS.

Bethnal Green T.C.—Bethnal Green-road is to be repaved with wood, from Teesdale-street to the Salmon and Ball, at an estimated cost of £3,000. Creosoted blocks will be used on the existing concrete foundations.

Blaydon U.D.C.—The surveyor, Mr. G. Symon, has been authorised to approach the owners of the adjoining land and ascertain their views as to a scheme prepared by him for a proposed diversion of the main road at the Dipwood Slide, Rowlands Gill, and a larger scheme.

Brigg R.D.C.—Street improvement works are to be carried out at Crosby, at an estimated cost of £2,177.

Chelmsford T.C.—The plans for making up the roads adjoining the Coval Hall estate, at a cost of £1,620, have been approved.

Colwyn Bay U.D.C.—The council on Monday last agreed to proceed with the scheme for the extension of the promenade at Rhos-on-Sea. The scheme comprises the continuation of the Cayley Promenade over the Combermere Gardens to the Rhos Promenade, and the construction of a boat slip down to the beach. The road will be widened, and lavatories will be built in the gardens, which will also be laid out. The tender of Messrs. Underwood Brothers (who constructed the promenade and sewage works at Colwyn Bay), at £2,124, was accepted, the work to be completed within twenty weeks.

Eastbourne T.C.—With regard to the conference concerning the proposed coastal road, a report was presented by the Highways Committee stating that facilities had been promised for the construction of a roadway through Lord de la Warr's estate from Cooden to a point near the Star Inn, and that the borough surveyors of Eastbourne, Bexhill, and Hastings, and the Eastbourne Rural District Council's surveyor had been requested to prepare a sketch plan showing the suggested line of the proposed road.

Ellesmere R.D.C.—The council have adopted a scheme prepared by the surveyor, Mr. W. H. Owen, for road improvements, at an estimated cost of £2,256.

Folkestone T.C.—It is proposed to repair part of the Sandgate-road with Lithofalt blocks, at an estimated cost of £750.

Guildford T.C.—A tar-spraying machine is to be purchased for £88.

Kensington B.C.—To effect the widening of Kensington High-street in front of the eastern portion of John Barker & Co.'s premises the Works Committee have intimated to the London County Council their willingness to pay one-third of the cost.

Kingsbridge R.D.C.—Plans and estimates for the proposed widening of the main road between Kingsbridge and Salcombe are to be prepared and forwarded to the county council.

Lewes T.C.—The Road Board have agreed to lend the council £500, free of interest, to be repaid by two annual instalments, in aid of the Station-street improvement.

Middlesbrough T.C.—The Streets Committee have agreed to advance the standard rate of wages for able-bodied street sweepers from 24s. to 26s. per week.

Newport (Mon.) T.C.—The borough engineer, Mr. H. Tremelling, has been instructed to report as to the cost of constructing a new street from Commercial-street to Dock-street between the William IV. Hotel and Emlyn-street.

Newton Abbot R.D.C.—Two tar boilers are to be purchased from the Municipal Appliance Company at £18 each.

Sculcoates R.D.C.—The council have approved a report submitted by the surveyor, Mr. A. Culken, suggesting that a further trial section of tarred slag should be laid during the ensuing year. The saving by the use of tarred slag was at least 50 per cent on rural roads. In view of the fact that the application of tarred slag had been necessitated solely by reason of motor traffic, he suggested that the Road Board, through the county council, should be requested to contribute one-half the cost. He further suggested that the main roads through the villages should be tar-sprayed, and application made to the county council for a grant to cover the cost of the work. Mr. R. Hayton-Thorp said tarred slag was very dangerous to horses, and tar-spraying was very objectionable. The chairman: I don't think we shall ever find anything to get over all the difficulties.

Stafford T.C.—With the view of improving the road at the junction of Corporation-street and Weston-road, it has been agreed to purchase 350 sq. yds. of land at about 3s. 4d. per square yard, inclusive of law costs.

Swansea T.C.—The borough surveyor, Mr. G. Bell, has submitted a report on a scheme for permanently improving the whole of the thoroughfares in the town proper, which would be laid either with wood paving, granite pitching or asphalt. The total cost would be about £54,000, and the annual charges £6,500, an increase, including repayment of loan, of £2,553.

Widnes T.C.—The proposed improvement at Deacon-road is to be carried out at an estimated cost of £4,400.

SEWERAGE AND SEWAGE DISPOSAL.

Bradford T.C.—The Sewage Committee have reaffirmed their decision, referred back from the council, to have the Esholt Valley crossing of a composite character, partly masonry and partly an embankment. They accepted, however, the suggestion of the two engineers that the embankment should be on the Esholt side of the aqueduct only, with arches from the Strangford side over the river and the earthen embankment for the rest of the way. The masonry portion will allow of an 18-ft. road, and the embankment will be 40 ft. wide. The cost of the amended scheme is estimated at £72,000.—A proposal is made for the extension of the Thornton Valley sewer to Thornton sewage works, at a cost of £830.

Chelmsford T.C.—In the report of the Joint Sewerage Committee it is stated that there would be no necessity to make a call upon the constituent authorities for the ensuing year for the sewage farm. It was estimated that the expenses would exceed the receipts by £300, but the receipts in the past year had exceeded their estimate by £343.

Eastbourne R.D.C.—The Pevensey and Westham Sewerage Committee have placed on record their appreciation of the integrity, ability and assiduity with which Mr. John Howie Wylie had carried out the duties of resident engineer over a period of nearly two years under circumstances of considerable difficulty, and of his unfailing courtesy and tact. He had also carried out tidal observations, and made various valuable records of strata and other particulars of the scheme, for which the committee tendered him their best thanks. The committee also recommended that a suitably inscribed copy of this resolution should be presented to him.—Mr. E. J. Dann moved the adoption of the report, and it was carried unanimously, it being mentioned that the scheme had cost over £2,000 more than the estimated cost, £13,000 in all.

Kirkcaldy T.C.—Mr. Lumsden, burgh engineer, has submitted two schemes for improving the drainage of the west end of the burgh. Under the first scheme he proposed a new main sewer along the Sands-road from Coal-wynd to Buchanan-street. The cost of this scheme, including the outfall and the cost of the Tiel Burn sewer, was estimated at £14,455. The second proposal was for a new main sewer from Coal-wynd to Charlotte-street. The cost of this scheme, including the cost of the Buchanan-street outfall and the cost of the Tiel Burn sewer, was £8,674.

Lichfield R.D.C.—The tender of Messrs. Sharp & Sons, at £335, has been accepted for the construction of the Armitage sewage disposal works.

Oakengates U.D.C.—It was stated at the council last week that it is intended to carry out a sewerage scheme shortly at a cost of nearly £15,000.

Reading T.C.—A surface-water sewer is to be laid in George-street, at a cost of £235.

Uxbridge R.D.C.—Tenders are to be obtained for an iron shed for the Harefield sewage farm.

Wenlock T.C.—The sewerage scheme has been completed at a cost of £4,553, which is £450 less than the estimate. The engineers reported that the work was most satisfactorily completed by the contractors and resident engineer.

WATER, GAS, AND ELECTRICITY.

Birkenhead T.C.—Excellent progress is being made with the initial work involved in the great scheme under which, in four or five years' time, Birkenhead will be receiving its water supply from the river Alwen. It is about two years since the construction of the Alwen reservoir was entered upon by Messrs. Robert MacAlpine & Sons, and the work is now so well advanced that, unless some great unforeseen difficulty arises, its conclusion by the date stipulated seems well assured.

Faversham R.D.C.—Proposals are under consideration for the extension of the water supply to Boughton at an estimated cost of £1,000.

Ludlow R.D.C.—As a preliminary a borehole is to be sunk at a cost of £250 in connection with the scheme for providing a water supply for Craven Arms.

Rochdale T.C.—Mechanical filters are to be provided at Ramsden reservoir, at a cost of about £6,000.

Spalding R.D.C.—The Local Government Board, it is announced, have sanctioned the scheme for the pur-

chase by the council of the Hop Hole bore for the purpose of a water supply.

Stafford T.C.—The Gas Committee report that from the profits of the gas undertaking £3,350 will be available in aid of the district rate.

MISCELLANEOUS.

Bournemouth T.C.—A scheme for trackless trolley cars has been referred to a committee for consideration.

Dublin T.C.—It has been decided to pay equal salaries to men and women sanitary inspectors subject to the approval of the Local Government Board. The resolution stated that women and men had the same examinations, the same hours, and equally important work.

Scarborough T.C.—The proposed harbour improvements have been approved by the Scarborough Corporation. The improvements include the construction of an additional fish-landing stage, the deepening the inner harbour, and the underpinning of the existing piers. It is estimated roughly that these improvements will involve an outlay of some £40,000.

PERSONAL.

Mr. W. A. Jackson, surveyor to the Malton Urban District Council, has had his salary increased by £20 a year.

Mr. A. E. Coupe, surveyor to the Fulwood Urban District Council, has had his salary increased to £200 per annum.

Mr. George Ford, city surveyor of St. Albans, has resigned owing to ill health. Mr. Ford has held the position since 1879.

Mr. Peter Sinclair, burgh surveyor of Carnoustie, has been appointed burgh surveyor and sanitary inspector of Buckhaven.

Mr. Arthur Tradewell, water engineer's office, Nottingham, has been elected an associate-member of the Institution of Civil Engineers.

Mr. B. Cooper, assistant to the Paddington borough surveyor, and chief draughtsman in the sewers department, has been granted an increase of salary.

Mr. E. G. Whitcombe, assistant surveyor to the Chipping Sodbury Rural District Council, has been appointed surveyor to the Winchcomb Rural District Council.

Mr. C. E. Hines, surveyor to the Windermere Urban District Council, has been appointed the council's delegate to the International Road Congress to be held in London next June.

Mr. F. L. Burch, surveyor of East Dereham, has been appointed surveyor to the St. Helens Urban District Council, Isle of Wight, at a salary of £135 per annum, with residence.

Mr. Stanley Olver, surveyor of the Newton Abbot Rural District Council's northern district, has been granted an increase of salary of £10 for one year, and then by annual increments of £5 to a maximum of £175.

Mr. W. W. Gale, surveyor to the Carshalton Urban District Council, was among those called to give evidence at the Surrey County Council inquiry into the proposed dismemberment of the Croydon Rural District. The inquiry was opened at Kenley on Thursday of last week.

Mr. Higgins, assistant surveyor to the East and West Molesey Urban District Council, has been, we regret to learn, so seriously injured at football, while playing for the reserve team of the Queen's Park Rangers, that it has been necessary for him to undergo treatment for septic poisoning.

Mr. W. Hadley Darby, surveyor to the Kettering Rural District Council, has resigned to take up an appointment as inspector of main roads under the Warwickshire County Council. Regret was expressed at the resignation, and the council resolved to grant Mr. Darby a testimonial under seal.

Mr. W. Parker, sanitary inspector to the East and West Molesey Urban District Council, who has resigned his position to take up a similar appointment under the Croydon Rural District Council, was the subject of well-deserved complimentary reference at the council's monthly meeting last week, when it was resolved to advertise for a successor.

Mr. R. G. W. Clements, ASSOC.M.INST.C.E., deputy borough surveyor of Brighton, read a paper on the subject of the relief sewer now in course of construction at Brighton at a meeting of the Public Health and Local Government Officers' Association for Sussex held on Saturday last. Previous to the meeting the members of the association inspected sections of the sewerage works.

Mr. W. Norman Ashplant, the newly appointed city engineer of London, Ontario, Canada, who took up his duties on the 1st instant, was engaged in the municipal engineering department of Cape Town, where he was attached to the staff of Mr. R. O. Wynne-Roberts, M.INST.C.E., who, as our readers are aware, is now engineer for the water supply of Regina, and is also reporting on a large power scheme for the Government of Saskatchewan.

Mr. T. R. Wilton, ASSOC.M.INST.C.E., 18 Westminster Chambers, 1 Crosshall Street, Liverpool, has taken into partnership Mr. Guy Kenyon Bell, ASSOC.M. INST.C.E., who was formerly an assistant to Mr. A. G. Lyster, vice-president of the Institution of Civil Engineers (at that time engineer-in-chief and now consulting engineer of the Mersey Docks and Harbour Board), and who latterly has been a resident engineer on the Canadian Northern Railway. Mr. Kenyon Bell, while with the Mersey Docks and Harbour Board, had considerable experience of the design and construction of large dock works, of reinforced-concrete work and of dredging, and during the time that he was with the Canadian Northern Railway he had charge of the construction of a section of main line and of bridges, including a large bridge 1,000 ft. in length.

"THE SURVEYOR" CONFERENCE AT OLYMPIA.

PROPOSITIONS TO BE SUBMITTED.

The following is the full text of the five propositions which will be submitted for discussion at THE SURVEYOR conference to be held at Olympia on Saturday, the 19th instant, at 3.15 p.m. We hope to be able to give in our next issue the names of those who will submit them.

(1) That in order to satisfy modern requirements in connection with the maintenance and improvement of roads it is essential that every highway authority having the charge of important roads should possess an efficient engineering organisation, and that great attention should be paid to the selection, conditions of employment and organisation under each authority of a thoroughly trained and adequate engineering staff.

(2) That it is desirable that facilities should be afforded and some form of organisation adopted to enable surveyors of small districts to obtain official advice, assistance and supervision from county surveyors, and that county surveyors should, where necessary, be provided with special engineering assistance to enable this advice and assistance to be effectually afforded.

(3) That it is desirable to encourage the publication and dissemination throughout the profession of annual reports by highway surveyors setting forth full particulars, arranged under heads as uniform as possible for purposes of comparison, in regard to work done, including all essential details as to materials, methods and costs, together with summaries of practical results obtained on different roads classified according to amount and character of traffic; that these reports should be circulated and exchanged between all surveyors of important highway authorities, and that arrangements should be made by highway authorities to enable their surveyors to visit and inspect work carried out in other districts, so that by frequent conference and interchange of experience among road engineers the science of road construction and maintenance may be advanced.

(4) That the question of drainage of subsoil water from roads as distinguished from surface drainage is of pressing importance on many roads and in many districts, and should receive the special attention of road engineers.

(5) That the terms asphalt and bitumen and other terms used in connection with tar-bound or bituminous-bound roads should be defined by some authoritative body, and that the attention of the Road Board be directed to the matter.

DUBLIN BOROUGH SURVEYOR APPOINTED.

A CANDIDATE'S PROTEST.

Three candidates' names were before the Dublin Corporation on Monday last in connection with the office of borough surveyor and engineer to the waterworks, rendered vacant by the death of Mr. J. G. O'Sullivan—viz., Mr. Henry Allen, Mr. Francis Bergin and Mr. Michael J. Buckley.

The town clerk stated that he had taken the opinion of Mr. Stephan Ronan, who had decided that Mr. Bergin was not an officer of the council, and was not entitled to be a candidate. The only qualified candidates were Messrs. Henry Allen and Michael J. Buckley.

The vote, which was by ballot, resulted as follows: Mr. Buckley, 38; Mr. Allen, 36.

Mr. Buckley was accordingly declared elected.

The town clerk read a letter from Mr. Bergin formally protesting against his exclusion from the list of candidates, and stating he would take such other steps as he was advised.

Institution of Mechanical Engineers.—The summer meeting of this body will be held at Cambridge, commencing on Monday, July 28th.

FOR OTHER ADVERTISEMENTS

See End of Paper.

COUNTY BOROUGH OF HALIFAX.
BOROUGH ENGINEER'S AND SURVEYOR'S OFFICE.

The Council of the County Borough of Halifax invite applications for the positions of three Engineering Assistants in the Engineer's Department, at the respective salaries of £120, £100, and £90.

Applications, in the handwriting of the applicants, giving full particulars of experience and qualifications, accompanied by copies of three recent testimonials, endorsed "Engineering Assistant, 1, 2, or 3," as the case may be, must be sent not later than Monday, the 21st inst., addressed to Mr. James Lord, M.INST.C.E., Town Hall, Halifax.

Canvassing by, or on behalf of, a candidate will disqualify.

(By order)
PERCY SAUNDERS.
Town Clerk.

Town Hall, Halifax.
April 9, 1913.

WANTED, in a county surveyor's office in the South of England, a Junior Surveying Assistant, at a salary of £100, rising to £130 per annum, to include the provision and upkeep of a bicycle. Age not to exceed 27 years. The duties of the person appointed will be to assist with making surveys, the calculation of stresses, and the design of bridges. He must also have a knowledge of architecture and the getting out of quantities, and must be a good draughtsman. When working outside the office reasonable out-of-pocket expenses will be allowed. The appointment will be determinable by one month's notice on either side. Applications, stating age and experience, giving references and enclosing copies of three recent testimonials (which will not be returned), to be sent to Box 1,233, office of THE SURVEYOR, 24 Bride-lane, Fleet-street, E.C., not later than the first post on April 25th. (353)

TO ENGINEERS. — Wanted, an Experienced Assistant for a few weeks to prepare drawings for a sewerage scheme and additional machinery in connection with waterworks. State experience and salary required.—Address Box 1,234, office of THE SURVEYOR, 24 Bride-lane, Fleet-street, E.C. (354)

MAIN ROAD SURVEYOR, well up in tar-painting, tarmac and ordinary work, desires temporary post immediately, preferably under County Surveyor. Highest references. Personally known to Editor of THE SURVEYOR.—Box 1,236, office of THE SURVEYOR, 24 Bride-lane, Fleet-street, E.C.

FOR SALE.—30 volumes Proceedings of Institution of Civil Engineers; limp covers; 1905 to date; complete set, perfect condition.—Box 1,235, office of THE SURVEYOR, 24 Bride-lane, Fleet-street, E.C. (355)

EAST SUFFOLK COUNTY COUNCIL.

MAIN ROADS.

TENDER FOR ROAD MATERIALS, CARTAGE, TEAM LABOUR, AND TOOLS.

The East Suffolk County Council are prepared to receive Tenders for the following, for the three Districts in the County—namely, Ipswich, Halesworth, and Eye—to the 31st March, 1914:—

(1) Supply of Granite, Flints, &c.
(2) Supply of Local Gravel, Sand, and Grit.
(3) Supply of Tools and Road Implements.
(4) Cartage of Road Materials and for Team Labour.

Specification and Forms of Tender can be obtained on application to the Chief Surveyor of Main Roads, County Hall, Ipswich, and applicants are requested to state which of the Forms of Tender they require, and also the name of the District.

Sealed Tenders, endorsed "Tender for Roads," should be delivered at the Office of the Clerk of the County Council, County Hall, Ipswich, on or before the 24th April, 1913.

The Council do not bind themselves to accept the lowest or any Tender.

A TOWNSHEND COBBOLD,
Clerk of the East Suffolk County Council.

County Hall, Ipswich.
April 9, 1913. (350)

SCUNTHORPE URBAN DISTRICT COUNCIL.

The above Council invite Tenders for the Supply of Broken Granite and Chippings, delivered free to Frodingham Station. The estimated quantity required is 650 tons and 60 tons respectively, but the Council do not bind themselves to any specific quantity.

Tenders, endorsed "Tenders for Granite," on a Form which can be obtained from my Office, are to be sent to me, with samples, not later than noon on the 22nd day of April, 1913.

C. CURTIS GRAY,
Engineer and Surveyor.

Council Offices,
Scunthorpe.
April 7, 1913. (351)

THE REPTON RURAL DISTRICT COUNCIL.

REPTON SEWERAGE.

The Repton Rural District Council are prepared to receive Tenders for the Construction of about 2½ miles of 9-in. Stoneware and Cast-iron Pipe Sewers, with Manholes and Accessories, also the Erection of Engine-house, Screening Chamber, Pump Well, Tanks, Filters, Sludge Lagoons, the Supply and Fixing of Engines and Pumps and other Works.

Plans and Specification may be seen, and further particulars and copies of the Bills of Quantities and Form of Tender obtained, on or after Wednesday, the 9th April, at the Offices of the Engineers, Messrs. John Shaw, Son & Fuller, of the College, All Saints, Derby, on payment of a deposit of Two Guineas, which will be refunded on receipt of a *bonâ-fide* Tender and the return of all documents.

Sealed Tenders, on the Form supplied only, and endorsed "Repton Sewerage," are to be delivered at my Office not later than 12 o'clock noon on Wednesday, the 30th April.

The Council do not bind themselves to accept the lowest or any Tender.

C. F. CHAMBERLIN,
Clerk to the Council.

Union Offices,
Burton-on-Trent.
April 9, 1913. (352)

BOROUGH OF CONWAY.

The Conway Suspension Bridge Commissioners invite Tenders for the Cleaning, Scraping and Painting of Conway Suspension Bridge according to the Specification, &c., of their Engineer, Mr. F. A. Delamotte, Town Hall, Conway, at whose office the Form of Tender and all information may be obtained on payment of £1 1s., which will be refunded on receipt of a *bonâ-fide* Tender.

Tenders, endorsed "Bridge Painting," to be forwarded to me on or before the 3rd May, 1913.

HUGH PARRY,
Town Clerk.

Town Hall,
Conway.
April 8, 1913. (347)

Reinforced Concrete.*

By PERCY J. WALDRAM, F.S.I.

I would ask to be allowed to regard reinforced concrete merely as a building material, and to discuss on broad lines the reasons why in some cases it is advantageous and profitable to use it, while in other cases it is not. It would appear to be essentially the province of surveyors to form a fair and businesslike estimation of its advantages and its disadvantages, because, without going into intricate calculations, it is possible to arrive at a sufficient and correct opinion of its general physical character and of the conditions essential to its proper production, and when these are clearly grasped the problem resolves itself into a matter of ordinary valuation.

When properly designed and properly made in situations where it is suitable, reinforced concrete is rot-proof, vermin-proof, fire-resisting, almost waterproof, and grows stronger with age instead of decaying. It can also be readily moulded to any given form, and in entire structures it is wonderfully monolithic—a very considerable advantage on bad foundations. But, at the same time, it is not a material to be used without accurate knowledge of its limitations. It must be designed with skill, made with more than customary care, carefully nursed during its infancy, and protected during the whole of its lifetime from agencies which are deleterious to cement, such as impermeating oils and acids.

In some cases these disadvantages are immaterial, and it is the peculiar province of the surveyor to estimate them.

In all situations where plain concrete, brickwork, or masonry would customarily be employed it can be expected to do the same work with far less bulk of material. But, on the other hand, its use invariably entails extra expenditure in casing, which may or may not outweigh the saving of material. A retaining wall, for instance, in reinforced concrete will do the same work as a solid brick or concrete gravity wall at a fraction of the cost, but in ordinary dwelling-house solid walls, where there is not much thickness which can properly be saved, reinforced concrete and its casing must be expected to prove more expensive than brick or stone.

On account of the great difference between the stiffness of steel and concrete, as well as between their respective strengths, it is a matter of no small mathematical difficulty to devise formulæ which will tell us accurately how such an ill-matched team are going to pull together upon any given load, and what work we can safely entrust to them without running the risk of the too willing steel being overworked, or setting a pace which the concrete cannot keep up with. Even at the present time, after engineering scientists all over the world have been engaged for years upon the subject, there are still problems which no text-books meet.

The proposed regulations of the London County Council, which are still under consideration, are eloquently silent with regard to deflection, and to the behaviour of beams and slabs for heavy loads, which require double reinforcement; while the clauses which relate to the strength of columns are based upon approximations covering large differences of actual strength.

Reinforced concrete suffers, and suffers badly, from the incubus of tedious and intricate calculations, and it is pleasant to be able to say that the results given by all formulæ can be plotted to curves. When these are drawn to a large scale, the slightest inaccuracy in calculating them is seen in some irregularity in the sweep of the curve. When they are used instead of the formulæ, the designer's task is reduced to that of selecting values from a set of diagrams, in precisely the same way that he now selects a joist or the properties of a stanchion from a table of British rolled sections.

In my own office we have almost completely eliminated the necessity for using the long standard formulæ, having plotted them all on diagrams. The saving of time and trouble effected by their use is enormous, but what is far more important is the notable gain in accuracy. If a draughtsman has a long and intricate formula to work to, the chances of error are far greater than if he has merely to take a value from a plotted curve.

Another important and unexpected advantage which results from the substitution of curves for tedious mathematics is the rapidity with which the designer can grasp the possibilities of a problem, can compare reinforced concrete with other materials, and, if it is found suitable, select the particular form in which it will give the results which combine efficiency and economy.

In a material which has a high ratio of dead weight to strength it is frequently only possible to secure a proper factor of safety by eliminating all superfluous bulk.

MATERIALS.

The stereotyped clause that "all materials should be the best of their respective kinds" is not one to be lightly interpreted. They must be of the very best. If the sand requires washing, it is far better out of the work altogether. Washing often removes those finer particles which are essential to a strong, dense mixture.

The aëration of cement should never be necessary. If it is of the proper quality and sufficiently ground, it will have been properly aërated by the manufacturer; in which case further aëration will only tend to render it inert. Even if kept too long in sacks it will be found to cake. Cement should be slow or at least medium setting, and should pass the British standard tests.

The aggregate should consist of large, small, and medium-sized particles, the largest of which will easily pass between the reinforcing bars.

GRADING AND PROPORTIONING.

The presence of small voids in ordinary concrete may be quite harmless, but in reinforced concrete every effort must be made to eliminate them by careful mixing and thorough damping. They may be the means whereby damp may enter and rust the rods, causing them to swell and burst off their cover. In beams there are high stresses concentrated on very small areas of cross-section, in which the presence of a void may be very serious. Voids may also interfere with the adhesion between metal and reinforcement at a vital point. It is therefore necessary to fix the proportions of the aggregate, sand and cement, with some care, so that the interstices of the larger materials may be exactly filled by the smaller, and a thoroughly dense mixture secured.

Ballast aggregate should never be assumed to possess the correct amount of sand. The latter should be screened out, and the correct proportion added back.

STEEL.

There are on the market many types of patent reinforcement and varieties of hard, high carbon steels.

The advisability of adopting any of them in a given situation is a complicated question. For ordinary work ordinary merchant bars of British standard steel are difficult to beat.

BENDING.

If reinforcements are, as they should be, kept as small as possible, all ordinary bendings can be done on the site by means of bending irons and a few iron pegs fixed into a wooden baulk. The only machine necessary for ordinary work is an efficient pair of shears. Loose scale should be cleaned off with a wire brush, but a slight coating of rust is not disadvantageous.

CASINGS AND FALSEWORK.

These should be made of stout well-seasoned wood, put together with a view to stolid firmness while the concrete is setting, and afterwards coming away easily without jarring or hammering.

Unless concrete is kept absolutely quiet and still until it hardens, the process of setting will be seriously interfered with or arrested altogether. For this reason the ideal connection for casings consist of outside bolts and straps, but the next best method is by square-cut nails with the heads left projecting half an inch, so that they can easily be drawn by the leverage of a claw-hammer or a split crowbar.

* Extracts from paper read at a meeting of the Surveyors' Institution on Monday evening last.

Screws are apt to rust in badly, however well they may be greased.

It generally pays to plane such parts of the casing as come into contact with the concrete, so that it will come away easily, leaving a smooth finished face. With the same object in view the forms are sometimes oiled. This should be done with care. The oil should be thin and allowed to dry.

MIXING AND PLACING OF CONCRETE.

In all cases where the concrete will be heavily stressed in compression it pays to use a rich, strong mixture (say, 1-1½-3), rather than to make up the deficient strength of a weaker mixture by means of compressive reinforcement, which must always be expensive and uneconomical.

When the mixing is done by hand, the sand and cement should be thoroughly mixed first until the colour is a uniform grey, then the aggregate should be added and mixed, and finally the water in measured quantity, the whole being then turned over until it is of uniform consistency. Machine mixing should combine a tipping with a rotary motion, unless the rotating drum is provided with inside blades.

NURSING OF GREEN CONCRETE.

It is impossible to overrate the importance of keeping the concrete thoroughly wet and perfectly still until setting is complete. It should be kept watered and protected from drying winds and sun for the first week or ten days of hardening, and it should be somebody's particular duty to see to this over week-ends and holidays.

TEST CUBES.

In all large work small test cubes of concrete should be made from each batch of concrete, tamped to the same degree as the concrete in the work, kept under the same atmospheric conditions, and tested by crushing.

Cubes of 4-in. side or 6-in. cylinders are usually specified, but it is not easy to construct a machine which will crush these. It is far better to have plenty of 3-in. cubes crushed on the site by a simple lever testing-machine made of 11-in. floor joists, than to send, at considerable expense, one or two 6-in. cubes to be crushed at the nearest town which possesses a 50-ton testing-machine.

The chief points in favour of reinforced concrete are:—

(1) Its freedom from decay and its improvement with age.

(2) Its impermeability, which prevents insects and disease germs from harbouring in it.

(3) Its monolithic character.

Its chief disadvantages are:—

(1) Its cost.

(2) Its weight and bulk for a given degree of strength.

(3) The difficulty of making alterations in it, or of strengthening parts which prove to be weak.

Upon these general considerations it is possible to form a general opinion as to whether, in any given situation, its use would probably prove advantageous or the reverse.

It should be expected to show advantages in efficiency or economy, or both, in situations where—

(*a*) Fire risk is a predominant or an important consideration.

(*b*) Repairs and renewals are expensive, inconvenient or difficult; or where neglected or unperceived decay is dangerous—as in sea reclamation works, reservoirs, storage tanks, &c.

(*c*) Where a hard, impervious surface, which can be readily cleaned, means money in the long run—as in the walls, floors and fittings of farm buildings, and especially of dairies, in storage tanks, grain stores, silos, &c.

(*d*) Where it can be substituted for plain concrete or thick masonry—as in retaining walls, foundations, rain-water tanks forming the roofs of dairies, water towers, and above-ground ensilage silos.

(*e*) Where considerable repetition reduces the cost of centering and falsework—as in piggeries and cowhouses, and their fittings, mangers, troughs, &c.

(*f*) In large complete buildings of a straightforward character—such as storage warehouses, especially on poor foundations.

It would be handicapped by its weight, bulk, cost, and by its permanent character where—

(*a*) Long spans or heavy loads are involved.

(*b*) Where steel or timber can be used for the same purposes without disadvantage.

(*c*) Where the work is small, and there is little or no repetition to enable casings to be reused, as in single cottages.

(*d*) Where the finished details of the work are not or cannot be settled, or where a building is only required for a few years. Cutting or altering a reinforced building, or pulling it down for re-erection elsewhere, are all but impossible.

The application to any given case of these general factors is practically ordinary valuation. As a simple illustration the case of fence posts may be taken. These can never be so strong as wood, size for size; but as more than half the safe strength of wood is earmarked for deterioration, this point is immaterial. In concrete they cost more than wood, whether bought ready-made or made in slack times; but then they require no upkeep or renewals, and the question is narrowed down to a comparison very similar to that which must be made between the present value of a well-secured freehold and of a leasehold term which is under the liability of a strict repairing clause, with a substantial fine in the shape of strayed or injured cattle awaiting any breach of covenant.

I suggest that nearly all cases can be treated in much the same way. The considerations are often more intricate and involved, but not more so than those which must be appraised in ordinary valuation.

THE APPLICATION OF REINFORCED CONCRETE TO RURAL HOUSING.

I have been asked to discuss the possibility of using reinforced concrete to solve some of the difficulties of building inexpensive cottages in rural districts.

I approach this question with diffidence, having no actual experience with regard to the building of cottages with materials other than ordinary brickwork, masonry, wood, &c., used in the ordinary manner; my knowledge of the many novel methods which have been suggested for the building of cheap cottages being limited to a study of their actual and possible disadvantages.

The essential structural requirements of cottages and small houses in rural districts are:—

(*a*) That the construction should be as inexpensive as is compatible with efficiency and durability.

(*b*) That the walls should be not only weather and damp proof, but should form an insulation against changes of temperature at least equal to that possessed by a 9-in. brick wall.

(*c*) That they should not disfigure the landscape.

(*d*) That they should be sufficiently substantial and fireproof to comply with reasonable or reasonably interpreted by-laws.

With regard to the last requirement, compliance with model by-laws may not be absolutely essential, but it is futile to discuss building methods which would be contrary to a reasonable interpretation of their efforts to obtain sound and substantial construction. It may be possible to secure the authorisation of some special relaxations all over the country if good cause be shown, but drastic alterations are highly improbable.

There can be but little doubt that a cottage built in reinforced concrete in the form in which we are accustomed to see it in warehouses and office buildings (a form which has been evolved with a view to securing economy with efficiency), would be so expensive in first cost that it would compare very unfavourably with sound construction in brick, masonry and wood; while the saving in fire insurance and repairs would be almost negligible, at any rate for some years. The use of reinforcement could only be justified by making the walls thin, and reinforced-concrete buildings with thin walls are by no means easy to warm properly in the winter. Add to this the fact that such cottages would also be, in all probability, supremely ugly, and it may be fairly concluded that the ordinary constructions of walls, floors and roofs in reinforced concrete is not likely to aid the solution of the difficult and complex problem of rural housing.

There are, however, other ways in which the properties of cement concrete, and the particular advantages of reinforced concrete, can be enlisted.

The manufacture of large, hollow, cement-concrete building blocks by means of hand machines, which any intelligent labourer can operate, is becoming a

well-established method of producing a cheap and efficient material for the building of walls. Being hollow, these blocks can be handled in large sizes, which reduces the joints and the upkeep in pointing. The internal air space also greatly aids their heat-insulating properties. As regards appearance, they can either be made to imitate stone or be rough cast, and they can be either plastered inside or pointed, distempered or painted. They can be made in slack times and stored until thoroughly hard and mature. Not being reinforced, they form simply a substitute for brick or stone, and the question as to whether in any given locality their use would materially reduce cost depends upon the cost of brick or stone in that locality, which is a matter for local consideration.

Probably in all situations other than those in the immediate neighbourhood of brickfields, and of quarries of good building stone, the balance of first cost would be in their favour.

CHEAP BUILDING.

As regards reinforced concrete proper, I have no brilliant scientific solution to offer, but I venture to suggest that if we study rural housing as practised some 500 or 600 years ago in the light of modern experience of reinforced concrete in farm buildings, there are substantial savings to be made by the new material over the cost of ordinary modern construction in brick and stone, without affecting but rather improving the health and comfort of the inhabitants of the building, and without transgressing any reasonable by-laws.

The modern house consists of walls built up from continuous foundations, and strong enough at all parts to withstand any ordinary or even extraordinary loads which may be imposed upon them from floors and roofs. We therefore start off with a structural scheme which is carelessly wasteful, using the same strength of walls everywhere, whatever their load, and keeping out the weather and damp with a porous material of poor insulating qualities against heat and cold, and possessing a very large number of joints.

The builders of the old houses first constructed a skilfully designed skeleton of hard timber to carry the loads, with the weight concentrated on posts let firmly into the ground. This skeleton they then filled in with plaster or clay, reinforced with wattles, often plastered or rough cast outside. It is certainly not only possible, but established and well-tried construction, to do in reinforced concrete what the mediæval builder did with stout oak and wattle and daub, and to do it, perhaps, a little better.

We cannot expect to be allowed to build nowadays with timber framework, nor to use reinforced mud filling, but we can certainly construct large corner posts very easily and very cheaply in reinforced concrete, and after letting them into the ground we can, by means of square trough casings, which can be re-used many times, cast beams between them all round at the first floor and at the roof level, forming, in fact, a framed skeleton similar to that which the mediæval builder constructed with oak baulks. As we frequently build such frames to-day in reinforced concrete to carry the enormous weight of water tanks, they are surely good enough to carry the floors and roof of a cottage. The filling material, which would stand on the 6-in. site concrete, can be constructed in many ways which would be quite as weather-proof as a 9-in. brick wall, would give far better insulation against heat and cold, and, what is by no means unimportant, would cost much less. For instance, double concrete slabs with mesh reinforcement and straining wires could be cheaply made and stocked either by a country builder or by estate workmen in slack times, and fixed with an air space between. This is a well-known and well-tried form of construction.

Another substitute for the old wattle and daub would be a method which is somewhat largely adopted in America—viz., the reinforced-concrete skeleton walls could be filled in with a timber framework creosoted or treated against dry rot. This framework, which incidentally forms the door and window frames, is covered on the outside either with thin reinforced slabs screwed on and rough cast or merely pointed, or with deeply ribbed expanded metal lathing rendered with fine concrete about 2 in. thick, forming, when set, a strong weather-proof reinforced outer skin with no joints. The inside face is either plastered or boarded, and the whole forms a very inexpensive yet a very efficient hollow wall, fire-resisting, weather-proof, and of good insulating properties.

It will be seen that this method of utilising the characteristics of reinforced concrete to reduce the cost of rural housing by no means involves the terrible monotony of the American "poured" house, whose chief merit is apparently that some hundreds of precisely similar cottages can be constructed from one set of iron moulds. On the contrary, by going back to the traditional methods of skeleton-frame construction, the designer is far less hampered in detail than with brick or masonry walls.

For instance, the old-fashioned overhanging first floor, giving additional bedroom accommodation over a shady porch below, would rapidly spring into favour if such obvious structural facilities for it were provided; as would also many similar picturesque features which to-day we reverence so deeply, but which had their commonplace origin many centuries back in the dictates of structural necessity and economy.

The cost of 9-in. external walls to a pair of small semi-detached brick cottages, such as we try to build for £300 a pair, and so seldom succeed in doing, may be taken as forming a rectangular block, about 35 ft. by 20 ft., and about 17 ft. 6 in. high from the ground level to the eaves. With ordinary doors and windows these walls would cost about £113. The same walls formed of corner posts connected with transverse beams at the first floor and roof level, all in reinforced concrete, and filled in with slab or similar double filling, resting on the 6-in. concrete over the site, would cost about £50, representing a saving of £60, or £30 a house, irrespective of the saving of door and window frames and the availability of the concrete casings for re-use. It is sound orthodox construction in reinforced concrete involving the minimum of expense in casing, and is as applicable for single houses as for pairs and groups. I cannot point to any cottages actually so constructed, but post and filling walls in reinforced concrete have been applied with considerable success in farm buildings.

I submit it for your consideration as one way in which the new material can properly be called upon to effect in rural housing at least part of that saving in cost which is almost invariably so highly essential and, at the same time, so difficult to effect.

INSTITUTION OF MUNICIPAL AND COUNTY ENGINEERS.

President—Mr. R. J. Thomas, M.Inst.C.E., County Surveyor, Buckinghamshire.

EASTERN DISTRICT.

District Chairman: Mr. Alfred Fidler, M.Inst.C.E., Northampton.

An Eastern District meeting is to be held at the Building Trades Exhibition, Olympia, on Saturday, April 19, immediately after the conference of engineers which is being held—probably at about 4.30 p.m.

Business.—To consider the formation of the Mutual Defence Fund. Any other business of interest introduced by the members.

E. J. Elford, Borough Engineer, Southend-on-Sea.

A. Fidler, Borough Engineer, Northampton.

VISIT TO AMSTERDAM AND THE HAGUE, WHITSUNTIDE.

Arrangements have now been completed for the visit of the institution to Amsterdam and The Hague next month.

Ladies are especially invited to attend this meeting.

Programme.

Thursday, May 8th.

Leave London (Liverpool-street Station) at 8.30 p.m. via Harwich and the Hook of Holland.

Friday, May 9th.

Arrive at the Hook of Holland and proceed to Amsterdam, arriving 7.30 a.m.

12.45 p.m.—Carriages leave hotels.

1.0 p.m.—Reception at the town hall by the Burgomaster and Aldermen of Amsterdam.

1.25 p.m.—Leave the town hall.

1.30 p.m.—Arrive at the Exchange, where the party will be received by Mr. A. W. Boss, the Director of Public Works, who, with Mr.

F. S. Jacob and Mr. P. Lohr, city engineers, will give a description of the drainage and sewerage works of Amsterdam, dealing with the special difficulties presented by the peculiarities of the country, after which the members will proceed to visit works in course of construction (*inter alia*), the sewage pumping stations (electric pumps), the old and new sewage outfall works, tramway garage.

6.0 p.m. Return to hotels.

Saturday, May 10th.

9.30 a.m.—Carriages leave hotels; visit to the city gasworks. These works are described as an installation with apparatus up-to-date in every detail.

1.0 p.m.—Return to hotels.
Afternoon free.

Sunday, May 11th.

10.0 a.m. Leave Amsterdam for trip to the Isle of Marken.

6.0 p.m.—Arrive back at Amsterdam.

Monday, May 12th.

Leave Amsterdam by train for Leyden. Take steamer trip; luncheon on board.
Return by train from Leyden to Amsterdam.

Tuesday, May 13th.

8.40 a.m. Leave Amsterdam for The Hague. On arrival at The Hague, leave luggage at the Consigne. Carriages will convey the party to the abattoirs (these are considered the best example in Europe). The members will be received by Mr. Lindo, the Director of Public Works.

1.0 p.m.—Luncheon.
The members will visit "The House in the Wood," by kind permission.
Drive to Scheveningen.
Dinner at hotel.

10.47 p.m.—Leave The Hague for the Hook of Holland.

11.50 p.m.—Leave the Hook of Holland by steamer for Harwich.

Wednesday, May 14th.

Arrive Harwich and proceed by train to London, reaching Liverpool-street Station at 8.0 a.m.

NORTH-EASTERN DISTRICT.

A meeting of the institution will be held in the North-Eastern District at Newcastle-on-Tyne on May 2nd and 3rd next.

SCOTTISH MEETING.

A meeting of the institution will be held in the Scottish District at Dundee on June 6th and 7th.

ANNUAL MEETING.

The annual meeting of the institution will be held from July 16th-19th.

Thomas Cole,
Secretary.

92 Victoria-street, S.W.

INSTITUTION OF MUNICIPAL ENGINEERS.

President—Mr. Frank Latham, M.Inst.C.E.I., F.S.E., Borough Engineer and Surveyor, Penzance.

GENERAL MEETING.

A visit will be paid to the International Building Trades Exhibition, at Olympia, London, on Saturday, April 12th, at 3.30 o'clock.

Programme.

3.15. Meet at the exhibition entrance.
3.30.—Informal meeting within the exhibition.
4.0.—Proceed to inspect the various exhibits.
4.45.—Adjournment for tea, at the kind invitation of Mr. H. G. Montgomery.

Tickets of admission have kindly been supplied by the exhibition authorities.

NORTH-WESTERN DISTRICT.

A meeting will be held at the Victoria Hotel, Manchester, on Wednesday next, at 7 o'clock, when a paper on "Sewage Treatment" will be read by Mr. R. J. McKenn, manager of the Heywood Corporation sewage works. Members will remember that a very interesting paper was read by Mr. McKenn at the Heywood sewage works in April of last year, and it is to be hoped that the attendance will be as large as it was then. The paper will afford excellent scope for full discussion.

J. W. Gleave,
Hon. District Secretary.

Brantwood,
Coomassie-street,
Heywood.

The following council meetings have been arranged: April 30th, London; May 31st, Manchester; June 28th, London; July 30th, London.

B. Wyand,
Secretary.

39 Victoria-street, S.W.

ILLUMINATING ENGINEERING SOCIETY.

A paper by Mr. A. P. Trotter on "The Specification of Street Lighting," giving an account of the work of the Joint Committee of the Institution of Electrical Engineers, the Institution of Gas Engineers, the Institution of Municipal and County Engineers, and the Illuminating Engineering Society will be presented at a meeting of the last named body at the Royal Society of Arts, 18 John-street, Adelphi, London, on Tuesday next, at 8 p.m.

The paper will not be read. The discussion will be opened after some introductory remarks by the author.

Members of the Institution of Electrical Engineers, the Institution of Gas Engineers, and Institution of Municipal and County Engineers are invited to attend, and they may obtain copies of the paper on application to Mr. L. Gaster, the hon. secretary of the Illuminating Engineering Society, 32 Victoria-street, S.W.

APPOINTMENTS VACANT.

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CLERK OF WORKS.—April 12th.—Bingley Urban District Council. £2 10s. per week.—Mr. A. Platts, clerk.

CHIEF ASSISTANT ENGINEER.—April 12th.—Port of London Authority. £1,200.—Mr. F. Ayliffe, secretary, 109 Leadenhall-street, E.C.

BOROUGH ENGINEER AND SURVEYOR.—April 12th.—Corporation of Ipswich. £350—£550.—Mr. W. Bantoft, town clerk.

SURVEYOR.—April 12th.—Kettering Rural District Council. £130—£170.—Mr. Charles W. Lane, clerk.

INSPECTOR OF NUISANCES.—April 12th.—Wigton Urban District Council. £110 per annum.—Mr. J. W. Crookes, clerk.

STOKER AND DRIVER.—April 14th.—At pumping station of Borough of Dorchester Waterworks. 21s. per week, with house, coal and light.—Mr. A. G. Symonds, town clerk.

CITY ENGINEER'S CLERK.—April 14th.—Corporation of Coventry. 30s. per week.—Mr. J. E. Swindlehurst, city engineer and surveyor.

JUNIOR ASSISTANT ENGINEER.—April 14th.—Merthyr Town Council. £150—£200.—Mr. T. Aneuryn Rees, town clerk.

TEMPORARY TOWN PLANNING ASSISTANT.—April 14th.—Corporation of Northampton. £2 per week.—Mr. Alfred Fidler, borough engineer.

ASSISTANT ROAD FOREMAN.—April 14th.—Salisbury Town Council. 35s. per week.—Mr. F. Hodding, town clerk.

CLERK OF WORKS.—April 16th.—Kinsale Rural District Council. £2 10s. per week.—Mr. J. Murphy clerk, Council Office, The Workhouse.

SURVEYOR OF HIGHWAYS.—April 18th.—Ashby-de-la-Zouch Rural District Council. £100 per annum.—Mr. George Farmer, clerk.

BURGH SURVEYOR'S ASSISTANT.—April 19th. Corporation of Dumfries. £65—£80.—Mr. John Barker, burgh surveyor.

CHIEF ENGINEERING ASSISTANT.—April 19th.—Corporation of Northampton. £193—£225.—Mr Alfred Fidler, borough engineer and surveyor.

CHIEF ENGINEERING ASSISTANT.—April 21st.—Corporation of Coventry. £200 per annum.—Mr. J. E. Swindlehurst, city engineer and surveyor.

CITY ENGINEER AND SURVEYOR.—April 21st.—Corporation of St. Albans. £300 per annum.—Mr. E. R. Debenham, town clerk.

FOREMAN.—April 21st.—Corporation of Barrow-in-Furness.—Borough Engineer and Surveyor.

SEWAGE FARM ATTENDANT.—April 23rd.—Blaby Rural District Council. 30s. per week.—Mr. B. A. Shires, clerk.

CHIEF ASSISTANT TO BOROUGH SURVEYOR.—April 26th.—Corporation of Darlington. £230—£250.—Mr. H. G. Stevenson, town clerk.

JUNIOR ASSISTANT TO BOROUGH SURVEYOR.—April 26th.—Corporation of Darlington. £90—£110.—Mr. H. G. Stevenson, town clerk.

WORKING FOREMAN.—April 30th.—Tavistock Urban District Council.—Mr. E. Warran, clerk.

ASSISTANT ENGINEERS. — May 1st. — Indian Public Works and State Railway Departments.—Secretary, Public Works Department, India Office, London, S.W.

SURVEYOR, INSPECTOR AND COLLECTOR.—May 2nd.—Buckfastleigh Urban District Council. £150 per annum.—Mr. Edward Windeatt, clerk.

ASSISTANT ENGINEER.—May 15th.—Board of Trustees for the Improvement of Calcutta. 500—700 rupees per mensem.—Mr. C. H. Bompas, chairman, 5 Clive-street, Calcutta.

MUNICIPAL COMPETITIONS OPEN.

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READING.—April 18th.—Designs for a public school, for the Education Committee. The competition is limited to local architects.—The Town Clerk.

DALZIEL.—April 19th.—Designs for a high school at Motherwell, for the Dalziel School Board. Assessor, Dr. J. J. Burnet.—The Clerk.

NORTHAMPTON.—April 21st. — Designs for a council school. Limited to local architects.—The Clerk, Education Offices.

BARNET.—April 29th.—Designs for new municipal offices, for the urban district council. Premiums £25, £15, £10.—The Clerk.

EXETER.—June 7th.—Designs for a hostel for male students, for the corporation. Assessor, Mr. Edwin Cooper, F.R.I.B.A.—The Town Clerk.

DEVONPORT.—June 14th.—Designs for municipal buildings and a guildhall, for the Corporation of Devonport. Premiums of £350, £150, and £100 are offered. The assessor is Mr. Ernest Newton, A.R.A., F.R.I.B.A.—Mr. R. J. Fittall, town clerk.

NEWCASTLE-ON-TYNE.—June 14th.—Designs for proposed public baths, for the corporation. Mr. H. W. Wills, F.R.I.B.A., has been appointed as assessor.—Mr. A. M. Oliver, town clerk.

NEWCASTLE-ON-TYNE.—June 19th.—Designs for laying out portion of the Walker estate, for the corporation. Premiums £50, £30, and £20.—Mr. A. M. Oliver, town clerk.

MUNICIPAL CONTRACTS OPEN.

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Buildings.

EARLSTON.—April 12th.—For the construction of a storage reservoir, for the Water Committee.—Mr. T. R. Atkinson, Earlston.

ABERDARE.—April 12th.—For the erection of two bridges, for the urban district council.—Mr. D. L. Griffiths, clerk.

LURGAN.—April 12th.—For the erection of fifty-four workmen's dwellings, for the town council.—Mr. F. W. Pollock, clerk.

EASTRY.—April 14th.—For the erection of workmen's dwellings, for the rural district council.—Mr. F. S. Cloke, clerk, Sandwich.

PRESTON (Lancs).—April 14th.—For erection of bridge, stable and sheds, and road construction, for the corporation.—Mr. Alfred Howarth, town clerk.

WOKING.—April 14th.—For the erection of shelters and sanitary conveniences, for the urban district council.—Mr. G. J. Wooldridge, surveyor.

YORK.—April 14th.—For the erection of a school, for the Education Committee.—Mr. J. H. Mason, secretary.

ALNWICK.—April 14th.—For the erection of a pumping station, for the urban district council.—Mr. J. Balmbra, clerk.

NORWICH.—April 14th.—For the erection of a school, for the Education Authority.—Mr. C. J. Brown, architect and surveyor, The Close.

YORK.—April 14th.—For the erection of two lock-up shops, for the corporation.—Mr. F. W. Spurr, city engineer.

MANCHESTER.—April 15th.—For the roofing over of avenue at Hyde-road car works, for the corporation.—Mr. Thomas Hudson, town clerk.

BOLTON-UPON-DEARNE. — April 15th. — For a bridge and highway improvement, for the urban district council.—Mr. J. Ledger Hawksworth, clerk.

DURHAM.—April 15th.—For the erection of a school, for the county council.—Mr. J. Eltringham, architect, General Chambers, West Summiside, Sunderland.

CARNARVON.—April 16th.—For the erection of a police station and court room at Llandudno, for the Joint Committee.—Mr. A. Bodvel-Roberts, Clerk of the Peace, Carnarvon.

KINSALE.—April 16th.—For the erection of cottages, for the rural district council.—Mr. J. Murphy, clerk, Council Offices, The Workhouse.

PORTSMOUTH.—April 16th.—For erecting two dressing rooms at public baths, for the corporation.—Mr. G. Hammond Etherton, town clerk.

LINDSEY.—April 17th.—For the erection of a school, for the Education Committee.—Mr. S. M. Grant, secretary, 286 High-street, Lincoln.

QUEENSTOWN.—April 18th.—For the erection of twenty workmen's dwellings, for the urban district council.—Mr. James H. Campbell, clerk.

TOTTENHAM.—April 21st.—For the erection of a school hall, for the Education Committee.—Mr. W. H. Prescott, town hall, Tottenham.

WILTS.—April 21st.—For the reconstruction of Bulford Bridge, for the county council.—Mr. J. George Powell, county surveyor, Trowbridge.

PORTSMOUTH.—April 21st.—For building an isolation hospital, for the Committee of Visitors.—Mr. S. B. Jones, architect, 21 Hampshire-terrace, Portsmouth.

BARKING.—April 22nd.—For the erection of six cottages, for the urban district council.—Mr. C. J. Dawson, architect, Clock House Chambers, Barking.

CROYDON.—April 22nd.—For additions and alterations to offices, for the corporation.—Mr. F. C. Lloyd, town clerk.

LAMBETH.—April 24th.—For the erection of a pavilion, for the borough council.—Mr. B. Penny, town clerk.

LANCASHIRE.—April 24th.—For the erection of an elementary school, for the Education Committee.—Mr. H. Littler, county architect, 16 Ribblesdale-place, Preston.

WEST RIDING.—April 25th.—For the enlargement of a school, for the Education Committee.—Clerk of the County Council, County Hall, Wakefield.

DURHAM.—April 25th.—For the erection of a police station, for the county council.—County Surveyor, Shire Hall, Durham.

WOOD GREEN.—April 30th.—For the erection of a central fire station, for the urban district council.—Mr. W. P. Harding, clerk.

Iron and Steel.

DAVENTRY.—April 14th.—For the supply and erection of a water-softening plant (capacity 10,000 gallons per hour), and a water-level indicator, for the corporation.—Mr. Frederick Willoughby, town clerk.

TOTNES.—April 17th.—For laying cast-iron water mains and other work, for the rural district council.—Mr. F. K. Windeatt, clerk.

EXMOUTH.—April 26th.—For the supply of cast-iron water mains, 9-in., 6-in., 4-in. and 3-in. diameter, supply of valves, valve hydrants and other fittings, and for the necessary labour and materials required in laying 9-in. and 6-in. mains and fixing valves, for the urban district council.—Mr. Samuel Hutton, engineer.

Roads.

REIGATE.—April 12th.—For the supply of granite macadam, basalt, flints, granite kerb, Kent ragstone, tar paving, artificial stone paving, gravel, concrete beach, pea beach, compo. grit, Portland cement, and Beddington grit, for the corporation.—Mr. Alfred Smith, town clerk.

BONNYRIGG.—April 12th.—For cleansing the streets, for the corporation.—Mr. J. G. Forbes, town clerk.

SOUTHBOROUGH.—April 12th.—For the supply of basalt, granite, or other suitable stone, for the urban district council.—Mr. P. Hanmer, clerk.

WALSALL.—April 12th.—For the supply of granite paving setts, for the corporation.—Mr. H. Lee, town clerk.

WROTHAM.—April 12th.—For the supply of stone, team labour and steam rolling, for the urban district council.—Mr. H. E. Pyle, clerk, 123 London-road, Sevenoaks.

TANGIER.—April 12th.—For the construction of the second section of Casablanca-road, for the Special Committee of Public Works.—Commercial Intelligence Branch of the Board of Trade, 73 Basinghall-street, E.C.

INVERNESS.—April 12th.—For road improvement works, for the Badenoch District Committee.—Mr. A. M. Grant, district road surveyor, County Buildings, Kingussie.

BRUMBY AND FRODINGHAM.—April 12th.—For the supply of 800 tons of whinstone, and about 150 tons of tar-macadam, for the urban district council.—Mr. Joe Green, surveyor.

GUILDFORD.—April 14th.—For the supply of granite, for the rural district council.—Mr. J. Anstee, surveyor.

TIVERTON.—April 14th.—For work of steam rolling, for the rural district council.—Mr. A. J. Mildon, surveyor, Ash Thomas, Tiverton.

HARPENDEN.—April 14th.—For the making up of private streets, for the urban district council.—Mr. Chas. S. Tuckey, clerk.

PLOMESGATE.—April 14th.—For the supply of broken granite and flint, for the rural district council.—The Clerk.

HAVERHILL.—April 14th.—For the supply of broken granite or basalt and tar-macadam, for the urban district council.—Mr. John H. Clarke, surveyor.

BRIGHTON.—April 14th.—For the supply of the necessary materials and laying of tarred slag macadam, or other material of quality and durability equal to tarred slag macadam, on Preston-road, for the corporation.—Mr. Hugo Talbot, town clerk.

SHERRINGTON.—April 14th.—For making up two roads, for the urban district council.—Mr. Edgar C. Rolfe, clerk.

AYR.—April 14th.—For permanent-way construction and road widening, for the corporation.—Mr. P. A. Thomson, town clerk.

WARRINGTON.—April 14th.—For the supply of setts and whinstone or granite in cubes, for the corporation.—Mr. Andrew M. Ker, borough engineer and surveyor.

AYLESBURY.—April 14th.—For the supply of slag and granite, for the rural district council.—Mr. W. J. Cook, district surveyor, Aylesbury.

STOCKTON-ON-TEES.—April 14th.—For street improvement work, for the corporation.—Mr. Arthur B. Crosby, town clerk.

KENSINGTON.—April 14th.—For paving work with creosoted deal blocks, for the borough council.—Borough Engineer and Surveyor.

LONG BENTON.—April 14th.—For roadway construction, for the urban district council.—Mr. J. Lindall Nicholson, engineer and surveyor, 12 Gray-street, Newcastle-on-Tyne.

WIGTON.—April 14th.—For work of road maintenance, for the rural district council.—Mr. J. F. W. Ritson, clerk.

ALDERSHOT.—April 15th.—For the supply of Rhenish or Devon basalt, flints, limestone tar paving, blast-furnace slag tar-macadam, bituminous asphalt binder, granite kerbing, and blue pennant channel, for the urban district council.—Mr. W. E. Foster, clerk.

HAMILTON.—April 15th.—For the execution of road-making work, for the Middle Ward.—Mr. W. E. Whyte, district clerk, Hamilton.

WANTAGE.—April 15th.—For the supply of hand-picked stones, gravel and chalk for the rural district council.—Mr. J. H. Robinson, East Ilsley.

LEWISHAM.—April 15th.—For kerbing and paving work for the borough council.—The Borough Surveyor.

BANFF.—April 15th.—For the construction of 4 miles of road, for the county council.—Mr. James Grant, district clerk, Banff.

SALFORD.—April 15th.—For work of making-up, for the corporation.—Borough Engineer.

BOURNEMOUTH.—April 16th.—For making up a certain road, for the corporation.—Mr. F. W. Lacey, M.INST.C.E., borough engineer and surveyor.

TURTON.—April 16th.—For the supply of four vans for street watering, for the urban district council.—Mr. J. B. Goulburn, clerk.

BOLLINGTON.—April 16th.—For paving work in certain streets, for the urban district council.—Mr. S. Knight, clerk.

ARUNDEL.—April 16th.—For the supply of broken granite, for the corporation.—Mr. E. F. Farrington, borough surveyor.

BECKENHAM.—April 16th.—For resurfacing with tar-macadam, or with macadam grouted with pitch or other approved bituminous compound, Wickham-road, Albemarle-road, and Newlands Park-road, for the urban district council.—Mr. F. Stevens, clerk.

ISLE OF WIGHT.—April 16th.—For supplying up to 50,000 gallons of refined tar, according to the Road Board Specification No. 4, Tar No. 1, for the rural district council.—Mr. H. Eldridge Stratton, clerk.

WORSBOROUGH.—April 16th.—For the supply of broken granite, tarred dross, rough dross, limestone and asphalt, for the urban district council.—Mr. A. Clegg, clerk.

GUILDFORD.—April 16th.—For carrying out private street works, for the corporation.—Mr. A. D. Jenkins, town clerk.

NEWPORT (Isle of Wight).—April 16th.—For the supply of 50,000 gallons of refined tar, for the rural district council.—Mr. H. E. Stratton, clerk.

OXFORD.—April 17th.—For the supply of York flagging, artificial flagging, blue paving bricks, York kerb, Clee Hill paving setts, reservoir paving setts, unbroken Clee Hill granite, unbroken Hartshill granite, lias lime and Portland cement, for the corporation.—Mr. W. H. White, city engineer.

CROYDON.—April 17th.—For private street works, for the rural district council.—Mr. R. M. Chart, surveyor.

MARCH.—April 17th.—For the supply of broken granite, for the urban district council.—Mr. C. Greenwood, clerk.

FRINTON.—March 17th.—For work of tar paving, for the urban district council.—Mr. E. M. Bate, surveyor.

DONCASTER.—April 18th.—For work of road widening, for the rural district council.—Mr. W. R. Crabtree, surveyor.

BEXHILL.—April 19th.—For making up a certain road, for the corporation.—Mr. G. Ball, borough surveyor.

WESTHAMPNETT.—April 19th.—For the supply of Guernsey granite, for the rural district council.—Mr. W. D. Rasell, clerk, 5 South-street, Chichester.

REIGATE.—April 21st.—For making up a portion of Station-road, Redhill, for the corporation.—Mr. Alfred Smith, town clerk.

MAIDENHEAD.—April 21st.—For laying 40,000 yds. of tarred footway, for the corporation.—Mr. H. E. Davies, town clerk.

AIRDRIE.—April 21st.—For the supply of kerb and channel work, granolithic paving and carting, for the town council.—Mr. H. Inglis, burgh surveyor.

BURGESS HILL.—April 22nd.—For the supply of broken granite and fine granite, for the urban district council.—The Surveyor.

AUDENSHAW.—April 22nd.—For work of road construction.—Mr. F. Hamer, clerk.

ENFIELD.—April 23rd.—For providing and laying about 4,300 yds. of artificial stone paving, for the urban district council.—Mr. T. W. Scott, clerk.

CARSHALTON.—April 23rd.—For treating 80,000 yards super. of road with bituminous dust-preventing material, for the urban district council.—Mr. C. P. Lovelock, clerk.

ELY.—April 23rd.—For the supply of coarse clunch and coarse-screened gravel, for the rural district council.—Mr. F. W. Firby, district surveyor, Sutton, Isle of Ely.

WEST RIDING.—April 23rd.—For work of excavating, rubble pitching and macadamising, for the Highways Committee.—Mr. F. G. Carpenter, West Riding Surveyor, County Hall, Wakefield.

ISLE OF THANET.—April 24th.—For the supply of 2,081 yds. of broken flints and 1,815 tons of broken granite, for the rural district council.—Mr. Charles Taylor, clerk.

GRANTOWN-ON-SPEY.—April 26th.—For forming kerbs and footpaths, for the corporation.—Mr. W. Forsyth, town clerk.

NEW SARUM.—April 30th.—For the execution of street work, for the corporation.—Mr. W. J. Goodwin, city engineer and surveyor.

SALISBURY.—April 30th.—For the execution of private street works, for the corporation.—Mr. W. J. Goodwin, city engineer and surveyor.

MADRAS.—May 29th.—For the supply of special distilled coal tar for tar-spraying roads, for the corporation.—The Surveyor, 24 Bride-lane, Fleet-street, E.C.

Sanitary.

TADCASTER.—April 12th.—For laying sewers and manholes, for the rural district council.—Mr. Geo. A. Bromet, clerk.

OUNDLE.—April 12th.—For fixing oil engine and air receiver, with pipes and fittings in connection with the sewage ejector at sewage disposal works, for the urban district council.—Mr. Robert Knight, clerk.

TROWBRIDGE.—April 14th—19th.—For the conversion of storm-sewage filters to stand-by tanks, alterations and additions to settling tanks, and the erection of sewage pumping machinery, for the urban district council.—Mr. H. G. Nicholson-Lailey, surveyor.

WARMLEY.—April 14th.—For the construction of main outfall and branch sewers, for the rural district council.—Mr. Seymour Williams, clerk.

ECCLES.—April 14th.—For the supply of engine packing, waste, wading boots, shovels, forks and valves, for the Sewage Disposal Committee.—Mr. Edwin Parkes, town clerk.

EDMONTON.—April 14th.—For the erection of a sanitary convenience, for the urban district council.—Mr. C. Brown, engineer.

NORTH BATTLEFORD (Canada).—April 15th.—For the supply of vitrified tile sewer pipes and junctions, for the town council.—Messrs. Chipman & Power, Mail Building, Toronto.

CHELTENHAM.—April 16th.—For laying stoneware pipe sewers, manholes, lampholes, and connecting houses to sewers, for the rural district council.—Mr. G. MacIlquham, clerk.

CHELTENHAM.—April 16th.—For the provision, laying and jointing of about 3,900 yds. of 15-in., 12-in. and 9-in. stoneware pipe sewers, with manholes and lampholes, and the conversion of sewers into storm-water drains, for the rural district council.—Mr. Gilbert McIlquham, clerk.

STOURBRIDGE.—April 16th.—For the construction of a surface-water drain, for the urban district council.—Mr. F. Woodward, surveyor.

HUNTLY.—April 17th.—For laying pipe sewer, for the corporation.—Mr. J. Allan, burgh surveyor.

KIRKHEATON.—April 17th.—For the supply and construction of fireclay pipe sewers and manholes, for the urban district council.—Mr. Joseph Wood, clerk.

BARNSTAPLE.—April 19th.—For the execution of drainage work, for the corporation.—Mr. E. V. Saunders, borough surveyor.

WALLASEY.—April 19th.—For the erection of a public convenience, for the corporation.—Mr. W. H. Travers, borough engineer and surveyor.

TROWBRIDGE.—April 19th.—For the conversion of primary and secondary contact beds to percolating filters, including the erection of sewage distributing machinery, also the construction of humus tanks, sludge-water and sludge drains, manholes, chambers and other work, for the urban district council.—Mr. H. G. Nicholson-Lailey, engineer.

HEBDEN BRIDGE.—April 21st.—For work of laying new sewers, for the urban district council.—Mr. T. Waddington, engineer and surveyor.

WARE.—April 21st.—For laying cast-iron sewer and constructing manhole, for the rural district council.—Mr. H. J. Jackson, surveyor, Rye-road, Hoddesdon.

EASTLEIGH AND BISHOPSTOKE.—April 23rd.—For laying storm-water sewers, for the urban district council.—Mr. W. Wallace Gandy, surveyor.

ST. MELLONS.—April 23rd.—For the completion of the sewerage scheme for the drainage area of Rumney, consisting of storage sewer, screening chambers, pumping station, pumps, engines, cast-iron rising main, and about 2½ miles of 6-in. and 9-in. stoneware and cast-iron pipe sewers, for the rural district council.—Mr. A. H. Rees, clerk.

DAVENTRY.—April 23rd.—For the construction of sewers, sedimentation and storm-water tanks, percolating filter beds, pumping machinery, manholes, and other works, for the rural district council.—Mr. J. D. Spearing, clerk.

BILSTON.—April 24th.—For the construction of about 600 yds. of pipe sewers and manholes in various streets, for the urban district council.—Mr. Vincent Turner, engineer and surveyor.

BURNLEY.—May 3rd.—For laying earthenware pipe sewers, manholes, concrete tanks and percolating filters, for the rural district council.—Mr. H. Pritchard, engineer, 18 Nicholas-street, Burnley.

Stores.

RUGBY.—April 12th.—For the supply of stone, tools, cotton waste, engine oils, paraffin, cleaning material and horse provender, for the urban district council.—Mr. J. H. Sharp, surveyor.

GLASGOW.—April 14th.—For the supply of various articles, for the sewage department.—Mr. T. Melvin, general manager, 30 Cochrane-street.

WIGAN.—April 15th.—For the supply of gasworks stores, for the corporation.—Mr. F. Betley, engineer, The Gasworks.

BATLEY.—April 16th.—For the supply of general stores, for the electricity works.—Mr. J. H. Craik, town clerk.

TROWBRIDGE.—April 21st.—For the supply of steam rolling, hauling, team labour, coal, ironmongery and brushes, for the urban district council.—Mr. H. G. Nicholson-Lailey, surveyor.

GLASGOW.—April 22nd.—For the supply of materials, for the gas department.—Mr. A. Wilson, gas manager, 45 John-street.

Miscellaneous.

WORKINGTON.—April 12th.—For the supply of best quality of Portland cement, for the corporation.—Mr. H. Bowman Williams, borough and waterworks engineer.

CHELMSFORD.—April 16th.—For the provision of an additional filter at public bath, for the corporation.—Mr. George Melvin, town clerk.

MANCHESTER.—April 17th.—For cleaning and painting pillars, brackets and lamps, for the Gas Committee.—Mr. Thomas Hudson, town clerk.

MANCHESTER.—April 21st.—For painting iron bridges, for the corporation.—Mr. Thomas Hudson, town clerk.

WEST HAM.—April 24th.—For painting, cleansing and repairs to public buildings, for the corporation.—Mr. Fred. E. Hilleary, town clerk.

CONWAY.—May 3rd.—For cleaning, scraping and painting the suspension bridge, for the corporation.—Mr. Hugh Parry, town clerk.

We All Hope So.—"The duties of a surveyor are arduous," says *Punch*, in introducing the following quotation from a contemporary: "The Wells Urban District Council have been inviting tenders for the purchase of a rotary road-sweeping machine, and the surveyor has been instructed to go through same and report to the next meeting." "We hope he'll come out all right" is *Punch's* comment on the item of news.

TENDERS FOR MUNICIPAL WORKS OR SUPPLIES.

The Editor invites the co-operation of Surveyor *readers with a view to making the information given under this head as complete and accurate as possible.*

* Accepted. † Recommended for acceptance.

CARMARTHEN.—Accepted for the construction of a water tank, and providing and laying 3-in. cast-iron or steel water main, for the rural district council:—

Harries Towy Works, Limited, Carmarthen, £532.

DAVENTRY.—For the erection of a hospital for infectious diseases, for the rural district council:—

W. L. Franklin, Limited, Deddington, Oxon	£2,379
H. Martin, Limited, Northampton	2,140
R. Cosford, Connaught-street, Northampton	2,009
Beardsmore & West, Stimpson-avenue, Northampton	1,979
W. W. Webster, Guilsborough, Northampton	1,963
T. Adams & Son, Daventry	1,825
Holland & Marks, Daventry	1,748

DONCASTER.—For the erection of retort-house and coal store extensions, for the corporation.—Mr. R. Watson, engineer, Gasworks:—

S. Beastall & Sons, Doncaster, £4,100.

EARSDON.—For the supply of hand-broken whinstone, slag, whinstone kerb, and cartage, for the urban district council.—Mr. J. R. MacMillen, surveyor:—

Whinstone.	s. d.
Northumberland Whinstone Company, Northumberland	8 4
Ewewsley Quarry Company, Northumberland	8 3
M. Appleby, Lesbury*	8 2
H. Reid & Co., Newcastle	7 10
Slag.	
W. Fairbain, Newcastle	5 10
Jarrow Slag Company, Jarrow	5 3
F. J. Nickol, Newcastle	5 0
Kerb.	**Per yd.**
Northumberland Whinstone Company, Newcastle	4 6
W. Fairbain, Newcastle	3 8
J. Potts, Newcastle	3 5½
J. McKelvin, Newcastle*	3 4
H. Reid & Co., Newcastle	3 0
Cartage.	**£ s. d.**
J. Urwin, Earsdon*	36 12 11
Whillis Brothers, Earsdon*	25 14 0
J. W. Crawford, Earsdon*	13 10 0
J. Taylor, Earsdon*	3 7 6

GUILDFORD.—The following tenders for the ensuing year were accepted by the corporation:—

Cast-iron Pipes.—Stanton Ironworks Company, Limited.
Horse Hire and Cartage.—B. Heath, Guildford.
Iron Castings.—H. Clark, Guildford.
Tarmac.—Tarmac, Limited
Creosote and Pitch.—E. Catchpole & Sons, Rotherhithe.
Tar.—Guildford Gas Company.
Portland Cement.—Martin, Earle & Co., Limited.
Blue Lias Lime.—Evercreech Lime and Stone Company.
Shoeing.—T. May & Son, Guildford.
Sharpening Picks, Tynes and Chisels.—A. Grinstead.
Sharpening Mattocks and Clinker Bars.—A. Ward.
Broken Granite.—Rowe & Mitchell, London.
Durax Cubes.—A. & F. Manuelle, London.
Granite Setts and Cubes.—Gamble Wood, London.
Granite Chippings.—Mountsorrel Granite Company, Leicestershire
Brooms and Brushes.—Pryke & Palmer, London; Couchman & Co., Maidstone; N. Vincent and W. J. Brown & Co., Guildford.
Galvanised Steam Tubes.—Pontifex & Co., London.
Carbolic Acid and Powder.—Adcocks, Limited, London.
Ironmongery.—N. Vincent.
Oils.—W. J. Brown & Co. and N. Vincent.
Stoneware Pipes.—Hooper & Ashby.

HORNCASTLE.—For rebuilding a bridge, for the rural district council:—

W. & C. Steadman, Woodhall Spa	£136
C. Hensman & Son, Horncastle	99
Sutton & Horton, Horncastle*	86

LYDD.—For the supply of tarred Kentish ragstone and Rhenish columnar basalt, for the corporation.—Mr. T. Kettle, borough surveyor:—

W. & E. Earl, Aldington, near Hythe.—50 tons 2-in. tar-macadam, 9 tons ¾-in. tar-macadam, 15s. and 16s. per ton.*
Chittenden & Simmons, Maidstone.—16s. and 17s. per ton.
Constable, Hart & Co.—15s. 2d. and 16s. 2d. per ton.
W. H. Bensted & Son.—16s. and 17s. per ton.
Johnston Brothers, Mark-lane, London.—30 tons Rhenish columnar basalt, 1½ in., 15s. 3d. per ton.*
Road Maintenance and Stone Supply Company, The Crescent, Gravesend.—15s. 11d. per ton.

NUNEATON.—For the supply of broken granite and haulage, for the rural district council.—Mr. H. W. Wilson, surveyor:—

Judkins, Limited, Nuneaton, about £1,100.*
Midland Quarry Company, Nuneaton, about £1,100.*
B. J. Forder & Sons, Limited, Nuneaton, about £1,100.*
W. Griffiths & Co., Bishopsgate, London.
Mountsorrel Granite Company, Limited, Mountsorrel, near Loughborough.

POCKLINGTON.—Accepted for the supply of the best blue stone and slag, for the rural district council:—

Stone.	Tons.
M. Appleby, Lesbury, Northumberland	2,759
J. N. Smith & Co., Park-row, Leeds	2,000
J. Green & Son, Limited, Silsden, near Keighley	900
A. Brunton & Son, North Queensferry, Scotland	730
Skipton Rock Company, Skipton, Yorks	435
Brookes, Limited, Halifax	400
Slag.	
J. N. Smith & Co., Park-row, Leeds*	1,400
Hanson, Brown & Co., Limited, Queen's-square, Middlesbrough	960
W. H. Musgrave, Cumberland Villas, Middlesbrough	530
G. Firth & Co., Ousegate, Selby	525
T. W. Chapman, Victoria-road, Darlington	400

TRING.—For the supply of broken granite and flints, for the urban district council.—Mr. S. S. Gettings, surveyor:—

2-in. Granite.—Ellis & Everard, Bardon Hill, near Leicester, 11s. per ton.
¾-in. Chippings.—Ellis & Everard, Bardon Hill, near Leicester, 9s. per ton

MEETINGS.

Secretaries and others will oblige by sending early notice of dates of forthcoming meetings.

APRIL.

12.—Association of Engineers-in-Charge: Annual Dinner, Holborn Restaurant.
12.—Opening of Building Trades Exhibition, Olympia, by Lord Mayor of London.
15.—Joint Meeting of the Illuminating Engineering Society, the Institutions of Gas and Electrical Engineers, and the Institution of Municipal and County Engineers: Mr. A. P. Trotter, on "Standard Clauses for a Specification of Street Lighting."
15.—Illuminating Engineering Society: Mr. A. P. Trotter on "The Specification of Street Lighting." Royal Society of Arts. 8 p.m.
16.—Institution of Municipal Engineers: North Western District Meeting at Manchester.
17.—Roads Improvement Association: Annual General Meeting, 15 Dartmouth-street, S.W. 4.30 p.m.
18.—Institution of Mechanical Engineers: Ordinary General Meeting. President's Address. 8 p.m.
19.—Institution of Municipal and County Engineers: Eastern District Meeting at Olympia.
19.—"Municipal Engineers' Day" at Olympia.
21.—Institution of Civil Engineers (Students' Meeting): Mr. A. T. Walmisley, M.Inst.C.E., lectures on "Production of Steel Sections and their Application in Engineering Structures."
21.—Institute of Sanitary Engineers: Mr. Frank R. Durham on "House Drainage on the Continent." 8 p.m.
21.—Royal Institute of British Architects: Messrs. F. W. Jackson and Bernard Dicksee, on "Modern Steel Construction." 8 p.m.
23.—Royal Sanitary Institute: Ordinary General Meeting, 4 p.m.
30.—Institution of Civil Engineers: London Students' 38th Annual Dinner, Trocadero Restaurant. 7.45 p.m.

MAY.

8-14.—Institution of Municipal and County Engineers: Visit to Amsterdam and the Hague.
14-18.—Royal Institute of Public Health: Annual Congress in Paris.
19.—Institute of Sanitary Engineers: Dr. H. R. Kenwood on "Micro-Organisms and Public Health." 8 p.m.
21-24.—Institution of Electrical Engineers: Meeting in Paris.
23-24.—Surveyors' Institution: Meeting at Oxford.

JUNE.

6-7.—Institution of Municipal and County Engineers: Meeting at Dundee.
23-28.—International Road Congress in London.

APPOINTMENTS OPEN.

BOROUGH OF DARLINGTON.

CHIEF ASSISTANT TO BOROUGH SURVEYOR, &c., AND JUNIOR ASSISTANT.

The Darlington Corporation invite applications from suitable persons for the appointment of Chief Assistant to the Borough Surveyor and Waterworks Engineer, at a salary of £230 per annum, rising, subject to satisfactory service, by two annual increments of £10, to a maximum of £250 per annum.

Applications are also invited for the appointment of a Junior Assistant, at a salary of £90, rising, subject to satisfactory service, by two annual increments of £10, to a maximum of £110 per annum.

The persons appointed will be required to devote the whole of their time to their respective duties, and preference will be given to those who have had previous experience in the office of a Municipal Authority.

Applications (on Forms which will be supplied by the Borough Surveyor, Town Hall, Darlington), in candidate's own handwriting, and accompanied by copies of not more than three recent testimonials (which will not be returned), must be sent to me, the undersigned, not later than Saturday, the 26th day of April next, endorsed "Chief Assistant to Borough Surveyor," or "Junior Assistant to Borough Surveyor," as the case may be.

Canvassing, either directly or indirectly, is prohibited.

H. G. STEAVENSON,
Town Clerk.

Houndgate, Darlington.
April 4, 1913. (343)

PUPIL.—Civil Engineer has a vacancy for a well-educated gentlemanly youth as pupil. Moderate premium, personal supervision, first-class training.—Apply Box 1,232, office of The Surveyor, 24 Bride-lane, Fleet-street, E.C. (346)

The Surveyor

And Municipal and County Engineer.

Vol. XLIII. APRIL 18, 1913. No. 1,109.

Minutes of Proceedings.

Road Crust Developments: Colonel Crompton's Views.

The subject-matter of the paper which Colonel R. E. Crompton, C.B., M.INST.C.E., read before the Institution of Automobile Engineers last week may be sifted into material of two kinds: first, that which readily passes a "sieve" representing criteria of accepted theory and recognised practice; and, secondly, that remaining upon this sieve, and challenging, in varying degrees, the comments of several classes of persons interested in road maintenance and crust construction. This consideration applies not only to the paper as a whole, but also, in some cases, to its constituent parts. For instance, in the very important matter of wheel diameters, all who have any real knowledge of the subject will heartily endorse the general contention as to the advantage of using wheels of large diameter. Few, however, will follow the author of the paper in his particular contention that "the diameter of the rigid steel motor wagon wheel should be at least three times the diameter of the rubber-tyred one carrying the same weight in order to be equally fair to the road surface." The damage done to road crusts and street pavements by motor omnibuses is, in so far as it is out of proportion to the tonnage, mainly due to the fact that these vehicles, instead of being provided with wheels, are supported, as regards the larger part of their weight, by the driving pinions of the friction gear by means of which the vehicle is propelled along the road. Again, as regards the coefficient of elasticity of the road surface, one follows the other up to a certain point; but there remains the further important considerations that the coefficient of elasticity may be too high, and that what is of equal, and in some cases greater, import is the range of movement through which the purely elastic resistance is maintained. This subject was, however, recently dealt with in our pages in connection with the Road Board's trials at Sidcup and elsewhere, and need not be further discussed in the present connection.

The controversial residuum is, perhaps, most conspicuous in the case of the passages relating to asphaltic and bituminous carpets. Much of what Colonel Crompton had to say in this matter consisted of a presentment, in well chosen terms, of some of the main principles governing the design of bituminous upper courses and carpet layers; but his views as to the relative values of natural and artificial products of this class are so set forth as almost to suggest that developments which have been mainly due to the need for reducing costs carry with them improvements of considerable importance, leading up to the sand-bitumen carpet, with the advocacy of which Colonel Crompton definitely associates himself, as the result of his studies and investigations. Whatever may be the merits of this form of carpeting, Colonel Crompton goes too far in saying that "he is supported in this, his personal opinion, by all the best of the English as well as of the foreign road engineers who have paid close attention to the subject." This almost suggests the Psalmist's phrase, "When the wicked, even mine enemies . . . ." Possibly, the view which Colonel Crompton takes as regards the road surface is partly the result of somewhat unusual views as to the crust as a strength crust, and as to the significance of the part played by internal movements. He seems, in so far as it is fair to judge from a single paper, to under-rate the importance of the principles of crust design in this respect, for he says "the considerations which govern its structure are very faithfully reflected in the requirements for the sheet pavement itself," which cannot be admitted.

As regards the experimental track at the National Physical Laboratory, and the ingenious equipment with which it has been provided, we expressed, some time ago, our views as to its scope and limitations; but whatever may be the difficulties attending its employment as a testing machine, it is to be hoped that surveyors will keep its possibilities in view, and we shall, therefore, be glad to receive and to publish any suggestions that may be forthcoming as to tests which could usefully be made with it in order to provide comparisons between different local conditions, or the effects of traffic of varying intensity upon the same crust. As a painstaking and earnest investigator Colonel Crompton will always command the attention of all who are interested in roads, and by the valuable services which he has performed in keeping to the front sound views as regards the widths of tyres, wheel diameters, and

wheel design generally, he has earned the gratitude of all who pay for the upkeep of our highways.

* * *

The Roads Improvement Association.

Increased support, which has enabled it correspondingly to extend its activities, has been accorded to this body during the past twelve months. The systematic and painstaking manner in which the work of the association is conducted is made evident by the report which was presented at the annual general meeting yesterday. It was shown that when the organisation of its various branches is fully developed the association will always have available an up-to-date report upon the roads within the areas covered by these branches, and thus, at all times, be in a position to formulate, for submission to the authorities, suggestions and schemes for the improvement of roads towards which the assistance of the Road Board can reasonably and usefully—as the association put it—be invited. For the better working of the arrangements the several areas will be divided into a number of districts, each of which will be under the personal control of a member of the branch committee, who will, in turn, divide his own district in such manner as he thinks desirable. The member in charge of the district will send to the hon. secretary of the branch at least once a quarter a report upon the existing condition of the more important roads under his control and suggestions for improving them. A summary of these reports will afterwards be laid before the branch committee, from which suggestions for improvement will be evolved. In Lancashire and Cheshire this advanced form of organisation has already been initiated.

The re-drafting of the association's Highways Bill is among the other matters to which reference is made in the report presented at yesterday's meeting. The establishment of the Imperial Road Improvement Fund and the creation of a road board have satisfied some of the requirements of the association's old Bill. The new Bill will provide for the re-classification of the roads of Great Britain by a central authority upon a definite principle and a re-adjustment of the existing expenditure upon the roads in accordance therewith. It is contended that at present the roads are not classified by any satisfactory machinery, with the result that they do not correspond to modern-day traffic requirements. This matter will be discussed at the forthcoming International Road Congress, and the association's Bill will not, therefore, be settled until after the congress, and any expression of opinion given at the congress will be considered in connection with the settling of the Bill. There are a number of small but important questions connected with the administration of the roads not now, in the view of the association, dealt with satisfactorily in highways Acts, and these will be included in the new Bill.

* * *

The Dual Control of Irish Roads.

The movement which is on foot for the promotion of legislation which will have the effect of giving Irish county councils full administrative and financial control of the main roads of their counties is a natural result of the development of road traffic in Ireland, and of a consequent sharpening of the distinction between the more important and the less important of the roads. The dual financial control exercised by county and district councils has probably been much less inconvenient than a similar arrangement would have been in England, but it seems to be a system which has features rendering it very unsuitable for the conditions of the present day. As regards main roads the practical difficulties associated with the present arrangement centre round the allied subjects "steam-rolling" and "direct labour," and in a short note which he contributed to the Second Irish Road Congress, Mr. E. A. Hackett, M.INST.C.E., county surveyor of Tipperary, contended that "where a county council has not adopted steam rolling, direct labour or other modern methods of maintaining and improving roads the fault lies in the obstructive policy of the district councils."

One of the results of dual control is the provision, in the "Development and Road Improvements Funds Act," that in Ireland: "The expression 'highway authority' means the council of any county or county borough." This provision can hardly be regarded as having been made without consideration of the fact that the funds for road maintenance must first be voted by district councils and afterwards approved by the county council. In England and Wales a district council or a county council is, in each case, an individually responsible body, with which the Road Board can negotiate the terms of a grant, or to which can be communicated offers of grants, for final acceptance or rejection. Clearly, the board could not be placed, as regards Irish highway authorities, in a position which made it necessary to deal, in the case of a single proposed grant, with two authorities linked by the financial procedure of Irish road expenditure, and, since a choice had to be made, one can hardly be surprised that this choice fell on the county council. If the matter be looked at as a whole, the present system might seem to suggest the possibility of the development from existing elements of a single highway authority for each Irish county, but to those who know anything of Ireland it suggests no such thing. At all events, whatever the final arrangement may be, there are very strong arguments for making, without delay, the important first step of giving the Irish counties full control over a reasonable mileage of the more important roads of the country.

* * *

The Comparative Efficiency of Filters.

In a recent paper by Mr. Aird Murray upon the "Purification of Water by Slow and Rapid Sand Filtration" the question of comparative efficiencies is discussed, and some very interesting figures relating to the costs of water filtration are given. We reproduce elsewhere extracts from this paper from which it will be noted that the author gives some very definite conclusions. He takes the view that filtration should be considered chiefly as a means of removing dirt and suspended matter from water, while disinfection is the only method by which an infected water can be made safe. This is a very safe view to take, but it should be observed how it differs from the views expressed in the paper of Mr. George C. Whipple, quoted in our issue of the 4th inst., which were to the effect that filtration was the best method for purifying the sewage polluted lake waters, sterilisation being considered merely as an emergency method or temporary expedient, or perhaps as an additional safeguard to be employed in case of special need. Mr. Aird Murray finds that slow sand filters and mechanical filters are equally efficient, but that the first cost of the installation of rapid filters is about one-half that of slow sand filters. Also the maintenance cost is to be determined by the amount of coagulant employed in rapid filtration; when this does not exceed one grain per gallon the cost of rapid filtration is below that of the slow filters.

Why the author considers that the disinfectant can be advantageously applied to the water before filtration with rapid filters is not apparent. The question has been frequently discussed, and it seems sufficiently obvious that it is better to

apply a sterilising agent to the water after filtration when, owing to the absence of organic matter, only a very small dose is required. To apply it to water before filtration means that the sterilising agent will be used up by the larger amount of organic matter present in the water. This makes it necessary to use a much larger quantity of the disinfectant when it is added to the water before filtration, to mention only one of the disadvantages. What corresponding advantage may result is not clear. A paper upon this very question was read before the Royal Sanitary Institute some time ago, and it was then decided that the disadvantages of adding the sterilising agent to the water before filtration were so evident that it was unnecessary to discuss the matter. It would be interesting to learn the basis of Mr. Aird Murray's argument.

* * *

Motor Cars on Bridges.

Our readers are no doubt very familiar, both practically and by observation, with the notices which are frequently to be seen on bridge approaches to the effect that the bridge is insufficient to carry a heavy motor car having an axle weight above that specified. These notices have been erected up and down the country by various persons and bodies who are liable to keep bridges in repair, pursuant to regulations made by the Local Government Board under the Motor Car Act, 1903. An important case arising under these regulations was decided in the High Court last week. A motor omnibus belonging to the London General Omnibus Company, Limited, had been driven, contrary to the regulations and notice, over a railway bridge at Muswell Hill. It was contended on behalf of the omnibus company that the regulations of the Local Government Board were *ultra vires*, and the arguments, which were of a very technical character, and dealt with the construction of the various motor car Acts and regulations, were directed to this point. Our readers should note, however, that in the result the appeal of the omnibus company was dismissed, and the validity of the regulations was upheld.

In the course of his judgment, Mr. Justice Ridley observed that up to 1904 section 6 of the Locomotives Act, 1861, which gave to the person liable for the repair of a bridge the right by putting up a notice prohibiting locomotives passing over the bridge, was in force. That section was repealed by the Act of 1896 so far as light locomotives were concerned. Under the Act of 1903 and Orders made thereunder, the class of vehicles coming within the operation of the Act of 1896 was largely extended, but he thought that the words of section 12 of the 1903 Act, "subject to any conditions as to the use and construction of the vehicle which may be made by the regulations," kept alive for the benefit of persons liable to repair bridges the privilege they had under section 6 of the Act of 1861 and enabled the Local Government Board to make the regulation in question. Mr. Justice Pickford and Mr. Justice Avory gave judgment to the same effect.

* * *

Professional Status.

At a recent meeting of the Society of Engineers the subject of the professional status of engineers was under discussion, being introduced by Mr. William Ransom, Assoc.M.Inst.C.E., who read his essay on "How to Improve the Status of Engineers and Engineering, with Special Reference to Consulting Engineers," which was awarded the second prize in the society's status prize competition last year. The subject of professional status is one upon which we have frequently expressed our views, more particularly with special reference to municipal or civic engineers. Mr. Ransom's excellent essay dealt broadly with three aspects of the question. In the first place, he put forward a plea for the "closing" of the engineering profession, so as to bring it into line with those of law and medicine. He next dealt with the organisation of the profession so "closed" under one central institution, having sub-divisions devoted to the peculiar requirements of the various classes of specialists—not the least important of which would be that concerned with the interests of municipal engineers. Finally, he pointed out that the public estimate of the profession is based upon their observation of the conduct of the average member, and that in consequence the status of engineers can never be really raised unless every individual lives up to a high standard of professional conduct. The question of improved status is an important one for all classes of engineers, and we therefore commend Mr. Ransom's essay to the attention of that section of the profession to which most of our readers belong.

* * *

At Olympia.

Mr. H. Greville Montgomery, the promoter of the Building Trades Exhibition, which will remain open up to the 26th inst., inclusive, is to be congratulated on the unqualified success that has rewarded his tactful and generous organisation. A building packed with exhibits of the highest novelty and interest, and a daily attendance of great numbers of visitors of the best class, as distinct from the mere pleasure-seekers who are to be found at popular exhibitions, these are the main features which testify to the fact that this year's exhibition is widely appreciated and supported. The bulky catalogue of exhibits is itself a remarkable record of all, within the scope of the exhibition, that is new or excellent, and it should certainly be in the reference library of every engineer and architect. It was, perhaps, unfortunate that the Lord Mayor was, on the opening day, unable to extend to the gallery his tour of parts of the building, but it was impossible for him to inspect in detail more than a small proportion of the huge show, owing to the pressure of other official engagements for the same day. This, however, was a matter beyond Mr. Montgomery's control, and is probably the only thing that can be cavilled at in an exhibition which is, surely, as nearly perfect as experience and enterprise can ensure.

* * *

"The Surveyor" Conference.

We take this last opportunity of reminding our readers of "Municipal Engineers' Day," to-morrow (Saturday), at Olympia. The demonstration of Messrs. J. & P. Hill's interesting vacuum street-cleansing motor car will take place at 2.30, in a street adjacent to the exhibition buildings. At 3.15 commences the conference of road engineers and others, and we trust it will be well attended, and will provide opportunity for free and full discussion. The propositions to be submitted are again set out on another page; we need only add that they will be introduced to the meeting by the following, to whom our sincere thanks are due for their invaluable assistance at quite short notice: No. 1, Mr. H. T. Wakelam, M.Inst.C.E., county engineer of Middlesex; No. 2, Mr. H. Percy Boulnois, M.Inst.C.E.; No. 3, Colonel R. E. Crompton, C.B., R.E., consulting engineer to H.M. Road Board; No. 4, Mr. A. Dryland, M.Inst.C.E., county surveyor of Surrey; and No. 5, Mr. H. P. Maybury, M.Inst.C.E., county surveyor of Kent. Mr. Greville Montgomery hospitably invites those who attend the conference to take afternoon tea with him in the Pillar Hall on the conclusion of the meeting.

Storm Water Discharge.

By R. O. WYNNE-ROBERTS, M.Inst.C.E., F.R.San.I., Consulting Engineer, Regina, and T. BROCKMANN, Dipl.Ing.(Berlin), Civil Engineer, Regina.

(Conclusion.)

Before proceeding to explain the method of constructing flow areas and curves, it will be necessary to submit the following formulæ:—

Let Q = volume of storm water discharged in cub. ft. per sec., when the whole of the drainage area is contributory.
Q_1 = volume of storm water discharging at any time during or after a storm, in cub. ft. per sec.
P = coefficient of impermeability, taken from diagram or table.
R = quantity of rain reduced to cub. ft. per sec. per acre.
I = coefficient of rainfall intensity; see table or diagram.
A = drainage area in acres.
T_c = time required for storm water to concentrate at the lower end on the sewer of L length, in minutes.
L = length of sewer in ft.
V = mean velocity of flow in sewer in ft. per sec.
D = duration of storm in minutes.
T = any time in minutes.

Then (1) $T_c = \frac{L}{V}$

and (2) $Q = P \times I \times R \times A$.

In the preliminary design of a sewerage system the length of any particular section is known, and the velocity of flow may be assumed at, say, 3 ft. per second, when running half full or full, so that the time T_c required for the storm water under such condition to flow from point to point can be easily ascertained by formula (1).

The duration of a storm is D, and the ordinates of any sewer having L length, and during any storm of D duration, is clearly indicated in the diagram Fig. 12. It may be explained that in this case the

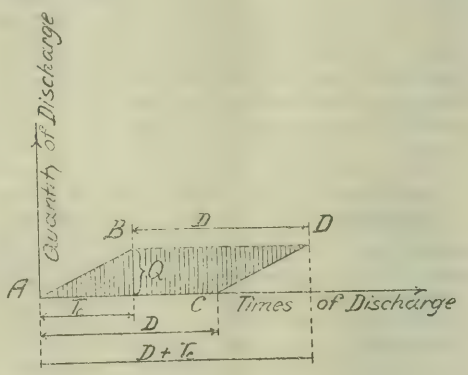


Fig. 12.

direction of the flow is from the right to the left, and the outlet is situated at the toe-point A.

RECAPITULATION.

It is to be hoped that what has already been stated regarding the problem of calculating the quantity of storm water to be dealt with in any district has been

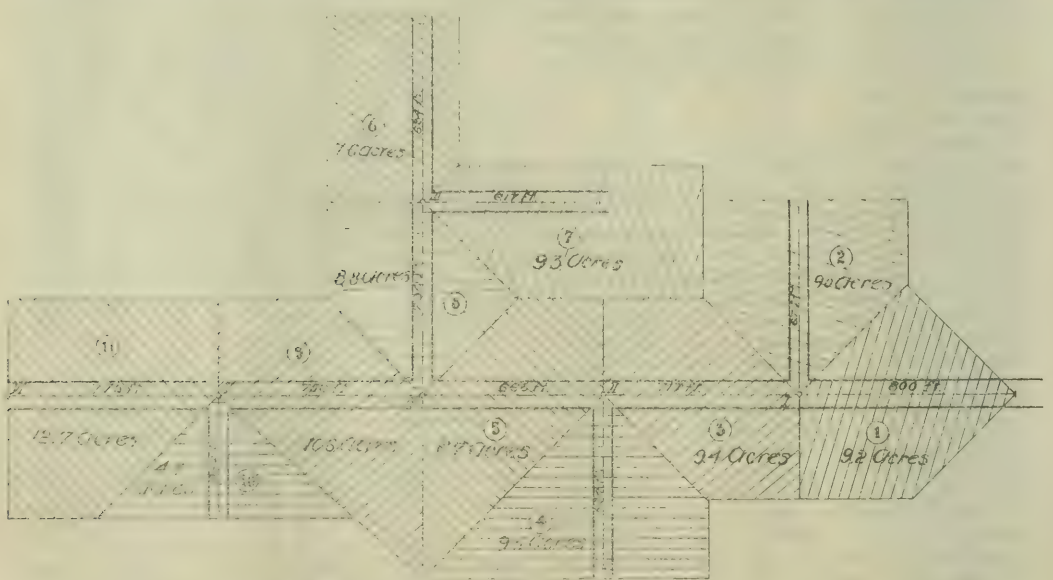


Fig. 13. Plan showing Storm-water Sewers of a District.

expressed in explicit terms, and that it will be recognised that, having regard to the variable factors which have to be considered, the best way of arriving at a satisfactory solution will be by drawing flow areas.

The engineer will therefore have first to—

(1) Assume the intensity of the rainfall.
(2) To ascertain if retardation takes place.
(3) If retardation does not take place, then use formula . . .
(4) If retardation does take place, then to draw flow-areas.

EXAMPLE.

A complete example will now be worked out to illustrate the method which the writers submit is the more rational one to follow.

representing the volume of storm water Q_1 for any time, T will be as follows:

If T is greater than zero and less than T_c then

$$Q_1 = \frac{T}{T_c} \times Q;$$

if T is greater than T_c and less than D then $Q_1 = Q$;
if T is greater than D and less than D + T_c then

$$Q_1 = \frac{(T - D) - T}{T_c} \times Q;$$

if (D + T_c) is less than T then $Q_1 = 0$ (see Fig. 12).

The [illegible] slope A-B of Fig. 12) of the flow area is parallel to the right-hand slope C-D.

The volume of storm water run off is represented by the [illegible] the shape of the rhomboid A-B-C-D, and the period of concentration, as well as the quantity discharged at any time at the lower end

The plan shown in Fig. 13 is presented as a typical lay-out of a sewerage system for storm water. There are six sections, to which eleven areas are to be drained.

Assumptions.

Duration of storm = 10 mins. or 600 secs.
Rainfall = 2 cub. ft. per sec. per acre

Accordingly the volume of discharge will be:—

Q. Area × rainfall × coefficient of impermeability × coefficient of intensity.

Q A × R × P × I 9·2 × 2 × 0·77 × 0·92.

Q. 13 cub. ft. per sec.

Having ascertained the time of concentration and the volume of discharge as above, the flow area is

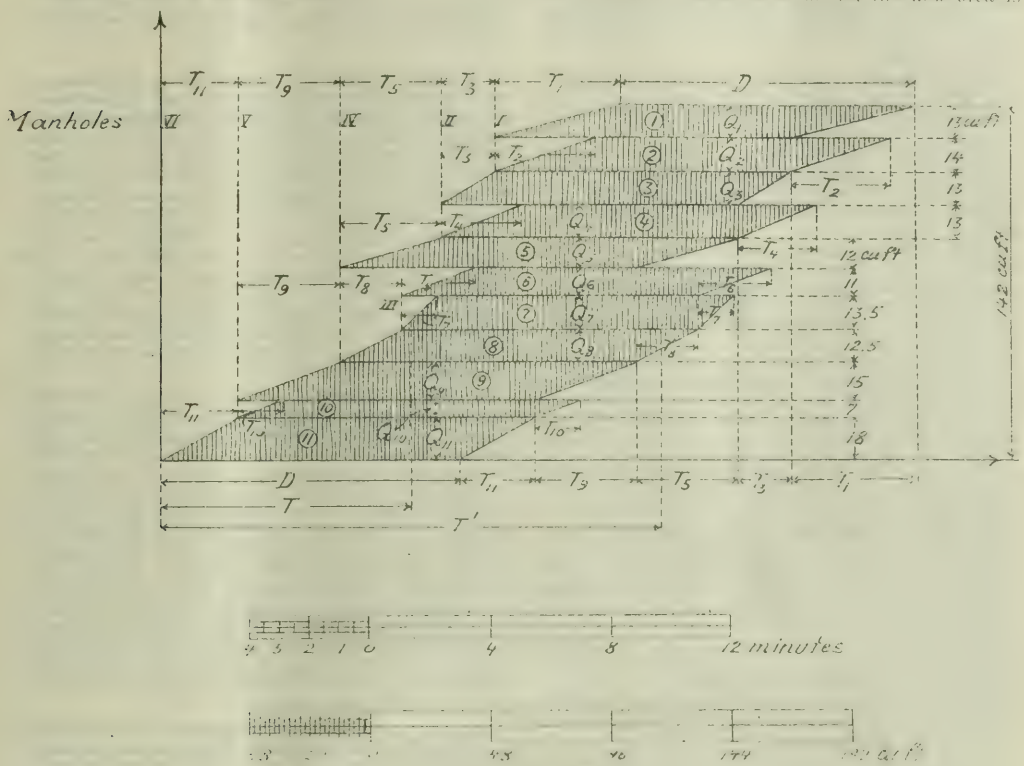


Fig. 14

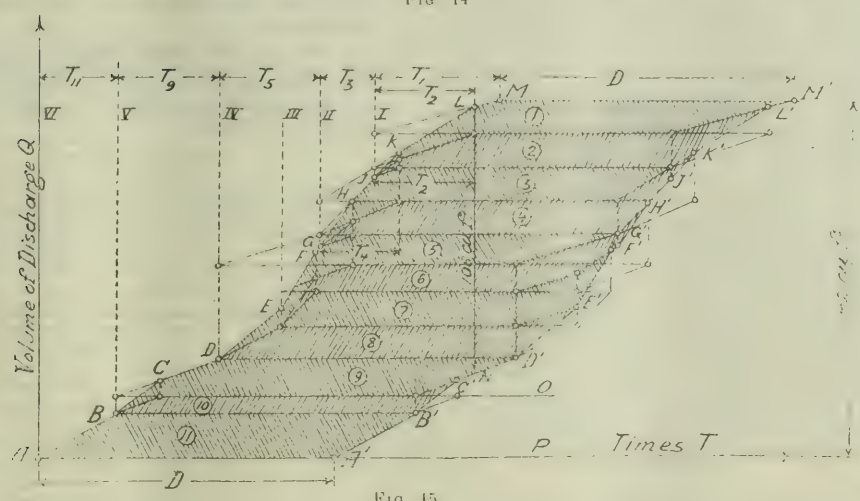


Fig. 15.

Scales of the flow areas are—

Time 1 in. = 4 mins.

Volume of discharge $\frac{1}{48}$ in. = 1 cub. ft.

Commencing with section 1—

L = 800 ft.

V = 3·2 ft. per sec

Time of concentration = $\frac{L}{V} = \frac{800}{3·2}$ = 250 secs. or 4 mins. 10 secs.

Coefficient of impermeability for, say, 70 persons per acre, as per diagram = 0·77.

Coefficient of intensity for a section 800 ft. long, as per table, equals

$$1 - 0·0028 \sqrt{800} = 0·92.$$

The drainage area for section 1 is 9·2 acres.

plotted in the top right-hand portion of the diagram Fig. 14.

The volumes of discharge for the other ten areas can be arrived at by analogous calculations, and the following results will be obtained:—

Section 1.	13 cub. ft.	per sec.
2.	14	,, ,,
3.	13	,, ,,
4.	13	,, ,,
5.	12	,, ,,
6.	11	,, ,,
7.	13·5	,, ,,
8.	12·5	,, ,,
9.	15	,, ,,
10.	7	,, ,,
11.	18	,, ,,
Total	142	,, ,,

So that the total discharge at manhole VI. amounts to 142 cub. ft. per second.

Fig. 14 shows the flow area for each section and drainage area illustrated in Fig. 13.

Those who wish to draw similar charts may be guided by the following simple rules:—

(1) Start by drawing the flow area of the section of sewer lying near the remote limits of a district—that is, the farthest from the point of outlet—and then proceed, section by section, downwards in the direction of the flow.

(2) Flow areas of sewers which meet at a manhole have the same abscissæ—*i.e.*, the toe-points of their ascending slopes are located perpendicularly above each other.

(3) The flow area of a sewer section located between two manholes is to be drawn beneath those of the upper sections, the toe-point being moved leftwards, a distance corresponding to the time of concentration for that particular sewer.

(4) Secondary collecting sewers joining the main sewers will have to be dealt with in a similar manner.

The chart illustrated in Fig. 14 has been constructed in accordance with the foregoing rules.

The volume of discharge passing through manhole VI. at the time T is represented by an ordinate erected at T and cutting the flow areas 11-5. The parts of the erected ordinate which signify discharge are those which lie within the shaded areas. The flow areas 4-1 are not passed through by the ordinate, which shows that they are not yet contributing. Whereas at the time T^1 the sections represented by the flow areas 9-1 are discharging into manhole VI., while the water from sections represented by flow areas 11-9 has already run off.

Fig. 15 has been prepared by depressing the projecting points on the left and elevating those on the right to the area next to them, and so a flow curve is obtained, which is characteristic for the volume of storm-water discharge at any time from the whole drainage area under discussion.

It will suffice to construct only the ascending curves A, B, C, &c., because the descending curves M^1, L^1, K^1, &c., are parallel to them.

The largest ordinate of the total flow area will give the maximum rate of flow on which the calculations of the sewer dimensions are to be based.

In the present example the ordinate L-N shows this maximum rate of flow to amount to 106 cub. ft. per second, and this is the volume of storm water that must be provided for in sections 9, 10 and 11.

The difference between MP and LN indicates how much the storm-water discharge is modified by retardation. In this case the difference equals 142-106, or 36 cub. ft. per second. In a like manner the difference between MO and LN represents the modification of the aggregate flow due to retardation in sections 1 to 9 inclusive.

In conclusion, the writers have to urge upon city engineers and others the desirability of installing automatic recording rain gauges, so as to obtain reliable information concerning the quantity of rain falling in short periods and in different districts, for without this data it is possible that the assumptions which will be made when designing storm-water sewers may be erroneous, and lead to inadequate or excessive provision for storm water. In each city the rainfall should be automatically recorded for those having a duration of 2 to 120 minutes, and such data plotted as shown in Fig. 1, illustrating the intensity of the rainfall. The rain gauges required for this purpose are to be had at a moderate price, while the information thus secured will be of great value.

The Surveyors' Institution.—The next ordinary general meeting will be held at the Institution on Monday next, when a paper, entitled "Site Value Deductions for Construction of and Appropriation of Land for Roads," will be read by Mr. R. G. G. Reed (Fellow). The chair will be taken at eight o'clock.

Public Health Law. This concise little work* has been prepared mainly for the use of all concerned in local government work who may find the larger books too elaborate. In twenty chapters it covers the ground sufficiently for its purpose, including such matters as highways, but omitting rating elections &c. For students it should be of assistance in preparing for examinations in Public Health Law, while the practitioner will find its arrangements well suited for easy reference. *The Law Times.*

* A Manual for Sanitary Authorities, Engineers and Surveyors, Town Clerks, Clerks to District Councils, and other officers and members of local authorities. By S. G. Warner, of the Middle Temple, Barrister-at-Law, A.M.I.C.E., &c. London: St. Bride's Press, Ltd. Price 10s. 6d.

"THE SURVEYOR" CONFERENCE AT OLYMPIA.

PROPOSITIONS TO BE SUBMITTED.

The following is the full text of the five propositions which will be submitted for discussion at The Surveyor conference to be held at Olympia to-morrow (Saturday), at 3.15 p.m. The names of those who will submit them are given in "Minutes of Proceedings," p. 621.

(1) That in order to satisfy modern requirements in connection with the maintenance and improvement of roads it is essential that every highway authority having the charge of important roads should possess an efficient engineering organisation, and that great attention should be paid to the selection, conditions of employment and organisation under each authority of a thoroughly trained and adequate engineering staff.

(2) That it is desirable that facilities should be afforded and some form of organisation adopted to enable surveyors of small districts to obtain official advice, assistance and supervision from county surveyors, and that county surveyors should, where necessary, be provided with special engineering assistance to enable this advice and assistance to be effectually afforded.

(3) That it is desirable to encourage the publication and dissemination throughout the profession of annual reports by highway surveyors setting forth full particulars, arranged under heads as uniform as possible for purposes of comparison, in regard to work done, including all essential details as to materials, methods and costs, together with summaries of practical results obtained on different roads classified according to amount and character of traffic; that these reports should be circulated and exchanged between all surveyors of important highway authorities, and that arrangements should be made by highway authorities to enable their surveyors to visit and inspect work carried out in other districts, so that by frequent conference and interchange of experience among road engineers the science of road construction and maintenance may be advanced.

(4) That the question of drainage of subsoil water from roads as distinguished from surface drainage is of pressing importance on many roads and in many districts, and should receive the special attention of road engineers.

(5) That the terms asphalt and bitumen and other terms used in connection with tar-bound or bituminous-bound roads should be defined by some authoritative body, and that the attention of the Road Board be directed to the matter.

Business Announcement.—Messrs. S. H. Morden, 11 Tothill-street, Westminster, S.W., have been appointed agents for the Anglo-Mexican Petroleum Products Company, Limited, for their well-known products, "Fluxphalte," for road spraying, and "Mexphalte," for road making.

Cornwall Roads: County Surveyor and Heavy Motor Traffic.—At a recent meeting of the Highways, Bridges, and Main Roads Committee of Cornwall County Council, a resolution was passed asking the chief constable of the county to use his best endeavours to put a stop to the practice of heavy motors going at an excessive speed. The county surveyor, Mr. Albert E. Brookes, said the greatest damage was being done by these heavy motors. The speed stipulated was five miles an hour. They went faster than that, and it was the excessive speed that caused the damage. The fast speed of the lighter motors certainly affected the surface of the roads, but the wheels did not crush the material. Mr. Brookes reported that the total of the estimates exceeded that of last year by the sum of £5,000, the total for maintenance only being £4,644 in excess of last year. Of that sum £2,670 arose in the eastern and £2,014 in the western division. He submitted schemes of road improvement to be carried out during the year 1913-1914, which, if approved, he asked might be submitted to the Road Board for grants under the Development and Road Improvement Funds Act, 1909. He had assumed that the grant allocated to Cornwall under that head would be £6,000, on the same basis as last year 1d. per super. yard on rural roads, and 3d. per super. yard on urban roads, towards the cost of surface tar treatment, and 75 per cent of the improvement cost of strengthening road foundations and crusts.

The Wheel and the Road.

By COL. R. E. CROMPTON, C.B., M.INST.C.E.

[The following paper was read at a meeting of the Institution of Automobile Engineers held at the Institution of Mechanical Engineers on Wednesday of last week.]

In these days of mechanical transport of passengers as well as of goods we hear on all sides of the immense damage done to our roads by the new form of locomotion. On all sides demands are made that all mechanically propelled vehicles should be heavily taxed in order to pay for the damage they do to the roads they traverse, but the unfairness of confining the taxation to one class of vehicle only is obvious, and can only have the effect of retarding the progress of modern development, so that things are quite certain to right themselves eventually.

It is probable, however, that the mere fact that such statements are made in the columns of the daily press shows that the public have insufficiently considered the real difficulty, which is that, whereas on a railway one authority controls not only the railway track, but the vehicle which rolls over it, in the case of the ordinary road, vehicles are owned and maintained by one set of persons and the roads are maintained by another set, and, unfortunately, the two interests have hitherto been considered antagonistic. . . .

The subject has interested the author for years past, and he was at work at it in India on the first introduction of mechanical transport in 1869. He brought it before this institution in a paper read seven years ago. . . . He again touched upon it in his presidential address; he discussed it at some length in a paper he read before the Institution of Civil Engineers on "Modern Motor Vehicles" in February, 1907, and again in the discussion which took place here on Mr. Mallock's paper on "Wheel and Road" in the session of 1910-11.

WHEEL DIAMETERS.

Much that he is going to put before you is not new to some of you. Many observations that he has made have probably been made by several of the present audience, but he hopes that this institution, through its increasing numbers and increasing influence, may carry the matter a step further.

In his former papers and writings the author has always urged the advantages of using wheels of large diameter. This is particularly necessary when the tyres are comparatively rigid, as are the steel tyres used by traction engines, traction engine wagons, motor wagons and the trailers they draw behind them. The same is true to a lesser extent when the wheels themselves are fitted with elastic tyres, which, as Mr. Mallock pointed out in the paper above alluded to, has practically the same effect as increasing the wheel diameter of a rigid-tyred wheel.

Notwithstanding this, the author regrets much to have to say how little the designers of commercial vehicles have studied this question. The makers of the heavier class of motor wagon appear to have adopted a standard driving wheel diameter of 40-41 in., practically the same for the steel wheel as for the rubber-tyred wheel of the motor omnibus, although undoubtedly at the speeds at which these vehicles are run the diameter of the rigid steel motor wagon wheel should be at least three times the diameter of the rubber-tyred one carrying the same weight in order to be equally fair to the road surface.

The chief cause for the non-adoption of large diameter wheels has in the past been their great weight, and the difficulties in loading the vehicles which are introduced by their use when such loading has to be carried on over the side; now, however, when so many of these vehicles run long journeys in which convenience of loading and unloading is not nearly so important as the reduced wear and tear both of vehicle and road which follows on the introduction of large diameter wheels, the author hopes that what he is about to say in this paper may bear useful fruit, and that the ingenuity of the designers will overcome the constructional and loading difficulties that have been alluded to.

The author does not propose to go into the mathematical investigation of the work done on a road surface when a loaded wheel is driven over it by power, but in order to complete this paper, and to help students who wish to investigate the matter mathematically, Mr. Leslie Hounsfield has kindly consented to prepare and attach to this paper a *résumé* of the mathematical considerations involved (see Appendix). The investigation is not very simple, even when it is confined to the rolling resistance of a comparatively rigid wheel on a rigid steel rail, but in all cases the elasticity of the road surface, for which Mr. Hounsfield has used "*e*," plays a very important part.

ELASTICITY OF ROAD SURFACES.

It is common knowledge that the elasticity of the wheel surface has played a most important part in helping forward the introduction of mechanical transport.

The author believes that we are now in a fair way to render the surfaces of our highways sufficiently elastic to enable them to stand up to the destructive forces which lead to their permanent distortion, deterioration, and wear, and certainly to the rapid wear of the wheel tyres when these are composed of that expensive material rubber.

Our "well-informed" daily press has frequently pointed out that the ideal road of the future will resemble the carriageway under the entrance to Euston Station, where a short length of rubber-surfaced road has been laid down for many years. We are told that the ideal road must eventually be faced with rubber. What such a road would cost, even if rubber was reduced to 6d. a pound, the author leaves to the imagination of the members.

The author's belief is, however, that sufficient elasticity can be introduced into the surface of our carriageways to make them a practical proposition, and that the chief reason for the success of the methods which have been introduced during the past eight or nine years, and which have resulted in reducing the mud, the dust, and the noise of travelling, has been really due to the small amount of elastic cushioning which has been already introduced into the surface of these roads. Thus, the main direction in which still greater improvement is being sought for is in further perfecting these methods, so that Mr. Hounsfield's "*d*," which may stand for the permanent distortion and wear of the road surface, and perhaps equally for the permanent wear of the wheel tyre, may be diminished in the future as "*e*," our elastic factor, is increased.

The elastic factor of the old style of water-bound macadam was very small; consequently most of the work done on the road was expended in displacing the upper surface of the road, partly in the form of a slight forward displacement or rocking of the particles, which road surveyors are in the habit of calling "push," and which tended to loosen these particles in their bed, and partly in the grinding up or pulverising of the particles which had become detached from their bed in the surface, and which grinding action is so characteristic of a steel wheel rolling over gravel, or whenever loose, gritty material covers a harder surface, such as when our streets are gritted with gravel, which is ground down by the traffic into finer material.

WEAR.

Many people, including a considerable proportion of the road surveyors, have, up to quite recently, looked on the question of the wear of road surfaces rather superficially—that is to say, they have always considered that surface wear was the most important matter, and have selected for their macadamised roads the stones from those rocks which offer the greatest resistance to attrition. In this, however, they are wrong. The main source of the mud and dust found on our roads arises from the inter-attrition of the stones of which our macadam roads are composed. This inter-attrition arises from the rocking action above alluded to, which is caused by a rolling wheel, and which, again, causes the sides of the stones to rub against one another, and thus gradually removes the angles and changes the stones from the familiar angular shape in which new road metal is seen previous to its being spread on the road

to the rounded form in which it is to be seen when a road is broken up for recoating and repair; in other words, the wear of the road material, far from being confined to the surface, as would be the case if the stones were firmly held in position and subjected only to attrition on their upper surface, goes on by grinding away the whole surface of the stones, and this affects the stones next the surface to the greatest extent; in winter weather, however, the inter-attrition extends to a considerable depth, the quantity of mud produced by this attrition increasing in direct proportion to the depth to which the rolling or rocking action of the stones extends.

All improved pavements have for their object the reduction of this interstitial wear, and the confining of the wear as far as possible to the upper surface of the blocks or of the sheet asphalt. Taking these in order, granite blocks or setts were first used bedded on sand, and afterwards in pitch, and either close-jointed or with cement or other non-elastic joint between them; this, although it resulted in small inter-attrition, and small surface wear, transferred the effects of the work done on the road very largely to ear-splitting noise or to the destruction of the vehicle itself.

When wood blocks were substituted for granite, the elasticity of the material itself at once led to an improvement. The streets became more silent, the vehicles lasted longer, and the extension of wood pavements has only been restricted by considerations of cost.

SHEET-ASPHALT PAVEMENTS.

Sheet-asphalt pavements attack the question in a different manner. A sheet-asphalt pavement may be considered as a macadam road in which particles are of extremely small size, and are prevented from rocking and consequent interstitial wear by the interposition between each particle of a very thin film of bituminous cementing matter, and as the surface of an asphalt pavement is thoroughly well sealed and the entrance of water prevented, it does not suffer as a water-bound macadam road does by the lubricating action of the water causing "wet grinding" of the particles which always goes on in a water-bound macadam road during the wet season.

Unfortunately the early asphalt pavements were very expensive, as the material of which they were formed was artificially ground-up natural asphalt rock, of which the supply is limited, and on which the carriage from abroad is heavy. About twelve years ago, however, our American friends found that artificial asphalt could be produced at reasonable cost by binding together mixtures of graded sand with a small proportion of limey matter and with the purer bitumens which are found in various parts of the world, notably in Trinidad, Venezuela, and Mexico. As in this case the sand and the finely-ground lime dust can be obtained anywhere locally at comparatively low cost, the expense of the pavement was chiefly confined to the cost of the bitumen itself, and hence the production of artificial asphalt increased largely in the United States, so that most of the sheet-asphalt pavements in the American cities have been gradually developed and improved on these lines.

About five years ago a still further improvement was introduced by an English company on the Thames Embankment, and other pavements of the same class have been tried here and have found increasing favour, and their further development seems likely to help us in producing our ideal road in which the elastic factor will be sufficient for our purpose.

The reason for the rather tardy development of sheet-asphalt pavements made from rock asphalt has been its admitted slipperiness for horse traffic, and no doubt it would never have been further developed but for the fact that, as we now see, the motor vehicle traffic is likely to form the most important fraction of the whole.

SURFACE TARRING.

Going back to the stages of improvement of road surfaces, as will be remembered, the prevention of dust by surface tarring began to be introduced about eight years ago, and has since gone steadily on. Owing to the abundant supply and the low price of tar in this country, this was the first practical method by which the particles of the surface of a macadam road could be held in position by a partially elastic binding material, for, although it is not correct to say that tar, or the pitch which remains on the surface of our roads and binds the fine particles together after the lighter oils of the tar have dried out, is truly elastic, yet when this pitch becomes combined with the finer particles of the road surface, such as the sand or the limestone dust, it does behave to a limited extent as an elastic, but extremely viscous, liquid, and as it has the effect of preventing the entrance of water into the road, it also reduces the inter-attrition between the stones, thus allowing of dry-grinding only under the rocking action of the traffic instead of the destructive "wet grinding" which always takes place in wet weather.

The pitch which is employed for our roads is very slightly elastic, and when combined with sand is plastic within certain limits of temperature. It is brought to the requisite consistency to give fair average results—*i.e.*, not to be too soft in summer, or too hard and brittle in winter—by the process of tempering it, or adding what is called fluxing oil, so that at a fixed temperature, which the Americans usually take at 77 deg. Fahr., and which the author prefers in this country to take at 60 deg. Fahr., its consistency and its ductility should approach a certain figure which must be determined by experiment; but the use of pitch in our roads must, nevertheless, on account of its considerable temperature variation in consistency, always be a difficult matter. It is not possible to specify pitch of a consistency which will be equally suitable for the Brighton sea-front and for the Scotch roads, as a medium consistency would be too soft for Brighton but too hard for Scotland.

BITUMINOUS BINDERS.

Fortunately discovery has kept pace with the demand. We are now offered materials found to some extent in Nature, when Nature itself distils and hardens the asphaltic oils which are found in considerable quantities in the central portion of the American Continent, and which are also available as a residual product when the asphaltic oils are distilled from the crude oil wells of the same region to obtain from them petrol as well as the illuminating and lubricating oils. After these oils have come over from the still, the process can be stopped at a point at which the residual substance is practically pure bitumen, which can be tapped off and shipped to us for road-binding purposes. This substance is most distinctly elastic or resilient, and does not lose its resilient properties if to it be added an equal mass of fine powder (which may be lime, clay, Portland cement, or similar substances, which can be readily reduced to an impalpable powder), which appears to add to the bitumen what painters call "body," and also to increase what painters call its "covering power"—that is, the area of sand or stone particles which can be covered with a thin film of it. This process of combining bitumen with a fine powder, technically called "filler," is somewhat analogous to the fillers used in the preparation of vulcanised rubber for our tyres, and in both cases a certain fixed amount can be added without materially decreasing the resilience or the mechanical strength of the product.

The next step is to use this bituminous binder combined with its filler to the best advantage by a very careful study of the stony substance which must be used to give good foothold and to resist attrition at the surface of the pavement. Many substances, such as crushed granite, basalt, and other finely divided stones, have been tried for this purpose, but it appears likely that angular particles of silicious sand, such as is found in Nature on our sea shores, river estuaries, or in inland sandpits, or which can be produced by the disintegration of sandstone rocks, or by the grinding up of flint, gravel and shingle, form, on the whole, the most suitable material to be bound into a pavement by the bituminous binder.

Much thought and study have been given to this question on the American side, and the author is greatly indebted to Mr. Clifford Richardson, Messrs. Smith and Dow, Prof. Blanchard, and others who have heartily co-operated with him in this matter, and placed before him without stint the results of years of investigation, which have enabled him to prepare specifications and to design machinery for carrying out these specifications, in which work he would have been delayed for years if it had not been for their kind co-operation.

The point aimed at in producing a road surface which shall be durable, sufficiently resilient, non-slippery, waterproof, and which can be produced at reasonable cost, is that the road should be built up on a foundation or strength crust strong enough to

carry the weight of the traffic, and in order to distribute the weight on the wheels over a sufficient area of the subsoil to prevent settlements or permanent depressions being formed at points where the subsoil is soft or plastic, and on this foundation or strength crust to lay a wearing crust similar to a sheet-asphalt pavement and constructed chiefly of sand bound together by bitumen. The strength crust may be practically similar to the wearing crust, but larger and cheaper material is generally used for it, and it is not so necessary that this strength crust should be so perfectly watertight, as it is protected from the entrance of water from above by the impermeable nature of the upper sheet pavement, but as the considerations which govern its structure are very faithfully reflected in the requirements for the sheet pavement itself, the author confines himself to stating briefly what these latter are as far as our knowledge at present extends.

Our sheet pavement must consist of sand with the particles so graded and so interlocked that, when combined and cemented together by the bitumen and the filler, the surface resembles a natural gritty rock of a nature sufficiently resilient to recover the temporary deformations caused by the rolling over it of a wheel, and this condition is best obtained when the grading of the grains of sand is so contrived that they approach one another so closely that the interposed elastic film of bitumen and filler combined forms from 20 to 30 per cent of the total mass. The author feels that he shows considerable temerity in laying down these two limits, as he is aware that some of the most useful sheet pavements formed from natural rock asphalt are supposed to contain very much less bitumen, but he believes that he will be supported by those who have closely studied this matter in the figures now given.

Considerations of expense and the costliness of the bitumen point to the desirability of approaching as closely as possible to the lower limit. Unfortunately it is a very serious matter to experiment on the roads themselves. If too little bituminous matter is used, the surfaces are not sufficiently sealed against the entrance of water, wet grinding between the sand grains takes place, the sand particles become loosened and grind against one another, and the interposed film of bituminous matter becomes detached, and is washed away at each succeeding rainstorm. This process, which we have called "denudation," is the chief cause of the break-up of all classes of bituminous-bound roads during wet seasons. We are most familiar with it in the case of surface-tarred roads, but it has also occurred to a great extent in America and in this country, even where the better class of bitumens have been used in insufficient quantity, or without due consideration for combining the proper proportion of filler with the bitumen or pitch as the case may be.

So long as heavy traffic was confined to the principal roads or streets of large towns, the cost of wood-block or asphalt pavement, although extremely heavy, was cheerfully borne by the street or road authority; but now that in this motor era the traffic has to spread itself widely over the roads that radiate from all our cities, the consideration of maintaining these roads in a satisfactory condition at a reasonable cost has become the problem of the moment.

Our Road Board has already done a good deal to promote the study of these improved road surfaces by laying down twenty-three comparative experimental roads near London, at Sidcup, in Kent, five lengths of the Portsmouth road in the Borough of Wandsworth, and twelve lengths in parts of Fulham, but the difficulty of obtaining results from any class of experimental roads, even on those where traffic is extremely heavy, is greatly enhanced by the variable nature of our climate, by variations in traffic, and by the very considerable time which must elapse before any notable changes in the surface can be observed.

LABORATORY TESTS.

Hence it is with great pleasure that the author is able to announce that the Road Board, seeing this, have sanctioned the design and construction at the National Physical Laboratory of the first large-scale road machine—that is to say, a building containing a circular track on which experimental lengths of roads can be readily laid down and tested to destruction by the passage over them of wheels driven by motors which are guided and steered in a circular track by a revolving framework. This machine, which has taken a year to design and construct, is now complete and has been set to work, and the preliminary difficulties have been overcome. The track has been filled with four lengths of waterbound macadam made up in four different ways, and the behaviour of these lengths will be compared with one another, and each of them tested to destruction, almost at the time that this paper comes before you for discussion. The designers hope that by means of this machine, which is the only one as yet put down in any country, they will be able to arrive rapidly at conclusions which otherwise it would have taken years to reach by actual use on the roads themselves. As the roadway is under cover and protected from weather influences, they will be able either to eliminate the weather conditions entirely or introduce them one by one and study their effect. For instance, the track can be heated by hot air blown on to it; rain can be imitated by spraying devices: it can be artificially cooled to the freezing point. The wheels used can either be standard wheels with plain steel tyres, carrying a fixed weight of 1 ton each; the diameters and widths of these wheels can be varied, solid rubber tyres or pneumatic tyres, plain, corrugated or studded, can be substituted in turn, and the effects of each of these on a standard road surface noticed, and it will also interest members to know that in all probability this will be a very effective and perfect manner of testing the durability of various classes of rubber tyres and of the covers of pneumatic tyres.

At this laboratory, and in the author's own private laboratory, a good deal of minor apparatus has been provided to enable the value of the materials used to be tested and compared, but so far means have not been found to enable the small-scale experiments of the laboratory to be effectually co-related with the practical durability of the materials when used on the roads themselves. The author believes, however, that the road machine just described will form the necessary connecting link for this purpose, and he has great hopes that it will enable the board to settle quickly a number of very important points which have always been open ones to road surveyors on account of the uncertainty of the various weather and traffic factors which have in the past prevented any correct comparative data being obtained. With this road machine, as the variable factors may be eliminated in turn, it ought to be possible to put a value on each of these factors with far greater accuracy than has ever been possible up to the present.

The paper is already too long, but as, no doubt, the author will be asked the important question whether it is reasonable to suppose that the covering of any considerable length of our roads by sheet pavement resembling asphalt is a practical possibility, he unhesitatingly answers "Yes" to this question; that he personally thinks that the gradual introduction of methods of covering our roads with a satisfactory and smooth-running wearing coat or carpet of sand or other silicious matter bound by pitch or bitumen at a cost which can be borne by the ratepayers is only a question of engineering study, of the use of suitable machinery and suitable methods of rolling, and of the organisation of staff and workmen, and he feels confident that he is supported in this, his personal opinion, by all the best of the English as well as of the foreign road engineers who have paid close attention to the subject.

The accompanying illustrations will show on an enlarged scale the progress of our knowledge in applying successively tar, pitch and bitumen as a binding material to hold the particles of the road sufficiently firmly in position, and the efficiency of these generally may be said to increase as the binding effect extends deeper below the surface.

Fig. 1 shows generally the distribution of tar used in surface tarring when the quantity applied, whether it be by hand or by machine spraying, reaches from 2 lb. to 2½ lb. of distilled tar per super. yard. It will be seen that the effect of the tar when this is applied for the first time to a water-bound macadam road already in good order, extends to only ¼ in. or ⅜ in. below the surface, for although, if individual stones are taken out of the road, we often find them discoloured to a greater depth, it is probable that this discolouration is due to the lighter oils contained in the tar penetrating to a greater depth (probably by a differential surface tension effect) than the pitch itself penetrates, the pitch being the real permanent binding agent.

Figs. 2, 3 and 4 show the effect of the application of tar as a binder by previously coating the material in increasing quantities. It will be seen that in Fig. 2,

9·6 lb. per yard, there is only sufficient material to coat the comparatively large stones, so that the road, when consolidated by the roller, contains a considerable number of voids, and that the large stones are only cemented together by the tar when the latter has completely set at their angles, and is consequently

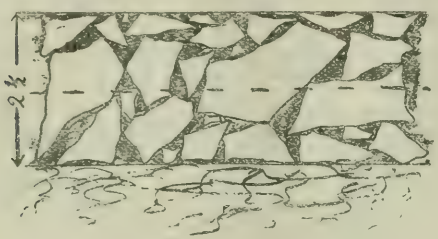


Fig. 1.

very weakly held to resist the push of the rolling wheel.

Fig. 3 shows that by increasing the quantity to 16 lb. per square yard there is enough tar to coat the small particles to partly fill the voids, and Fig. 4, where 22½ lb. per yard is used, shows this to a much

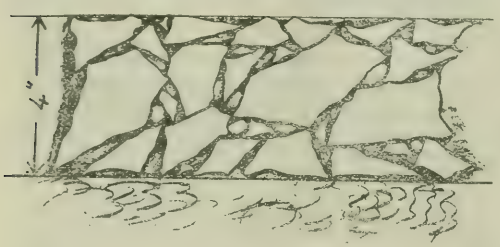


Fig. 2.

more perfect extent, so that the road is almost voidless, and from this it will be seen that in this case the strength of the road to resist the push of the wheel is almost in proportion to the weight of the tarry matter or other binder used per super. yard.

In these first three figs. the author has supposed

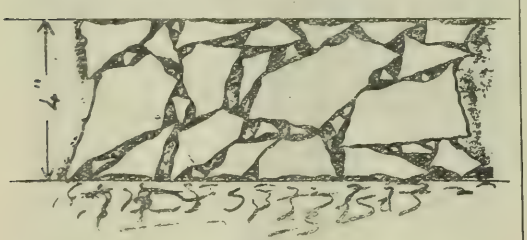


Fig. 3.

that the harder class of roadstones, such as granite or basalt, are used. With these stones the roller has little power of crushing the stone out of shape so as to increase the surfaces forced into contact and thus cemented by the tar, but Fig. 5 shows how, from this point of view, the use of slag as a material to be

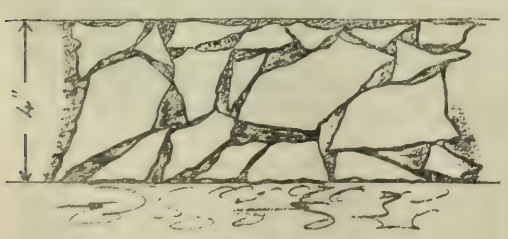


Fig. 4.

coated by tar is superior to the harder stones, and the same may be said, though to a lesser extent, of some of the limestones that can be used.

In Fig. 5 will be seen the form and gauges of stones that are shown in Figs. 2, 3 and 4 to squeeze or crush out of their original shape so as to conform to some extent, and so fill up the voids; at any rate, it can be seen that even with a thin film of tar, 9·6 lb. per yard, the surfaces are far better cemented together than was the case in Fig. 2, and this, in the author's opinion, is the chief cause why, on the whole, the Hooley principle of using tar and slag for his tar-

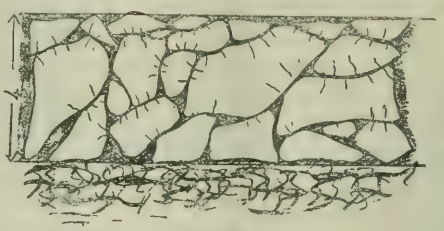


Fig. 5.

macadam has turned out so successful and durable, and why the roads are so capable of resisting the injurious push of the rolling wheel.

Figs. 6 and 7 show two methods of producing a road by "penetration" or grouting" methods to the specification laid down by the Road Board. In the first case, the material is rolled when in a dry con-

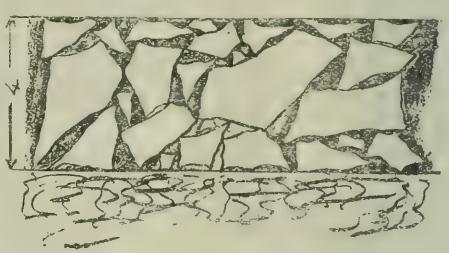


Fig. 6.

dition until the angles of the stones are sufficiently firmly in contact, but not to close the surface so as to prevent the entrance of the hot binder, which consists of one-half melted pitch and one-half hot sand, which is poured in at a suitable temperature, and

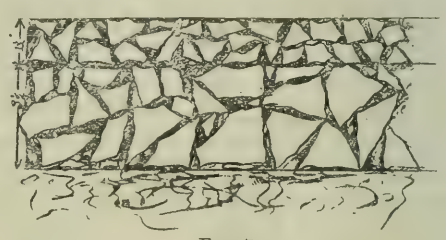


Fig. 7.

flows to a limited extent from the surface so as to fill the upper voids and hold the stones more firmly than the same quantity of binder would do if used on any of the methods shown in Figs. 2, 3 and 4.

Fig. 7 shows the same penetration method, using the pitch and sand binder applied in two layers. This method, called "double pitch grouting," or the

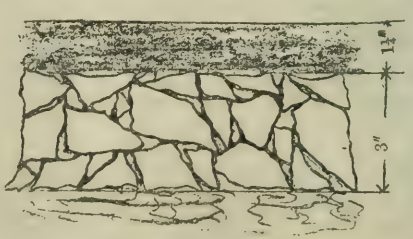


Fig. 8.

"Pitchmac," invented by Mr. Brodie, the city engineer of Liverpool, gives undoubtedly one of the strongest roads that can be produced with pitch.

Fig. 8 shows the double coating method, which is that advocated by the American engineers and by the

Trinidad Company, who laid the Thames Embankment and other roads, and by the author, who has strongly advocated it wherever the amount of traffic warrants the cost of such a pavement. It will be seen that, to some extent, it resembles Brodie's "Pitchmac," or double pitch grouting; the lower portion or strength crust may be prepared either by penetration method or by previously coating slag or stone with pitch or with bitumen, but in all cases the upper coating should consist exclusively of sand graded homogeneously throughout its mass, and the binder, which consists of the best bitumen mixed with its own bulk, or in some cases with an equal weight of impalpable lime powder used as a filler. This road, the cost of which the author believes can be so reduced that it can be extended at least to a great many of our main roads, is that to which he referred in the paragraph preceding the description of the figs.

SOME CONSIDERATIONS CONCERNING ROLLING RESISTANCE.

By L. H. Hounsfield.

At the request of his former chief, Colonel Crompton, the author submits some problems in applied mechanics for those whom it may interest in order to explain what road engineers call the "push" on the road by the wheel, and the effect of a partly elastic road surface on the value of the depression d. Of course all roads and wheels are partly (though none perfectly) elastic, and the absence of homogeneity complicates the problem.

The author will first deal with an imaginary non-elastic homogeneous road and then with a perfectly elastic one, which will, he thinks, show the great benefit of elasticity to the vehicle, and consequently to the road also.

The work done against the rolling resistance, P, is the product of this force in pounds by the distance moved in feet, and although some of this work is dissipated in the wheel, a large proportion of it goes in disintegrating or pulverising the road material.

The importance of having the correct proportion of each grade of road metal and cementing material has been proved by Colonel Crompton, and all further disintegration of the metal alters this proportion and so weakens the road, while the increased surface of the road metal caused by disintegrating requires more cementing material.

A certain amount of traffic on a road may be necessary to maintain it as such, but leaving atmospheric effects, &c., out of the question, the life of a road must bear some relation to the work done on it.

It must not be assumed, however, that the rolling resistance of a road and its durability are inversely proportional. The relation between the two may be similar to that existing between the friction and durability of a bearing where we know that if the friction is halved the bearing lasts more than twice as long.

Some members of the institution have submitted that certain kinds of vehicles improve the roads they pass over, and have laid stress on the beneficial rolling effects, apparently assuming that roads require rolling for their own benefit.

The author understands that pot-holes are indirectly attributable to the steam rollers used in making the roads. The roller passing over the loose surface raises a wave of unconsolidated road material immediately in front of it and pushes it along till the resistance offered is such that it is easier for the roller to mount the wave than to push it along. This has the effect of giving a non-homogeneous road surface, and it seems possible that the ordinary traffic would do the work better if it were not for the fact that each driver endeavours to drive in the existing tracks, and thus, even were the use of steam rollers eliminated and ordinary traffic compelled to consolidate the roads, they would still be far from perfect, and thus it would be better to roll with as many rollers as possible, all of different weights, wheel diameters and wheel bases.

As it appears to be a mistake to endeavour to consolidate the surface *ab initio* with a heavy roller, the author would suggest as a more practical solution that a very light roller should first pass several times over the newly laid metal. This would better assist the road metal to move about, and enable the faces to fit themselves together compactly; the effect which it is desirable to obtain is that which would be secured by shaking the road, and may be illustrated by pouring coarse sand into a tin and then subjecting it to vibration; the surface is lowered considerably in the tin, and the sand becomes comparatively rigid to the touch. He would also suggest that this light roller should have less weight on the front member than on the second, and as the roller must be made to work both ways, three rolling members in line are necessary. If the wheel bases of these were in some odd ratio, such, for example, as 5 ft. and 7 ft. respectively from the middle roller, the formation of waves would be less likely to occur.

He then submits that further consolidation could be obtained with a heavy roller without the same tendency to produce waves.

If a road were made of a very viscous fluid, such as tepid pitch, it could be imagined that all the work done against P would be dissipated in low temperature heat instead of pulverising the road metal, but the value of P would become enormous.

The life of existing roads probably bears a definite relation to P, and not until P becomes zero can a vehicle pass over a road without decreasing its life. The application of emery cloth to a journal may improve its surface somewhat, but no one could argue from this that the journal should run on emery cloth.

It should be noted that the value of P, as dealt with, applies to the resistance offered by the road to a wheel drawn along the road, and experiments tend to show that the road resistance increases if the wheel be self-propelled; further, the total tractive force T, neglecting gradients, is largely dependent on wind resistance, particularly at high speeds, and this still further increases the damaging effect of the self-propelled wheel.

The value of P with iron tyres appears to increase with speed, and the damage done to the road certainly increases greatly with the speed. The author has driven a traction engine over a certain macadam road with scarcely any noticeable effect at 4 or 5 miles per hour, but at 18 miles per hour the crushing was most marked.

The author believes that he is right in stating that the usual method of treating road resistance in applied mechanics is to assume that the wheel is continually endeavouring to climb out of the rut or

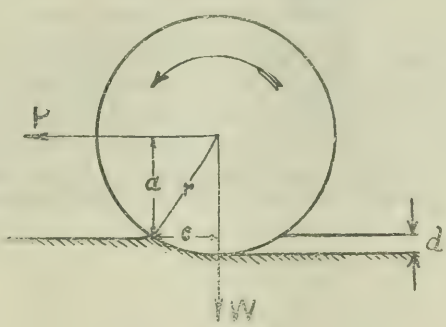


Fig. 9.

ride over its crest as though it were an obstacle, and on this assumption the problem is treated as follows:

Consider a rigid wheel rolling along a soft, non-elastic road surface, and climbing over the crest of the rut as shown in Fig. 9.

$$Pa = Wc$$
$$P = Wc/a, \text{ and } a = r - d;$$
$$\therefore P = c.W/r - d.$$

d is (usually) the second order of small quantities compared with r.

$$\text{Hence } P = c.W/r \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (1)$$

This equation indicates that P varies inversely as r, it having apparently assumed that c is a constant depending on the softness of the road, but independent of the diameter of the wheel or weight.

This is correct, as c is a function of r, for

$$c^2 = r^2 - (r-d)^2$$
$$= 2rd - d^2$$

$$\text{neglecting } d^2,\ c = \sqrt{2rd} \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (2)$$

$$\text{Hence } P = W\sqrt{2d/r} \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (3)$$

If the road is homogeneous and incapable of resisting tension, we may say that the area of contact ($c \times b$, the breadth of the wheel) is proportional to W, and we have $P \propto W/rb$, that is, that the rolling resistance is inversely proportional to the width of the wheel.

From certain of the Local Government Board regulations this formula appears to have been acted upon.

Doubtless P diminishes as b increases, but not inversely by any means, and P may increase *with* b after a certain point on actual roads.

The assumption necessary to introduce b into the formula is ridiculous; it assumes the road to consist of a non-elastic, incompressible, homogeneous, non-tensile fluid, such that when the rut is made the material rises on each side *in bulk equal to the volume of the rut.*

The regulations allow the load to be increased in proportion to the width of the wheel and the diameter of the wheel, but the area of contact with the hard road (as distinct from loose surface) is not proportional to the width of the wheel. We have already seen that the work done on the road in surmounting obstacles varies inversely as the square root of the diameter, and it will now be shown that the same holds for the work done in forming ruts.

Consider a rigid wheel rolling over a non-elastic, homogeneous road and leaving a rut behind it; refer-

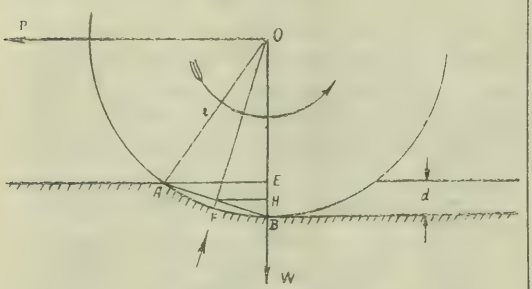


Fig. 10.

ence to Fig 10 will show that the reaction of the road is directed along the line FO, cutting AB at right angles.

$$\begin{aligned} P &= W.FH/OH \\ &= W.BE/AE \\ &= W.d/\sqrt{2rd} \\ &= W.\sqrt{d/2r} \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (4) \end{aligned}$$

This also shows that the rolling resistance is proportional to the square root of d, and varies inversely as the square root of the diameter of the wheel, but it should be noted that the force required to draw the wheel when depressing a rut is only half that required to ride over an obstacle of the same height as the rut.

In Vol. II. of the "Proceedings" of the Institute of Automobile Engineers, p. 395, Colonel Crompton

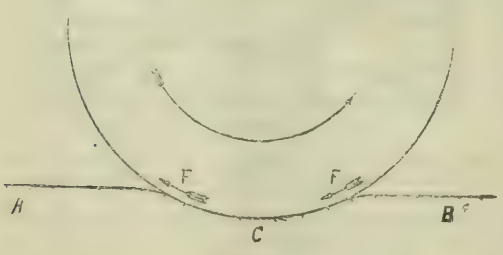


Fig. 11.

points out that the resistance for an 8-ft. wheel is half that for a 2-ft. wheel—that is, P varies inversely as the square root of the diameter.

If the road is partly elastic the wheel sinks deeper than the rut left after the wheel has passed on.

If, on such a road, we take d to represent the total depth to which the wheel sinks, then P is not proportional to $\sqrt{d}$, for d is now made up of two components—say, e the elastic recoverable portion of the depression, and $d-e$ the non-elastic portion. Then $P \propto \sqrt{d-e}$, and here we see that the greater the value of e as it approaches the magnitude of d, the less the tractive force, or the less the "push" or the resistance offered by the road to the progress of the wheel.

For all practical purposes the work dissipated in causing the depression e may be neglected, as on roads it must always be small compared with the work done in causing $d-e$; but even if e becomes equal to d, the value of P will not become zero as we see hereafter.

Consider a rigid wheel rolling along an elastic road (or an elastic wheel along a rigid road).

The surface of the road is lengthened (see Fig. 11), and if points be taken along the road at, say, 1-in. pitch, as at A and B, first we see that the lengthening of the surface must increase the average pitch, and, second, that vertical strain gives lateral tension, increasing the pitch at B.

There may be no change in pitch taking place at C, but between A and C the pitch is increasing, causing a creep or frictional force F against the direction of rotation, and between C and B the pitch is diminishing, causing a frictional force F, also contrary to the direction of rotation.

From this we see that, given nearly perfectly elastic materials, such as tempered steel wheels on tempered steel roads, there is a frictional rolling resistance. We know from railway work and ball-bearings that this force is negligibly small compared with that encountered with ordinary road conditions.

[A report of the discussion of Colonel Crompton's paper will appear next week.]

CORRESPONDENCE.

For every ill beneath the sun
There is some remedy or none;
If there be one, resolve to find it:
If not, submit, and never mind it.
– Anon., *circa* 1843.

"THE SURVEYOR" IN THE COLONIES.

To the Editor of The Surveyor.

Sir,—Please accept the hearty congratulations of a Victorian subscriber of thirteen years on the attainment of its majority by The Surveyor. As a constant and appreciative reader, I can honestly say that no other technical journal so fully meets the needs of those engaged in local government administration. It has also the merit of keeping up to date in all matters municipal, even in these days of rapid development and constantly recurring changes, and is as fresh to-day as when I first scanned its pages. If it is appreciated by municipal engineers in the Motherland, it is doubly valuable to those like myself stationed in the "far-flung fighting lines" in distant parts of the Empire, especially in a country like Australia with its wide spaces, where the privilege of meeting one's *confrères* to discuss matters of mutual interest is denied us except at long intervals, when our members may, at great personal inconvenience and expense, attend an annual meeting in the large centres of Melbourne and Sydney (600 miles apart).

The Surveyor has served to keep me personally in touch with the progress of events in Britain, and has in a very great measure enabled me to keep out of the rut and march with my brethren in the Old Land.

I sincerely trust that the future has in store a long and useful life for your journal, which has already done so much for the engineers of this day and generation.—Yours, &c.,

W. Calder.

Prahran.
March 5, 1913.

[We tender our cordial thanks to our correspondent for his most encouraging communication.—Ed. Surveyor.]

GRANITE-SETT PAVING AT ROCHDALE.

To the Editor of The Surveyor.

Sir,—On p. 605 of your issue of the 11th inst. there is a report of a Local Government Board inquiry recently held here with reference to the substitution of granite-sett paving for macadam on certain main roads, from which it appears that the cost of scavenging granite paved roads is $\frac{1}{16}$ of a penny per square yard less than the cost of maintaining and scavenging macadamised roads. This should be 1·16d.—not 1/6d., as printed. The annual charge for sinking fund and interest, based on repayment in twenty years for granite-sett paving, on a concrete foundation, worked out at 12·71d. per square yard.

	d.
	12·71
Saving in scavenging (3·07d. for macadam, – 1·89d. for granite)	1·16

Leaving the cost for granite paving per ann. 11·55 per sq. yd., as against 1s. per yd. per annum for maintaining macadam.

—Yours &c.,

S. S. Platt,
Borough Surveyor.

Rochdale.
April 15, 1913.

Assistants' and Students' Section.

Conducted by SYDNEY G. TURNER, Assoc.M.Inst.C.E.

All communications in regard to this page must be addressed to The Editor, St. Bride's House, 24 Bride-lane, Fleet-street, E.C. *Envelopes must be marked "Assistants' Section" in the top left-hand corner. Correspondents are invited to submit questions for consideration and answers to the questions which appear. For the contributions considered to be the most meritorious, one or more premiums in books will be awarded monthly. Diagrams must be drawn to scale on separate sheets, ready for reproduction.*

QUESTIONS.

This week answers are invited to the following questions:—

314. Concrete Roof.—It is desired to construct a semi-circular barrel roof in concrete of 50-ft. span, reinforced with expanded metal. Show the dimensions of the supporting walls, which are to be 15 ft. high from the top of the footings. The roof is to be ribbed with an extra thickness of concrete over the piers. (H. V. A., *Clapton.*)

315. Surveying: Theodolite.—If the graduated plate of a theodolite is not correctly centred, how may the error arising therefrom be eliminated? Prove that the method adopted does eliminate the error referred to. (T. W. P., *Bexhill-on-Sea.*)

317. Strength of Beam.—A rolled steel I beam of British Standard Section, 12 in. by 6 in., and weighing 54 lb. per foot, is capable of sustaining a load of 15 tons uniformly distributed over a span of 20 ft. What would be the safe load uniformly distributed which could be placed on either half of the lower flange? ("Pupil.")

320. Water Tower Design.—Design a small water tower to hold 8,000 gallons, top water level being 80 ft. above ground level, tank of cast-iron, framework of tower of steel. Show full calculations, including wind pressure allowances. (W. H. B., *Bocking.*)

321. Paving.—What is the correct method of setting out a paved road? Show how to work out the heights and cross-fall for a road 54 ft. wide, to be paved with a camber of 1 in 48 (channels each side are level. (P. G., *Chichester.*)

323. Weight of Cement.—Taking the specific gravity of Portland cement as 3·1, then the weight of 1 cub. ft. of cement should be 3·1 × 62·5 = 193·75 lb. As a matter of fact 1 cub. ft. of cement only weighs from 82 lb. to 104 lb. How is this difference accounted for? (J. R. H., *Rochdale.*)

[The Editor is at all times glad to hear from readers who desire to submit questions regarding matters of general interest, points of daily practice, &c., for insertion in the "Assistants' and Students' Section." Questions which are published are taken into consideration, as well as other matter, in awarding the Monthly Premium.]

REPLIES TO QUESTIONS.

322. Retaining Walls.—Given similar dimensions, which of the two walls in Figs. 1 and 2 has greater stability? Give proofs. (D. G. B., *Darlington.*)

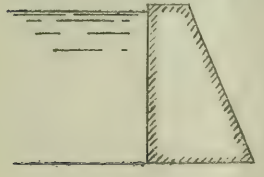


Fig. 1.

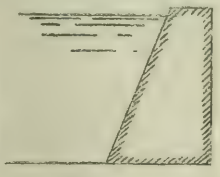


Fig. 2.

Let the wall be of the dimensions shown in the Fig.—viz.:

Let h = vertical height,
a = width at top,
$a + b$ = width at base.

First find the position of the centroid of the cross section.

If $\bar{x}$ be its distance from the vertical face,

$$\bar{x}\left(\frac{ah + bh}{2}\right) = \frac{a^2h}{2} + \frac{bh}{2}\left(a + \frac{b}{3}\right)$$

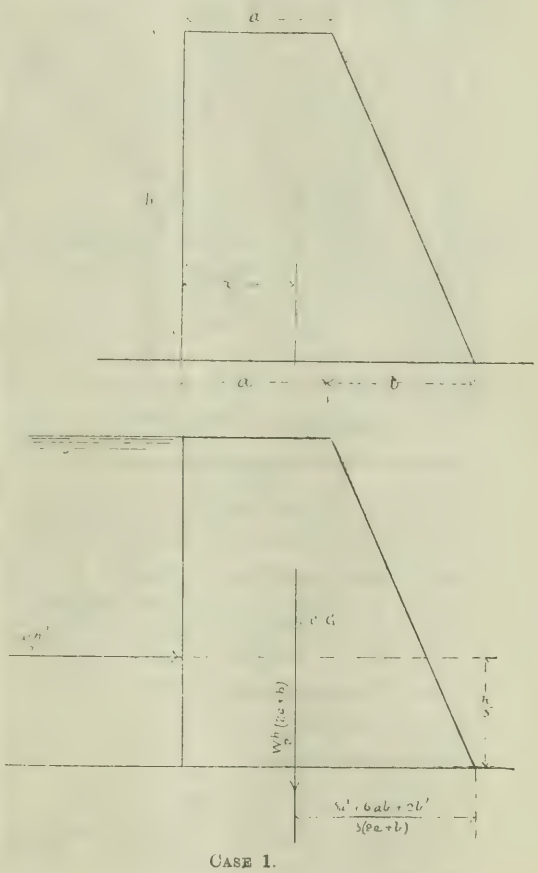
$$\therefore \bar{x} = \frac{\frac{a^2}{2} + \frac{b}{2}\left(\frac{3a+b}{3}\right)}{\frac{2a+b}{2}} = \frac{3a^2 + 3ab + b^2}{3(2a+b)}$$

Hence also the horizontal distance of the centroid from the toe of the battered face

$$(a + b) - \frac{3a^2 + 3ab + b^2}{3(2a+b)}$$

$$\frac{6a^2 + 9ab + 3b^2 - 3a^2 - 3ab - b^2}{3(2a+b)} = \frac{3a^2 + 6ab + 2b^2}{3(2a+b)}$$

Consider a strip of wall of unit width and let w = weight of unit volume of water, and W = weight of unit volume of masonry.



Case 1.

Case I., in which the pressure is on the vertical face.

Total fluid pressure on face $= \frac{wh^2}{2}$

The resultant acts horizontally at a point $\frac{h}{3}$ from the base.

Hence the overturning moment $= \frac{wh^2}{2} \times \frac{h}{3} = \frac{wh^3}{6}$

Weight of unit strip of wall

$$= W\left(\frac{ah + bh}{2}\right)$$

$\therefore$ Moment of wall about toe

= weight × distance of centroid

$$= W\left(\frac{ah + bh}{2}\right)\left(\frac{3a^2 + 6ab + 2b^2}{3(2a+b)}\right)$$

$$= \frac{Wh}{6}(3a^2 + 6ab + 2b^2)$$

Hence moment of stability for this case

$$= \frac{Wh}{6}\left(3a^2 + 6ab + 2b^2\right) - \frac{wh^3}{6}$$

Case II., in which the pressure comes on the battered face.

$$\text{Total fluid pressure} = \frac{wh}{2} \times \frac{h}{\sin\theta}$$

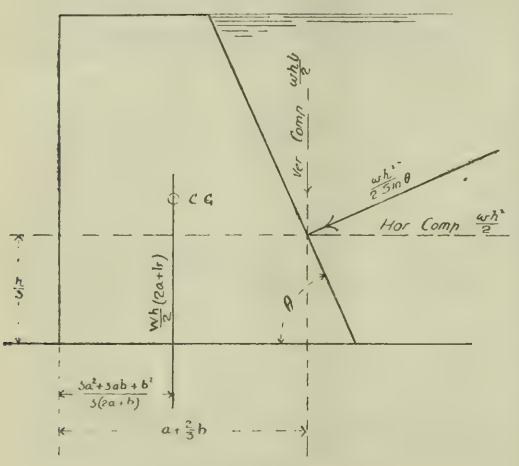
This acts in a direction normal to the face and at a point vertically distant $\frac{h}{3}$ from the base.

Resolving horizontally and vertically we get :

$$\text{Horizontal component} = \frac{wh^2}{2\sin\theta} \times \sin\theta = \frac{wh^2}{2}$$

$$\text{Vertical component} = \frac{wh^2}{2\sin\theta} \times \cos\theta = \frac{wh^2}{2\tan\theta} = \frac{whb}{2}$$

The horizontal component tends to overturn the wall, while the vertical component helps the weight of the wall to maintain equilibrium.



Case 2.

$$\text{Overturning moment} = \frac{wh^2}{2} \cdot \frac{h}{3} = \frac{wh^3}{6}$$

Moment of vertical component of pressure

$$= \frac{whb}{2}\left(a + \frac{2}{3}b\right) = \frac{whb}{6}(3a + 2b)$$

The weight of the wall is, as before, $W\left(ah + \frac{bh}{2}\right)$, but its moment about the heel must now be taken.

$$\therefore \text{Moment of wall} = W\left(ah + \frac{bh}{2}\right)\left(\frac{3a^2 + 3ab + b^2}{3(2a+b)}\right)$$

$$= \frac{Wh}{6}(3a^2 + 3ab + b^2)$$

Thus total resisting moment

$$= \frac{Wh}{6}(3a^2 + 3ab + b^2) + \frac{whb}{6}(3a + 2b)$$

Hence moment of stability

$$= \frac{Wh}{6}\left\{3a^2 + 3ab + b^2) + \frac{w}{W}b\,(3a + 2b)\right\} - \frac{wh^3}{6}$$

It is obvious that the stability of the wall in Case I. is $>$ or $<$ the stability in Case II. according as $(3a^2 + 6ab + 2b^2)$ is $>$ or $<$ $\left\{(3a^2 + 3ab + b^2) + \frac{w}{W}b\,(3a + 2b)\right\}$

In order to make a comparison between the two cases, the fraction $\frac{w}{W}$ must be eliminated. Assuming that 1 cub. ft. of water weighs 62·5 lb. and 1 cub. ft. of masonry weighs 125 lb., this fraction becomes $\frac{1}{2}$.

Then :

$$\frac{\text{The stability in Case I.}}{\text{The stability in Case II.}} = \frac{3a^2 + 6ab + 2b^2}{3a^2 + 3ab + b^2 + \frac{b}{2}(3a + 2b)}$$

$$= \frac{3a^2 + 6ab + 2b^2}{3a^2 + 4{\cdot}5ab + 2b^2}$$

It is clear that for all values of a and b this fraction will be greater than unity. Hence under the assumed values for the weights of water and masonry the wall in Case I. will have the greater stability.

It must be borne in mind that such will not be the case for every value of the fraction $\frac{w}{W}$. If this be made equal to 1 it will be found that the wall in Case II. will be most stable ; while for the value $\frac{3}{4}$ the greater stability will be found to depend upon the relative values which are given to a and b. (J. S., *Teddington.*)

DEATH OF MR. WILLIAM WEAVER.

PAST-PRESIDENT OF THE INSTITUTION OF MUNICIPAL AND COUNTY ENGINEERS.

We deeply regret to announce the death of Mr. William Weaver, for many years engineer to the Royal Borough of Kensington, and president of the Institution of Municipal and County Engineers, 1903-4.

Mr. Weaver was born in February, 1844, and saw early service as an articled pupil to the then surveyor of Kensington, the late James Broadbridge, in 1869. He eventually succeeded to the position of assistant surveyor, and became borough surveyor in 1875. He was connected with the Royal borough for a period of forty-three years, and his professional record was synonymous with the development of the district from a pastoral suburb into one of the most fashionable parts of London. Mr. Weaver was responsible for and superintended most of the municipal schemes that tended so much to the improvement of Kensington. He was a man of ideas and energy, and it was naturally with a sense of satisfaction that he found plenty of scope for his professional activities. He frequently read papers before engineering and scientific associations, and the originality of his views as well as the reasoning with which he supported his suggestions were such that his public appearances were always welcome and appreciated. As an expert on municipal work and law his evidence before the Committees of the Houses of Parliament or in courts of law carried considerable weight, as the practical experience of a man who has devoted the whole of his working life to metropolitan work. Mr. Weaver was a member of the Institution of Civil Engineers, and a Fellow of the Surveyors' Institution, in addition to filling the presidential chair of the Institution of Municipal and County Engineers, before which body he read papers on a variety of subjects connected with municipal work. He also read a paper on "Municipal Sanitation" before the Glasgow Engineering Congress in 1902, and at a meeting held in Kensington in 1892 contributed an exhaustive paper on the growth and work of that district. Common sense and thoughtfulness were his conspicuous qualities, yet his speeches were marked by humorous flashes which contributed to their attractiveness as well as their interest. He was, indeed, a member of the municipal engineering profession whose loss will be greatly felt by all who were privileged to know him.

The Late Mr. William Weaver.

The funeral took place on Monday afternoon at the Crematorium, Golder's Green. Among the many friends of the deceased who were present to testify their respect and affection were Mr. R. J. Thomas (president of the institution) and Mr. H. A. Giles, assistant secretary, on behalf of Mr. Thomas Cole, secretary, who was unable to attend owing to indisposition.

Purification of Water by Slow and Rapid Sand Filtration.*

By T. AIRD MURRAY, M.CAN.SOC.C.E.

There is a present tendency to give considerable attention to rapid filtration. Both systems of filtration have, however, their enthusiastic adherents, and there are those who claim that either system may be suited to some particular local condition. The purpose of this paper is to arrive at some fair conclusions. It is natural that the specialist who has particularly studied slow sand filtration and knows just what results may be expected and what have been obtained in the past, and has not troubled himself with recent rapid methods, should pin his faith to the former. It is also natural that others who have studied the question, and especially those who manufacture the parts and appliances in connection with rapid filtration, should have much to say in its favour.

THE QUESTION OF EFFICIENCY.

It is incontrovertible that there are results being obtained by rapid filtration in continuous operation that have not been reached by slow sand filters, as, for example, Harrisburg. At Cincinnati we have another fair example of the efficiency of rapid filtration. In 1908 the reduction of bacteria was 98·3 per cent, in 1909 99·2 per cent, in 1910 99 per cent.

There are many rapid filter plants which fall short in efficiency, and these are generally quoted by adherents of "slow sand" methods. This equally applies to slow sand methods; so much depends in either case on skilful manipulation and management.

At Albany, N.Y., generally referred to as an efficient "slow sand" plant, where very best results may be expected, the bacterial removal efficiencies for 1907, 1908 and 1909 were respectively 98·2 per cent, 98·5 per cent and 98·5 per cent, somewhat below the standard of either the Harrisburg or Cincinnati rapid plants.

Mr. Allen Hazen, in "The Filtration of Public Water Supplies," states: "It may be said that filtration as now practised in European works under ordinary conditions never allows over 1 or 2 per cent of the bacteria of the raw water to pass, and ordinarily not over one-fourth or one-half of 1 per cent, although exact data cannot be obtained owing to masking effect of the bacteria which come in from below, and which bear no relation to those of the raw water." Certain manufacturers of rapid filters are prepared to give a guarantee with reference to bacterial removal as follows: "When the number of bacteria contained in the raw water is more than 3,000 per c.c., the filtered water shall show an average bacterial reduction of not less than 97 per cent; that when the number of bacteria contained in the raw water is less than 3,000 per c.c., the average number of bacteria remaining in the filtered water shall not exceed 100 per c.c." Generally speaking, slow sand filtration has in the past produced higher bacterial removal efficiencies than rapid filtration. There are, however, exceptions to this rule, as above noted. The question of extremely high bacterial removal efficiencies is not of such importance in relation to a filter as it has been, owing to the general adoption of some method of finally disinfecting the filter effluent before it is passed on to the consumer. It is rapidly becoming the custom to add to all filter systems a hypochlorite disinfectant plant, which practically ensures sterile water from either system.

RECENT INQUIRY INTO RAPID FILTRATION.

Rapid filtration has for a long period been practically tabooed in Germany, but is now, however, making some headway. In this connection it may not be out of place to quote from Carl Schrieber, scientific member of the Royal Institution of Prussia for the investigation of water supply and drainage. After the conclusion of tests of a mechanical or rapid filter carried on alongside the municipal slow sand plant at Berlin, the results are summed up as follows: "Summing up the results of the above described tests, we may say that, bacteriologically, rapid filtration is equally efficient as slow sand, and in the removal of bacteria and colour is distinctly superior to the old slow sand system." Again, quoting from the same publication: "From a hygienic point of view rapid filtration is, undoubtedly, to be preferred to slow sand filtration."

Dr. H. Bitter, director of the Egyptian State Institution of Hygiene, Cairo, on the results of experiments which led to the adoption of mechanical filtration in preference to slow sand filtration for the water supply at Cairo, states in his conclusions: "Summing up, I desire to say that all the results obtained during the experiments lead me to the conclusion that the 'American' system of filtration has so many technical and hygienic advantages that it should, under all circumstances, be preferred to the old project elaborated for the City of Alexandria" (viz., slow sand).

Quoting from "The Filtration and Purification of Water for Public Supply," a recent publication by John Don, an English water engineer, we find as follows: "In Britain the battle is between the old 'slow sand' filter and the 'rapid mechanical' substitutes. Mechanical filters are less costly and they occupy much less space. They can be cleaned without exposing the filtering substances to contact with the workmen, and they can be set going to deliver potable water very shortly after cleaning. The addition of coagulants or of lime to the water presents no difficulty beyond the question of regulation. There are outstanding advantages in favour of mechanical filters. Notwithstanding the apparent simplicity of the slow sand filter, sand washing is a more elaborate operation than in the mechanical filters, and even the best of the patent sand washers do not quite remove the chances of contact with the labourers' bodies. On the whole, it would seem that the sand filter as a purifying agent, *per se*, is likely to lose its prestige."

THE RELATION OF TYPE OF FILTER TO CHARACTER OF WATER.

There can be little doubt that the possible high efficiency of rapid filtration is being recognised. On the other hand, there are well-known authorities engaged in designing filter plants who strongly hold views that the rapid types of filter are only suited to conditions where water shows excessive turbidity, and that where turbidity is low and the water is well settled, as in the case of lakes or reservoirs, that slow sand filtration is better suited to remove pathogenic germs. Referring to a report by Messrs. Hazen & Gray to the Pure Water Commissioners of the City of Grand Rapids, Mich.: "There are two kinds of filters often used in this country for the purification of public water supplies—viz., mechanical filters and sand filters. At the site selected all of the conditions are favourable for the installation of either sand or mechanical filters. In regard to the system to be selected, the results of experiences and of elaborate investigations made at a number of places in this country tend to show that mechanical filters are best adapted to the clarification of extremely turbid waters, while the sand filters are best adapted to the purification from disease-producing properties of sewage-polluted waters, which are not very turbid."

Again, the publication "The Filtration of Public Water Supplies," by Allan Hazen, states: "It is doubtful if a plant (mechanical) could be operated to regularly secure as high a bacterial efficiency as 99 per cent with any amount of sulphate of alumina." We now know by actual experience that efficiencies of almost 100 per cent are being obtained by mechanical plants.

With reference to the assumption that mechanical filters are more suited to turbid waters and slow sand to clear waters, it does not appear that there is any clear evidence. It does appear evident that the slow sand process is not suited to waters subject to very high turbidity where the surface layer would clog in a very short period, necessitating the expensive operation of frequent cleaning, but this is not an argument against the use of mechanical filters for comparatively clear waters. Experimental and practical working conditions generally tend to show that a rapid mechanical filter, aided by the use of a coagulant, will remove extremely fine silt, so fine

* Extracts from paper read before the annual meeting of the Canadian Public Health Association at Toronto.

that it is almost impalpable, and can hardly be intercepted by the ordinary sand-straining process without coagulation. On the other hand, there are certain waters which are so low in alkalinity that it is only possible to obtain coagulation at a prohibitive cost where the "slow sand" system would be advisable.

It appears reasonable, in the face of present evidence, although either system can be made to produce a safe potable water, that the use of the slow sand process is limited to waters which are free from excessive turbidity, and free from that class of turbidity which requires the use of a coagulant in order to remove it with efficiency. In any case where the choice may be an open one with reference to efficiency results, the deciding factor will generally be one of cost.

RELATIVE COSTS.

The cost of installation for rapid filtration is much below that of slow sand. Covered slow sand filters cost on this Continent from $50,000 to $60,000 an acre, apart from pumping, &c. Mechanical filters, with buildings, cost about $30.00 [£6] per square foot of filtering area.

Assuming slow sand filters to treat 10,000,000 gallons per day at the rate of 2,500,000 gallons per acre, the cost would be $220,000.00 [£44,000]. Assuming mechanical filters to treat the same quantity per day at the rate of 120,000,000 gallons per acre, at $30.00 [£6] per square foot of filter area, the cost would be $108,900.00 [£21,780], or a saving in first cost in favour of mechanical filtration of $111,100.00 [£22,220]. Approximately, slow sand filters in Canada may be said to cost at the rate of $20,000.00 [£4,000] per each 1,000,000 gallons of water per day, and mechanical filters half this amount.

In connection with the Grand Rapids scheme, the estimates (p. 14 of the Report) show a cost of $779,210.00 [£155,842] to install a slow sand filtration plant of a capacity of 15,000,000 gallons per day, while the estimated cost of mechanical filtration by Messrs. Fuller & Hering for a 20,000,000 gallon plant was $350,000.00 [£70,000] complete. The latter contracts have been let within a few thousand dollars of the estimated cost. In the above case the cost rate of slow sand was $50,000.00 [£10,000] per 1,000,000 gallons per day, while the cost of mechanical treatment was at the rate of $17,500.00 [£3,500] per each 1,000,000 gallons treated, or about one-third of the cost of slow sand.

It is an undoubted fact that mechanical filtration costs somewhat half of the amount of slow sand filtration in the first instance. On the other hand, it is held by some that this saving in first cost is more than set off by the extra cost in operation due to the use of coagulants. The cost with reference to pumping and laboratory administration may be said to be common to both systems, and need not be taken into account in comparative data. With slow sand filtration the frequency of scraping represents the chief cost, and this cost is in proportion to the turbidity of the raw water. With mechanical filtration the cost of operation also increases in ratio to the turbidity, as increased turbidity usually means an increased amount of coagulant.

A mechanical or rapid filter plant requires a less number of attendants, in fact, apart from the laboratory and pumping operatives, two men are usually sufficient to handle a fair sized plant. In order to compare the costs of slow sand and mechanical methods it is necessary that the amount of coagulant required by the latter be determined, as upon this factor the comparative operating expenses mainly depend.

It is usual to compare the operating costs of plants of both types, and thus create comparative cost data, but such data is not always conclusive. The only comparative data of exact value would be in the case of both slow and mechanical filtration treating an equal volume of the same character of water under similar conditions.

The operating costs of slow sand filtration plants vary considerably. In England the costs average about $1.24 [5s. 2d.] per 1,000,000 gallons in connection with the London water companies. There the water is first well settled in sedimentation areas, and is only slightly turbid when applied to the filters. The cost of labour is very much lower than on this Continent, and the data is of little value for comparative purposes. At Vernon, N.Y., with settled reservoir water, the cost per 1,000,000 gallons has averaged about $2.00 [8s. 4d.]. At Poughkeepsie, N.Y., with occasional turbidity, the costs average $3.00 [12s. 6d]. Four plants in connection with Philadelphia—viz., Roxbury, Upper Roxbury, Belmont, Queen Lane and Torresdale respectively—show operating costs of $4.24, $3.18, $3.23, $1.70 [17s. 8d., 13s. 3d., 13s. 6d., 7s. 1d.] per 1,000,000 gallons. Albany, N.Y., an average of three years, $3.67 [15s. 3d.]. Washington, an average of about $2.00 [8s. 4d.].

The average cost of treating raw waters, without previous sedimentation by slow sand filtration, appears to range somewhere between $3.00 [12s. 6d.] and $4.00 [16s. 8d.] per 1,000,000 gallons.

The operating costs by mechanical filtration also appear to vary considerably. John Don gives the cost of operating Jewell filters at from $2.60 to $3.00 [10s. 10d. to 12s. 6d.] per 1,000,000 gallons in England.

At Harrisburg, Pa., from 1906 to 1910, the average cost per 1,000,000 gallons, apart from pumping, has been $3.69 [15s. 5d.]. The average operating expenses for twenty-one plants in the States, including the cost of coagulant and labour, amounts to $2.02 [8s. 5d.] per 1,000,000 gallons of water treated. It may be concluded, however, that in order to obtain the high efficiencies as at Harrisburg and Cincinnati, a cost of $3.00 to $4.00 [12s. 6d. to 16s. 8d.] is nearer the actual average required, and that the extra cost incurred by the use of coagulants is about balanced by the extra cost of general operating expenses by "slow sand" filtration.

It has been said that the economic application of rapid filtration depends principally upon the amount of coagulant required. With river waters subject to high turbidity, much of the suspended matter can be retained by natural sedimentation. The coagulant frequently used is sulphate of alumina either by itself or with soda ash in cases where the water is low in alkalinity.

Assuming that the installation of slow sand filters cost $20,000.00 [£4,000], and mechanical filtration $10,000.00 [£2,000] per 1,000,000 gallons per day, the capitalised cost of the systems with a daily capacity of 10,000,000 gallons may be stated as follows:—

Slow Sand Filtration.		
Cost of installation... ...	$200,000.00	
Cost per annum at $3.50 per 1,000,000 gallons per day, capitalised at 5 per cent	255,500.00	
Total capitalised cost	$455,500.00	[£91,100]
Mechanical Filtration.		
Cost of installation... ...	$100,000.00	
Cost per annum of coagulants and labour, $4.00 per 1,000,000 gallons per day, capitalised at 5 per cent	292,000.00	
Total capitalised cost	$392,000.00	[£78,400]

Balance in favour of mechanical filtration when 1 grain of coagulant per gallon is required is thus $63,500.00 [£12,700].

The above appears to be a reasonable statement, as it will be found that there are few instances where the coagulant will exceed 1 grain to the gallon, and in such cases it is probable that excessive turbidity can be reduced by preliminary unassisted sedimentation. At Saskatoon, Sask., a mechanical filtration plant of a capacity of 4,000,000 gallons per day, assisted by sedimentation, is successfully treating the, at times, very turbid water of the South Saskatchewan River with ·5 of a grain of sulphate of alumina to the gallon. The filtered water is always sparkling and clear, while the bacteria count ranges from 0 to 8 per c.c. in the treated water.

REMOVAL OF COLOUR FROM WATER.

An evident factor in connection with mechanical filtration, accompanied by the use of a coagulant, is the removal of colour due to vegetable dye from waters. Slow sand filtration has very little effect on colour, as colouring matter is in partial solution, and passes almost freely through a sand layer. On the other hand, the effect of a coagulant is to resolve colouring matter into matter in suspension. In the case of the Ottawa River the colour ranges from 40 to 60 parts per 1,000,000, and can be reduced 90 per cent by mechanical filtration and coagulation. It is understood that for the latter reason the Ontario Provincial Board of Health have insisted upon mechanical filtration for Ottawa City, and it appears reasonable to conclude that the action is justifiable.

(To be concluded.)

Law Notes.

Edited by J. B. REIGNIER CONDER, 11 Old Jewry Chambers, E.C., Solicitor of the Supreme Court.

The Editor will be pleased to answer any questions affecting the practice of engineers and surveyors to local authorities. Queries (which should be written legibly on foolscap paper, one side only) should be addressed to "The Law Editor," at the office of The Surveyor, *accompanied by the writer's name and address, but correspondents who do not wish their names to be published should also furnish a "nom de plume." Where necessary, copies of local Acts or documents referred to should be enclosed.* **All explanatory diagrams must be drawn and lettered in BLACK ink only, and in such style as to be fit for direct reproduction—i.e., without re-drawing or amendment.** *Unless these conditions are complied with we cannot undertake to reply to queries.*

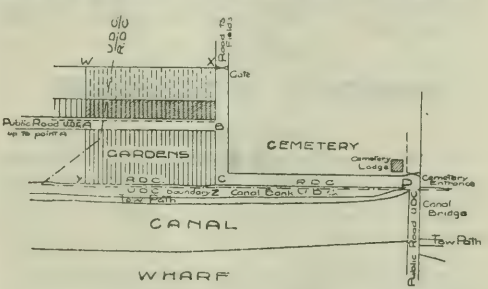
QUERIES AND REPLIES.

In order to avoid confusion querists are requested to use binations such as X.Y.Z., and words such as "engineer" and "surveyor," should never be used.

Contract for Works: Arbitrator.—"Anxious" writes: I should feel greatly obliged by your opinion on the following: A contracted to carry out certain works in accordance with plans and specification and to their true intent and meaning. A was requested to notify B (surveyor) when the excavations had been got out for his approval before filling them in with concrete. A failed to notify B, and proceeded with the work, although he had been informed that the work would not be passed until the foundations had been approved. Upon examining the work it was found that (i.) the foundations had not been carried down to the depths shown on drawings, and (ii.) that A had executed extra works for which he makes excessive charges. Included in the General Conditions of Specification, which also forms part of contract, are the following clauses: (1) "The work shall be executed in a thoroughly substantial manner, with the materials and workmanship of the best quality, and to the entire satisfaction of the surveyor, and if any difference of opinion or dispute as to the dimensions to be worked to, or the quality of the materials to be used, such dispute shall be decided by the surveyor, who shall be sole arbitrator, and whose decision shall be final and conclusive. (2) Failing any previous agreement as to the value of such alterations, omissions or additions, the same shall be measured and valued by the surveyor, whose decision shall be final and binding on the contractor. (3) In case any dispute or difference shall arise between the surveyor and the contractor, either during the progress of the works or after completion, as to the true intent and meaning of the drawings, description and specification, or as to the materials, workmanship, or any matter whatsoever relating to this contract, such difference or dispute shall be decided solely by the surveyor, whose decision shall be final and binding upon the contractor without any further reference or appeal." I have informed A that a final payment will be made when the specification and drawings have been complied with, and that I shall fix my own prices to the extra works. A now claims that my decision in the matter is not final and binding, and that he is entitled to refer the dispute to arbitration. I should be glad to know if such is the case in view of the foregoing conditions.

Under Clause 1 the surveyor is made arbitrator of disputes as to (*a*) dimensions, and (*b*) quality of materials, and his decision is to be final and conclusive. Under Clause 2 the surveyor is made valuer of alterations variations and additions, and his decision is to be final and binding on the contractor. In my opinion, under these clauses the decision of the surveyor would be binding unless fraud or collusion could be shown. Clause 3 is rather peculiar, however, and provides for the decision by the surveyor of disputes between *himself* (not the employer) and the contractor, and it is doubtful whether such a clause would be upheld, or how far it modifies the effect of the previous clauses. I do not think in any case A is entitled to refer the dispute to arbitration. He might bring an action for the amount he claims. If he did so an application could be made to stay the action, and then it would be for the Court to decide whether there was sufficient reason for withdrawing the matter from the decision of the surveyor.

Private Street Works.—"Q. R." writes: I should be glad of your opinion on the following point: In my district (rural), some twenty-four years ago, a building syndicate purchased the land WXYZ on sketch and laid out a private road AB through it, and erected on one side only of the road twenty-eight houses (twenty-four houses are in the rural district and four in the urban district), leaving the land on the other side of the road as gardens for the houses. The syndicate have long since sold the houses to various owners, the garden on the opposite side of the road and immediately in front of the house being in each case sold with the house. The road A to B, formerly laid out by the syndicate, is now in a very bad condition, and needs properly making up. Would you kindly state whether, in your opinion, the road in question, seeing that there are houses on one side only, could be deemed a "street" within the meaning of the Private Street Works Act, 1892, and could be compulsorily made up, provided my council obtained permission to adopt the Act? I should be also glad if you would state whether the portion of the road BCD on sketch (this portion being an unmetalled occupation road leading to fields, with public footpath along it, and in existence long before the road AB was laid out, but now forming a continuation of the road AB) could be deemed a continuation of the road AB, and the whole length ABCD compulsorily made up as one street under the Private Street Works Act, 1892. The length A to B is about 174 yds., B to C about 40 yds., and C to D about 166 yds. There are



no houses along the length B to C, the road being bounded on one side by a cemetery and on the other side by a garden belonging to the house on the opposite side of the road AB; neither are there any houses between C and D excepting the cemetery lodge cottage. This portion of the road is bounded on one side by a cemetery belonging to a Joint Burial Board Committee consisting of the town council and one rural parish council, and on the other side by a canal. If you are of opinion that the council could treat the whole length ABCD as one private street I presume that, seeing that canal companies are exempt under the Private Street Works Act, 1892, the Joint Burial Board Committee would have to bear the whole of the cost of the road from C to D, and share the cost of the length of road B to C with the owner of the garden.

The road A B is undoubtedly a "street" within the meaning of the Private Street Works Act, 1892, and the powers of the Act could be exercised with respect to it, on the adoption of the Act. It is immaterial that there are houses on one side only. Of course, the rural district council could only deal with the portion within their own district. I do not think B C D could be treated as a continuation of A B, and as it consists partly of a public footpath (presumably repairable by the inhabitants at large), it could not be dealt with under this Act, though it might be under sec. 150 of the Public Health Act, 1875, by virtue of the last clause of that section.

Officer of Local Authority: Extra Remuneration.—"Cymro" writes: I am the surveyor to an urban district council, and am carrying out a large sewerage scheme, part of which is outside my district, under powers of an Act of Parliament. I am a whole-time officer, and it has been suggested by the council to give me an honorarium for the extra work. I shall be pleased to know whether it would be legal on the part of the council to give such honorarium, and whether it would be a legal charge on the district fund. Also whether there are any decisions to this effect been given by the Local Government Board.

The question of the payment of extra remuneration to a surveyor of a local authority is always a very difficult one, having regard to sec. 193 of the Public Health Act, 1875. It has been decided that such a surveyor cannot be remunerated by a commission on the contract price of works superintended by him without being liable to the penalty imposed by the section (*Whiteley* v. *Bailey*, 21 Q.B.D., 154). And a resolution of a local authority to pay such a commission was quashed in *Regina* v. *Ramsgate Corporation* (23 Q.B.D., 66). There appears to be no authority one way or the other as to the legality of a payment, otherwise than by way of commission, for extra services. The Local Government Board have suggested that the object might be attained by an increase of salary for a specified period, pointing out, however, that if this course were adopted the

period for which the increase of salary is awarded must be prospective—*i.e.*, must commence not sooner than the date of the resolution of the council awarding the increase (Lumley's "Public Health Acts," 17th edition, p. 458).

Substitution of Water Closet for Privy.—"Alpha" writes: I am interested in a row of nine houses in an urban district. These houses have privies, and the sanitary inspector has served a notice under the Public Health Act, 1875, and Amending Acts, requiring the substitution of water closets for the privies. Kindly inform me if the Public Health Act, 1875 gives a local authority power to compel the substitution of water closets for privies. The Public Health Acts Amendment Act, 1907, has been adopted in the district. In sec. 39 it is mentioned that the local authority may themselves carry out the work of substitution in default of the owner, and may recover half the cost of such work from the owner. Kindly inform me if the owner can recover half the cost of the work of substitution from the local authority if he himself carries out the work of substituting water closets for privies under the before-mentioned notice?

The powers of the Act of 1907 are in addition to, and not in substitution for, those of the Act of 1875, and it appears, therefore, to be open to the council, in a proper case, to proceed under sec. 36 of the Act of 1875, and if they do so the owner cannot recover any part of the cost. They cannot, however, under this section enforce the carrying into effect of a general scheme for altering all privies in the district into water-closets (*Wood* v. *Widnes Corporation*, 1898, 1 Q.B., 463). They must consider each particular case separately.

ASSOCIATION OF ENGINEERS-IN-CHARGE.

ANNUAL DINNER.

The eighteenth annual dinner of this association took place on Saturday night at the Holborn Restaurant, and was attended by upwards of 300 members and guests. The president (Mr. H. S. Hele-Shaw, D.Sc., LL.D., F.R.S., M.Inst.C.E.), who took the chair, was supported by Sir Hay F. Donaldson, K.C.B. (president Institution of Mechanical Engineers), Mr. T. A. Coghlan, C.I.E. (Agent-General for New South Wales), Captain H. Riall Sankey, R.E.(ret.), M.Inst.C.E. (past-president), Sir Alexander B. W. Kennedy, LL.D., F.R.S. (vice-president), Mr. Henry Adams, M.Inst.C.E., M.I.Mech.E. (past-president), Judge Rentoul, K.C., LL.D., Sir Thomas Pile, Bart., LL.D., J.P., Prof. J. L. Hewitt, M.A., F.R.S., Sir Edward White, K.C.C., M.A.B., Messrs. H. A. McFerran, M.I.Mech.E., B. A. Rayworth, M.Inst.C.E., M.I.Mech.E., Frank Bailey, M.Inst.C.E. (vice-president), Sydney Brookes, F. Tucker, Arthur Elliott, F. L. Martineau, Thomas L. Devitt (president Institute Marine Engineers), F. B. Browne (president Institute Automobile Engineers), A. Valon (president Society of Engineers), T. Cooper, M.A., M.Inst.C.E., Thomas Sugden, W.H.Sc., M.I.Mech.E., Hal. Williams, M.I.Mech.E., M.I.E.E., Philip Dawson, M.I.Mech.E., M.I.E.E., W. H. Booth, F.G.S., M.Am.Soc.C.E., Frank Broadbent, M.I.Mech.E., M.I.E.E., H. Percy Boulnois, M.Inst.C.E., M.I.Mech.E., John T. Mould, F. W. Bridges, R. J. Cracknell, A. H. Allen, J. Y. Fletcher, H. E. Neale (chairman of association, vice-chairman of the evening), W. T. Pickett (vice-chairman of association), Henry Swann (hon. treasurer), Alfred E. Penn (hon. secretary), Arthur Davey, M.I.Mech.E. (past-chairman), Henry Capsey (late hon. secretary), W. Armitage (chairman General Purposes Committee), R. Thorp (chairman Social Committee), W. H. Ball (hon. social secretary), H. A. Murray (vice-chairman Educational Committee), J. A. Adams (chairman Parliamentary Committee), J. R. Manning (chairman Finance Committee), C. Clarke, T. Aldworth, G. W. Bartle, and M. C. White.

The loyal toasts having been honoured,

Mr. T. A. Coghlan proposed "The Engineering Profession." He was informed, he said, that the members of the association were occupying very important positions in this country, and that they were in charge of plant and machinery of a very valuable description, the value of which ran into considerably more than £1,000,000,000. Whether that was true or not there was no doubt of the importance of the association, and he thought it was a marvellous thing when they considered how modest were their pretensions and how little attention was given to their proceedings. In any other country they would be flooded with ostentatious notices of their proceedings. That, however, was not the English practice, and perhaps it was the right practice. He took it that he was invited to their dinner that night because he was the representative of the oldest, the most prosperous and the most populous of the British Colonies, and was not, therefore, an exile or a stranger, but was a fellow countryman standing among his own countrymen, and representing a community which shared in and sympathised with the prosperity and welfare of the people of the British Isles.

Sir Hay F. Donaldson replied, and observed in the course of his speech that he believed the problem of Australia, from which the proposer of the toast came, was the problem of water. If water was available the country, the land, was prosperous, and he believed there was ample water there if proper care was taken with it. In such a case they were reminded of the old proverb that God helped those who helped themselves. There had been in Australia a considerable neglect in the conservation of water. There had recently been something done in the sinking of artesian wells in order to get water. Some parts of the colony suffered severely from floods, and the conservation and the pumping of water and the control of floods were all engineering problems. From that point of view the profession of engineering was interested in Australian problems, and it was to be hoped that Australia, in its own interests as well as those of the engineering profession, would undertake to deal with the problem of the water supply at an early date. Then there were also such necessary works as railways, roads, and communications generally which the engineering profession was waiting open-mouthed to engage in. The members of the profession on their part had to be ready—trained and equipped—so that they need not necessarily work in one groove only, but turn their hands to something else if a particular line they had been accustomed to work at failed, or to some other line which held out the prospect of greater advantage. From that point of view—readiness to adapt themselves to circumstances—he believed the members of their association stood in the forefront of the engineering profession.

Mr. Alfred E. Penn proposed "Kindred Institutions and Our Guests," and stated that among the faces they missed that night was that of Dr. Moore, a past-president, whose absence was owing to the lamented death of his son. He was sure they would all sympathise with that gentleman in his bereavement.

Judge Rentoul made a happy and witty response to the toast.

Mr. Sydney Brooks submitted "The Association," and emphasised the debt which mankind owed to the engineering profession. By the aid of engineering the face of the world had been not merely changed, but transformed. He recalled a visit he paid to Niagara twenty years ago, and what he saw upon a second visit a few years since. He found that the skill of the engineer had harnessed some of the mighty force of Nature at Niagara Falls, and converted it into a humanising agency for supplying light and motive power to the surrounding community; and when he looked upon the means by which this had been accomplished he thought how much depended upon the efficiency and alertness of the engineer in charge of the works.

The President, in responding, alluded to the excellent work done by the hon. secretaries, the vice-chairman and the committee. The association, he said, was in some ways unique, for it had a strong technical side and a strong social side, and after a year's experience of office he was not able to say which he really thought was the most valuable aids to its success. The engineer who had attained to the proud position of being in charge of all that conduced to the comfort and wealth of the people was in danger more than he ever was before of falling behind and losing his position if he failed to keep pace with the rapid progress of technical knowledge and discovery which characterised the present day. Therefore, the technical side of the association was a great advantage to the members, the papers read and the discussions thereon being absolutely vital to their welfare and to their very existence. The social side was not less prominent, and proved very useful in promoting intercourse between the members. He had been told that an institution in America similar to this had a membership of 100,000. Such a figure was a sign of great hope to them. They began with seven members eighteen years ago, and they had now a membership of 400. They might greatly augment their numbers by encouraging the development of local branches.

The Surveyor
And Municipal and County Engineer.

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LOCAL GOVERNMENT BOARD INQUIRIES.

The Editor invites the co-operation of Surveyor *readers with a view to making the information given under this head as complete and accurate as possible.*

INQUIRIES HELD.

Birmingham T.C. (April 11th. Mr. A. G. Drury).—£8,700 for purposes of sewerage and surface-water drainage at Tyseley, Yardley, £4,732 for the improvement of King's-road, Hay Mill, including the construction of a bridge over the Birmingham and Warwick Canal, and £727 for the reconstruction of a sewer in Hagley-road.—In connection with the first application, it was stated that it had been decided to lay a sewer from Wharf-lane, Tyseley, to connect up with the Cole Valley main sewer in Hay Mill district, and to lay a surface-water drain to part of the district in Tyseley. At present a good part of the district was drained into cesspools. In Wharf-lane alone there were twelve houses which drained into one cesspool. The erection of the new railway line to Tyseley and the station had brought about a considerable growth in the population, and the city council regarded drainage by cesspools as quite unsuitable for an urban area, besides being in itself an unsuitable method. Mr. H. E. Stilgoe, city surveyor, explained the engineering details of the works proposed. With respect to the reconstruction of the sewer in Hagley-road, it was explained that the section lay between the Fountain and Barnsley-road. With regard to the new bridge at King's-road, Hay Mill, and the improvement of the road there, it was pointed out that King's-road was the main connecting link between the Coventry and Warwick main roads.

Carnarvon T.C. (April 3rd. Major C. E. Norton).—£2,250 for the provision of a cemetery on the west side of the main road leading from Carnarvon to Beddgelert.—The town clerk, Mr. R. O. Roberts, stated that negotiations were opened with Sir Charles Assheton-Smith for the purchase of a site on the west side of the main road from Carnarvon to Beddgelert. The purchase money agreed upon amounted to £800, the area being 4a. 2r.

Hexham U.D.C. (April 10th. Mr. R. H. Bicknell).—£1,134 for private street works, £830 for alteration and addition to the public slaughter-houses, and £789 for the purposes of the Abbey Grounds and the Seal.—Objection was taken only to the proposal to borrow £789 for the Abbey Grounds and Seal. This amount was proposed to be apportioned as follows: £107 for cementing the burn which runs through the grounds; £279 for the erection of wrought-iron railings round part of the grounds, £125 for proposed public shelter on the Seal, and £278 for the erection of gates at the entrance to the Seal from Hencotes. Councillor J. Civil took exception to the proposal to cement the burn. Councillor James F. Robb, chairman of the council, said the council's idea was to make an open water space where children could sail boats; there would also probably be water fowl, and they wished to make the place altogether more ornamental and in keeping with the grounds.

Hursley R.D.C. (April 4th. Mr. H. Shelford Bidwell).—This was an inquiry into the complaint made to the Local Government Board under the provisions of sec. 299 of the Public Health Act, 1875, "That the Rural District Council of Hursley have made default in providing the parish of Chandler's Ford with sufficient sewers."—Mr. Warner, on behalf of several complainants, stated that the present system of drainage was by cesspits, and the by-laws prescribed that those cesspits should be watertight. There was a public water supply to which several houses were connected, but there were seventy houses unconnected, obtaining their water from comparatively shallow wells. Experience had told them that there was need of frequent emptying of the cesspits, the practice being to pump the pits out and spread the contents over the gardens. The evil and unpleasant effects of that would be explained; it was one of the problems they had to face, especially in those cases where there was not sufficient ground over which to dispose of this liquid matter. Coupled with that was the fact that the soil was largely non-absorbent. Another point was that there were a large number of private roads in the locality, and it was impossible to make them up, the idea being that if the sewers were to be laid, they should be laid before the roads were made up and taken over by the local authority. Consequently the rateable value of the parish suffered.

South Shields T.C. (April 8th. Mr. H. S. Stewart).—This was an appeal by the owners of the property, the council of the Durham Colleges of the University of Durham, against the refusal of the council to determine an Order, made under the Housing and Town Planning Act, 1909, closing the dwelling-house No. 1 Forrest-hill.—Mr. J. Moore Hayton (town clerk) acted for the corporation, and Mr. F. E. Joblin, of Durham, for the Durham Colleges. The contention of the council was that the yard of the house in question should be paved, but the owners considered that sundry repairs that had been made to the premises were sufficient to make the house habitable. After evidence had been given by the borough engineer, Mr. Leslie L. Roseveare, medical officer of health and a sanitary inspector, the inspector proceeded to view the premises.—April 9th.—£5,077; £1,517 in respect of a proposed lavatory and shelter on the foreshore, £2,100 for the drainage of low-lying properties abutting the foreshore, including the erection of an ejector station, and £1,460 for a 2ft. 6in. diameter brick and concrete sewer in Stainton-street, together with a short length of pipe sewer in Laygate-lane.—The necessary information was given to the inspector by the borough engineer, Mr. Leslie Roseveare.

Wallasey T.C. (April 4th. Mr. H. Ascough Chapman).—£602 for the widening of Mill-lane, Liscard.—Mr. Percy Cook, assistant solicitor, represented the council. He said that Mill-lane was an important arterial road, accommodating a large amount of traffic. The particular frontage being dealt with projected considerably in advance of the general line of the road, and was without a footpath. The improvement was an absolute necessity. Arrangements had been made by which the widening could be effected on satisfactory terms. In all 634 sq. yds. of land were to be added, of which 155 sq. yds. were to be dedicated free, the remainder to be purchased at 6s. 8d per square yard. The estimated cost of the road-making was £440.

Wednesbury T.C. (April 11th. Mr. F. H. Tulloch).—£1,195 for street improvement purposes.—The town clerk, Mr. T. Jones, said it was proposed to purchase and demolish property at the junction of Meeting-street with Holyhead-road. The improvement would greatly facilitate traffic, and would enable Meeting-street to be much more used for heavy traffic between Wednesbury and Darlaston. The council had recently erected new schools in the locality at a cost of £18,000, and they had also acquired 10 acres of

land for a recreation ground, so that it was desirable the locality should be improved as much as possible. The land now to be acquired would be fenced in and planted with shrubs.

Whitley U.D.C. (April 10th. Mr. H. S. Stewart). £10,000 for workmen's dwellings.—The scheme relates to ground sold by the Duke of Northumberland to the Whitley Urban District Council at 1s. per square yard, on the stipulation that it should be used for workmen's dwellings. It was pointed out, on behalf of the council, that it was impossible for the working classes to reside in the Whitley district, as ordinary flats of three or four rooms ranged from 7s. to 10s. per week. The houses which the council proposed to build would consist of four rooms, rented at from 5s. 6d. to 6s. 9d. clear per week.

APPLICATIONS FOR LOANS.

Bath T.C.—£500 for sewerage works.

Bewdley T.C.—£3,000 for water pumping machinery.

Blackrock U.D.C.—£1,000 for laying out a recreation ground.

Devonport T.C.—£4,850 for school enlargement.

Dudley T.C.—£1,100 for the purchase of property for street improvement, and £400 for the purchase of a 10-ton steam roller.

Gainsborough U.D.C.—£2,500 for works of paving.

Hinckley U.D.C.—£2,000 for the erection of twelve cottages.

Newcastle-under-Lyme T.C.—£2,000 for electricity extensions.

St. Anne's U.D.C.—£1,286 for a wind screen and shelters.

Sevenoaks R.D.C.—£1,000 for refilling filters at the sewage works.

Southampton T.C.—£1,100 for the erection of four cottages at the waterworks.

Teignmouth U.D.C.—£1,080 for road widening works.

Thornton U.D.C.—£200 additional loan for public conveniences.

Tiverton R.D.C.—£350 additional loan for the Silverton water scheme.

Ulverston U.D.C.—£1,100 for the extension of gas mains and the provision of a coal store.

Yeovil R.D.C.—£430 for sewage disposal works.

LOANS SANCTIONED.

Abertillery U.D.C.—£3,368 for recreation grounds.

Bath T.C.—£2,750 for electricity extensions.

Barking U.D.C.—£2,275 for an administrative block at the isolation hospital (provisionally).

Colwyn Bay U.D.C.—£1,150 for public shelters.

Hay U.D.C.—£4,000 for a sewerage scheme.

Hendon U.D.C.—£10,663 for the erection of fifty workmen's dwellings.

Langport R.D.C.—£120 for a water supply for Ringsdon.

New Ross U.D.C.—£2,300 for a new sewerage scheme, repayable in thirty years.

Swansea T.C.—£2,454 for the purchase of land for a cemetery.

Whitehaven T.C.—£1,565 for the extension of electricity mains.

Yeovil R.D.C.—£104 for water supply works.

FORTHCOMING INQUIRIES.

APRIL. £

21.—**Meltham.** For a housing scheme (Mr. C. H. Eyles) 6,000

22.—**Bournemouth.** For cemetery and pleasure ground purposes (Mr. Edgar Dudley) 20,100

22.—**Chester-le-Street.** For a housing scheme (Mr. C. H. Eyles) 29,500

22.—**Chiswick.** For the extension of Turnham Green (Major J. Stewart) 825

22.—**Melton Mowbray.** For street widening purposes (Mr. R. H. Bicknell) 1,063

22.—**Pateley Bridge.** For sewage disposal purposes (Mr. F. O. Stanford) 3,300

22.—**Sunderland.** For the construction of a street (Mr. H. Shelford Bidwell) ... 1,500

22.—**Whitchaven.** For works of water supply (Mr. F. H. Tulloch) 810

23.—**Alfreton.** For works of water supply (Mr. R. H. Bicknell) 1,500

23.—**Grange.** For the provision of a tennis lawn and shelter (Mr. F. H. Tulloch) ... 200

23.—**Liverpool.** For the purposes of town planning (Mr. Thomas Adams)... ... —

23.—**Wetherby.** For sewage disposal purposes (Mr. F. O. Stanford) 4,500

24.—**Colchester.** For drainage purposes and the provision of a travelling crane (Mr. M. K. North) 1,690

24.—**Epping.** For sewage disposal purposes (Mr. A. W. Brightmore) 3,500

24.—**Hunsworth.** For sewage disposal purposes (Mr. F. O. Stanford) 3,350

24.—**Kingston-upon-Hull.** For the provision of stables, horses and boilers (Mr. R. H. Bicknell) 17,855

24.—**Marlborough.** For the erection of working-class dwellings (Mr. H. S. Stewart) 2,600

24.—**Windermere.** For the purchase of a stone-breaking machine (Mr. F. H. Tulloch) 500

25.—**Doncaster.** For sewage disposal purposes (Mr. F. O. Stanford) 3,990

25.—**Middlesbrough.** For the purposes of sewerage (Mr. H. Shelford Bidwell) ... 33,850

25.—**Thornton.** For the purchase of a tar-spraying machine (Mr. F. H. Tulloch) 125

26.—**Burnley.** For the purposes of the gas undertaking (Mr. F. H. Tulloch) ... 5,000

ASSOCIATION OF MANAGERS OF SEWAGE DISPOSAL WORKS.

There was a large attendance of sewage works managers at the laboratory of the Mersey and Irwell Joint Committee on Saturday last, the occasion being a demonstration of the dissolved oxygen test as recommended by the Royal Commission on Sewage Disposal, given by Mr. Frank Scudder, F.I.C., chemical adviser to the commission. The demonstration proved quite successful; Mr. Scudder being assisted by Mr. Petygrew and Mr. Newman.

Mr. Stamp (Ashton-under-Lyne) proposed a vote of thanks to Mr. Scudder for the readiness with which he responded to the request to give the demonstration.

Mr. Ball (Manchester), in seconding, remarked that the only drawback to the test was the long time required to carry it out—five days. The manager wanted a test that would tell him practically at once whether the effluents were satisfactory or not. Mr. Scudder's offer to those who wanted information to apply to him or to come to the laboratory was indeed a kind offer, and were the same spirit to exist all round it would result in much good.

Mr. Scudder thanked the members for their attendance, and assured them of his assistance, while the laboratory was at their service. He desired to see sewage works managers on a much higher plane. The nature of their work demanded this. He always considered the work of the manager of the gas works and that of the manager of the sewage works as being equal, and failed to understand why the sewage works manager was so inadequately paid. He hoped the time was not far distant when this would be remedied.

GUILDFORD MEETING.

By permission of the Sanitary Committee, the association will have the opportunity of inspecting the sewage disposal works at Guildford to-morrow (Saturday).

Programme.

12.15 p.m.—Assembly at the Guildhall, and reception by the mayor, chairman, and members of the Guildford Town Council.

Descriptive paper by Mr. C. G. Mason, Assoc.M.Inst.C.E., the borough engineer and surveyor.

1.15 p.m.—Lunch at Messrs. Brett Raynards, High-street, Guildford.

2.30 p.m.—Proceed to works by motor vehicles, for which a charge will be made.

2.45 p.m.—Arrival at works, and general inspection.

Municipal Work in Progress and Projected.

The Editor invites the co-operation of Surveyor *readers with a view to making information given under this head as complete and accurate as possible.*

The following are among the more important projected works of which particulars appear below:—Buildings—Arbroath, Barrow-in-Furness, Camberley, Pontefract; housing and town planning—Waterford; refuse collection and disposal—Newport; roads and materials—Middlesbrough £10,000, Swansea £56,000; sewerage and sewage disposal—Burton-on-Trent, Westhoughton; water, gas and electricity—York. Particulars of other works projected will be found on our "Local Government Board Inquiries" pages.

BUILDINGS.

Arbroath T.C.—At the meeting on Monday it was resolved to purchase premises in Marketgate-street as a site for the public baths, towards which Mr. Andrew Carnegie has given £7,000. It was resolved that premiums should be offered for the best plans, and Mr. James Thomson, city engineer, Dundee, was appointed adjudicator.

Barrow-in-Furness T.C.—The borough surveyor, Mr. Arthur Race, has received instructions to report upon a site for a proposed public library.

Camberley U.D.C.—Proposals are under consideration for the provision of a public swimming bath.

Derby T.C.—A report by the Sanitary and Registration Committee has been adopted recommending that the council should unite with the county authorities in erecting an hospital for smallpox patients.

Eastbourne T.C.—A scheme has been prepared for the erection of an hospital for consumptives, at an estimated cost of £4,500.

Greenwich B.C.—It is proposed to establish a tuberculosis dispensary at Park-place.

Hinckley U.D.C.—The council have approved the plans of the surveyor, Mr. E. H. Crump, for the erection of twelve cottages.

Montrose T.C.—A new public slaughterhouse is to be erected at an estimated cost of £1,930.

Pontefract T.C.—The tender of Messrs. James Fidler, Limited, of Sheffield, has been accepted for the erection of the new public baths.

Ramsgate T.C.—The borough engineer, Mr. T. G. Taylor, has received instructions to prepare plans for a shelter at the East Cliff.

Rhyl U.D.C.—The surveyor, Mr. A. A. Goodall, has been instructed to submit a scheme for the repair of the pier to the Office of Woods and Forests.

Stirlingshire C.C.—The Central District Committee have decided to build a smallpox hospital at Taylorton, at an estimated cost of £1,550.

Sunderland T.C.—It has been decided to construct a salt-water bath at the south end of the sea wall at Roker, at an estimated cost not exceeding £1,000.

Taunton T.C.—The council have approved the scheme of Mr. W. T. Douglass, of London, for the construction of a new weir, culvert, and footbridge at French Weir, at an estimated cost of £3,800.

Tunbridge Wells T.C.—A waiting-room and lavatory for women are to be provided at the cemetery at an estimated cost of £2,900.

HOUSING AND TOWN PLANNING.

Hadleigh U.D.C.—A contract has been signed with Mr. A. A. Death for building the cottages under the council's housing scheme, and the surveyor, Mr. T. F. Corder, has received instructions to proceed with the widening of that part of Ipswich-road adjacent to the site of the cottages.

Holywell R.D.C.—A scheme is to be prepared to provide working-men's houses in those portions of the union where they are needed, a start to be made by the erection of workmen's houses at Rhosesmor, Halkin, and Bagillt.

Launceston T.C.—The borough surveyor, Mr. A. W. Grace, has estimated the cost of providing workmen's dwellings at £200 per house exclusive of land.

Seaton (Devon) U.D.C.—A plot of land has been purchased for £200 as a site for any cottages that may be erected under a proposed housing scheme.

South Molton T.C.—The Local Government Board have sanctioned the amended plan for the erection of workmen's dwellings.

Spalding U.D.C.—The Local Government Board have intimated that they are unable to sanction the borrowing by the council of £6,000 for the purposes of a housing scheme as the land proposed to be used has already been definitely allocated for allotments.

Waterford T.C.—The Public Health Committee recommend the council to carry out a housing scheme at Ferrybank, at an estimated cost of £12,964.

PARKS AND OPEN SPACES.

Aberavon T.C.—The Highways Committee have had plans and estimates prepared for a recreation ground at the beach, at an estimated cost of £5,120.

Clydebank T.C.—It has been referred to the Parks and Open Spaces Committee to consider the advisability of procuring suitable sites for municipal bowling greens and recreation grounds.

Harrogate T.C.—The council have recommended the Pleasure Grounds Committee to consider the question of laying out two or three municipal bowling greens on the Stray, between the railway and Pal-velaine.

Whitstable U.D.C.—Land is to be purchased at Reeve's Beach for the purpose of a recreation ground.

REFUSE COLLECTION AND DISPOSAL.

Clitheroe T.C.—Three acres of land have been purchased for the purpose of a refuse tip.

Newport (Mon.) T.C.—The Health Committee have received the report of the sub-committee on the provision of a refuse destructor for the borough. This report, which is to be presented to the council, gives an estimated capital expenditure of £10,000, with annual upkeep of £2,000.

Rhyl U.D.C.—The cartage of refuse for the sanitary department has been let for the year for £360. Other cartage has been let at sums varying from 6s. 6d. to 8s. per day of eight hours for man, horse and cart.

ROADS AND MATERIALS.

Accrington T.C.—A new street is to be constructed to join up Pitt-street and Hayfield-street, at an estimated cost of £728.

Bexhill T.C.—An agreement has been arrived at between the council and Earl de la Warr, by which the town will secure possession of the Esplanade. The promenade, transferred includes ornamental railings, chalets and shelters, and the motor track.

Brighton T.C.—The Buildings Committee recommend the purchase of property to the value of £3,600 for the purpose of widening St. James's-street. The Road Board have written stating that they are prepared to make a grant of £2,000 towards the cost of laying a steel log roadway in Preston-road.

Burton-on-Trent T.C.—A further widening of Station-street at a cost of £2,350 is under consideration.

Cannock U.D.C.—Kerbing and channelling are to be carried out in various parts of the district at a cost of £1,934.

Cardiff T.C.—It has been agreed by the joint Public Works and Tramways Committees to recommend the council to do the whole of the work in connection with laying the wood paving of the tramway track from Newport-road corner of the City-road to Hayes Bridge by direct labour. The Public Works Committee also recommend the council to relay the remainder of the roads, about 2½ miles, by direct labour.

Derry (No. 1) R.D.C.—The county surveyor, Mr. Chas. L. Boddie, has intimated that the Road Board are prepared to lend a sum of £2,000, free of interest, repayable in five years, towards the cost of the proposed improvement of the Derry-Claudy-Park road. The council have accepted the grant, and congratulated the county surveyor on the successful outcome of his negotiations with the Road Board.

Fraserburgh T.C.—It has been decided to make up several streets with "Roemac."—The council have decided to make use of Akonia for dust prevention in other parts of the town.

Greenwich B.C.—Subject to the Road Board consenting to contribute £500 per annum, the council have decided to accept the tender of Val de Travers Asphalte Paving Company, Limited, for the re-surfacing of Little Heath, Charlton-road, and "Camomile Bottom," Shooters' Hill-road, from Delacourt-road to Wellhall-road, Blackheath-hill (from South-street to Merton-place) and Blackheath-road, and to maintain the paving for ten years. Payment is to be made in ten annual instalments, and the work, if carried out, would, it was stated, save the borough council something like £3,000 a year in road repairs.

Llangollen U.D.C.—A proposal is under consideration for improving the river front at Llwyn Bach, at an estimated cost of £400.

Middlesbrough T.C.—A proposal has been made for the construction of a new road from Linthorpe to the Stockton and Redcar main road, at an estimated cost of £10,000.

Newhaven R.D.C.—A letter has been received from the East Sussex County Council stating that the whole length of the road between the boundary of the borough of Lewes and the boundary of the urban district of Newhaven would be the subject of the proposed road improvement scheme.

Norwich T.C.—The tender of the Phœnix Engineering Company, Chard, at £11 each, has been accepted for three asphalt boilers.

Penrith U.D.C.—The council are again making use of Akonia on the roads for dust prevention.

Ripon T.C.—The necessary land having been given by the Dean and Chapter (subject to the sanction of the Ecclesiastical Commissioners) it has been decided to proceed with the road widening scheme at St. Agnesgate.

Sheffield T.C.—The corporation are making use of Akonia for dust prevention.

Swansea R.D.C.—Sir John Llewelyn has given the necessary land for a road diversion at Melin Llan Bridge, Penllergaer, and has received the cordial thanks of the council.

Swansea T.C.—The scheme of the borough engineer, Mr. G. Bell, for improving the streets in the central area of the town by laying down wood and asphalt has been approved. The estimated cost is £50,000. The annual charges on such a capital expenditure are £6,420, but this sum will be reduced by £3,112, saving in respect of cleansing and maintenance, consequent upon the adoption of wood paving.

SEWERAGE AND SEWAGE DISPOSAL.

Bromsgrove U.D.C.—Mr. Robert Green, M.INST.C.E., of Birmingham, has been instructed to prepare the specification, quantities and detailed drawings, and to obtain tenders forthwith for the construction of sewers in the Plymouth-road district.

Burton-on-Trent T.C.—It has been decided to reconstruct the rising main to the pumping station, from which sewage is pumped to the farm, at an estimated cost of £2,377.

Haworth U.D.C.—Plans have been sanctioned for a septic tank and filter at the sewage farm.

Montrose T.C.—It has been decided to provide a public convenience for men and another for women.

Morley T.C.—Experimental plant for pressing the sludge is to be erected at the sewage works at a cost of £475.

Penybont (Glam.) R.D.C.—A field of 4½ acres at Pencoed has been purchased for £585 for the purposes of a sewage farm.

Petersfield R.D.C.—Messrs. Chambers Smith & Adams, consulting and civil engineers, 53 Victoria-street, Westminster, S.W., have been instructed to prepare a scheme of sewerage and sewage disposal for the township of Liss.

Shifnal R.D.C.—The tender of Messrs. W. H. Thomas & Son, of Oswestry, at £3,850, has been accepted for carrying out No. 1 Contract in connection with the Albrighton sewerage scheme.

Westhoughton U.D.C.—It is proposed to enlarge the filter beds at the sewage farm, at an estimated cost of £2,400.

WATER, GAS, AND ELECTRICITY.

Alnwick R.D.C.—A committee has been appointed to draw up a scheme for providing the village of Acklington with a water supply.

Brixham (Devon) U.D.C.—The profits of the gas undertaking for the past year were £1,866, and from the electricity undertaking (first year) £6.

Carrick-on-Suir U.D.C.—Mr. James F. Reade, engineer, has reported that the water scheme for the town, carried out at a cost of £10,500, is almost complete, and that the water will be available for domestic use in a couple of weeks. The water has been brought from Crotty's Lake, in the Comeragh Mountains, co. Waterford, about 8 miles from Carrick-on-Suir.

Devonport T.C.—A gasworks improvement scheme is to be carried out at an estimated cost of £7,540.

Kensington B.C.—A loan of £3,700 is to be raised at 3¼ per cent per annum to meet the expenditure incurred in improving the street lighting of the borough.

Motherwell T.C.—It has been decided by the council to acquire the undertaking of the Motherwell Gasworks Company, whose paid-up capital is £56,307.

Ripley U.D.C.—A supply of water is to be obtained from Derwent Valley Water Board at the rate of 8¾d. per 1,000 gallons.

York T.C.—The tender of Oerlikon & Co., of Zurich, at £9,967, has been accepted for the extension of plant at the electricity works. The chairman of the Electricity Committee stated that the committee had been anxious to keep the work in this country, but the difference between the tenders was so large and other considerations were so great that the committee had no hesitation in asking the council to accept this tender. About half the work would be done in England, as the contract included sub contracts with English firms amounting to £4,157.

MISCELLANEOUS.

Little Hulton (Lancs) U.D.C.—The council have acceded to a request from the office staff for permission to start work half an hour earlier during the summer months, and finish at 5 o'clock instead of 5.30, in accordance with the principle of the Daylight Saving Bill.

Surbiton U.D.C.—Of five tenders received for the new first-aid motor fire appliance, that of Messrs. Dennis Brothers, Limited, of Guildford, has been accepted at £690.

Swansea T.C.—The Improvements and Tramways Committee recommend the council to apply to the Light Railway Commissioners for power to construct a tramway up Townhill, *viâ* Mount Pleasant.

Rutherglen T.C.—The wages of the municipal employees have been revised as follows: Dustbin-men, 28s. per week; street sweepers, park workers, &c., 26s. per week; street lamplighters, 26s. per week; stair lamplighters, 20s. per week; gravediggers, 27s. per week; causeway-layers, 32s. per week. It has been agreed to purchase a motor fire engine for the burgh at an estimated cost of £800.

PERSONAL.

Mr. Chas. L. Hamby, borough surveyor of Beccles, has had his salary increased by £26 per annum.

Mr. W. Quest, surveyor to the Wombwell Urban District Council, has had his salary increased to £200 a year.

Mr. Thomas Walsh, county surveyor of Queen's County, has been granted an increased salary of £50 a year.

Mr. Charles E. Smith, assistant burgh engineer of Aberdeen, has been granted an increase of salary of £25 per annum.

Mr. H. E. Mobbs, draughtsman in the Norwich borough surveyor's department, has obtained an appointment at Cambridge.

Mr. W. E. Putman, borough engineer of Morley, has been presented with a set of Royal Crown Derby ornaments and a rose-bowl by the corporation officials upon his retirement.

Mr. T. T. Strongman, surveyor for the south district of the St. Columb Rural District Council, has been granted two months' leave of absence on account of continued ill-health.

Mr. M. Hainsworth, surveyor to the Teddington Urban District Council, and Councillor E. D. Howe have been deputed to represent that body at the International Road Congress.

Mr. W. G. Cross, assistant borough surveyor at Tunbridge Wells, has been the recipient from his colleagues of a set of technical books, an armchair and a case of fish knives and forks, upon leaving to proceed to Richmond.

Mr. H. T. Mather, surveyor, with Mr. F. W. Wood, the clerk, and two chairmen of committees, have been appointed as representatives of the Surbiton Urban District Council at the National Housing and Town-Planning Conference in May.

Mr. O. E. Winter, M.INST.C.E., borough engineer and surveyor of Hampstead, has had his salary increased by £25, Mr. J. Williams, deputy borough engineer and surveyor, by £15, and Mr. J. W. Lee, assistant surveyor, eastern district, by £15 per annum.

Mr. Harry L. Lloyd, of Wolverhampton, has obtained an appointment as engineering assistant to the Weston-super-Mare Urban District Council. Mr. Lloyd was formerly an assistant to Mr. R. B. W. Berrington, M.INST.C.E., of Wolverhampton.

Mr. Charles G. Lawson, engineer and surveyor to the Southgate Urban District Council, has been presented with an illuminated framed address, a smoker's cabinet and case of pipes by the members and officials of the council on the completion of thirty-one years' service.

Mr. Wm. Low Strachan, who was some time ago recommended by the Association of Managers of Sewage Disposal Works to the War Office as a successor to Lieut.-Col. Jones, V.C., as manager of the Aldershot Camp farms, has been notified of his appointment, to date from this month.

Mr. Ralph W. Butler, ASSOC.M.INST.C.E., chief assistant to the engineer and surveyor of the County Borough of Newport, and Mr. Frank Staley, ASSOC.M. INST.M. AND CO.E., senior engineering assistant to the borough and water engineer, Bedford, have been appointed junior engineer assistants under the Road Board.

Mr. Chas. H. Ball, hon. secretary of the Association of Managers of Sewage Disposal Works, manager of the Withington sewage works of the Manchester Corporation, and temporarily in charge of the Davyhulme works during the absence of Mr. Ogden through illness, has been granted an increase of £25 per annum.

Mr. H. P. Maybury, the county surveyor of Kent, has, we regret to learn, been suffering from indifferent health for some months past. Probably it may be attributed to overwork, the modern cause of most of the ills that flesh is heir to, in which case our readers will hope that cause and effect may be removed without delay.

Mr. W. B. Purser, county surveyor, Grantham, and Mr. T. H. B. Heslop, county surveyor, Norwich, president and hon. secretary respectively of the County Surveyors' Society, and Mr. H. T. Wakelam, county engineer and surveyor of Middlesex, have been co-opted to the Highways Committee of the County Councils' Association.

Messrs. J. W. B. Blackman, city engineer, New Westminster, British Columbia, A. S. Frost, borough engineer's office, Durban, Natal, H. Hunter, council offices, New Malden, Surrey, H. Hurd, council offices, Broadstairs, and R. A. Webb, Municipal Board, Lagos, Southern Nigeria, have been elected members of the Royal Sanitary Institute.

Mr. H. T. Mather, surveyor to the Surbiton Urban District Council, and Mr. W. Howard-Smith, consulting engineer, Westminster, gave evidence in the trial of the action brought by a widow against the London United Tramways, Limited, to recover, under Lord Campbell's Act, damages in respect to the death of her husband, who was thrown from his bicycle—owing, it was alleged, to the wheel catching in a tramway groove at a switchpoint—and killed by a motor omnibus. Terms were agreed in court.

FOR OTHER ADVERTISEMENTS
See End of Paper.

FOR SALE — Stoney's Theory of Stresses, 36s.; Bailey Denton's Sanitary Engineering, 30s.; Rankin's Civil Engineering; Potts' Euclid, 4s. 6d.; Todhunter's Trigonometry, 5s.; Algebra, 5s.; Reid's Concrete; Cofferdams (American), 12s. 6d. What offers?—Address, Alpha Brown, Tothill-street, Westminster. (379)

DURHAM COUNTY COUNCIL.

TEMPORARY ENGINEERING AND SURVEYING ASSISTANTS AND SURVEYOR'S CLERK.

Engineering Assistant wanted temporarily (about two years), at a salary of £150 per annum; also surveying assistant temporarily (about two years), at a salary of £150 per annum, and a divisional main road surveyor's clerk, at a salary of £48 per annum.

Applications, on forms to be obtained from the undersigned, must be submitted not later than Wednesday, April 30th.

WILLIAM CROZIER,
County Surveyor.

Durham.
April 17, 1913.

RURAL DISTRICT COUNCIL OF SEDGEFIELD.

PRIVATE STREET WORKS.

CLERK OF WORKS.

Applications are invited for the Appointment of Clerk of Works to act under the Surveyor during the construction of several private street works in the Council's district.

Salary at the rate of £2 per week.

Candidates must have had recent experience in Street Works, and be capable of taking and fixing levels, setting out and measuring up the various works.

Applications in writing, together with copies of two recent testimonials, to be sent to me not later than Wednesday, 30th instant.

(By order)
J. W. LODGE,
Clerk to the Council.

Union Offices,
Sedgefield, Ferryhill.
April, 1913. (380)

ALSAGER URBAN DISTRICT COUNCIL

OAK FARM WATER SUPPLY.

TO BORING CONTRACTORS.

Tenders are invited for the Boring and Lining of Borehole No. 2 in connection with the above Works.

Copies of Specification and full details may be obtained upon application to F. W. Stocks, Esq., F.S.S., Engineer, Town Hall Chambers, Middlewich.

Sealed Tenders, endorsed "Tender for Boring," to be sent to the undersigned not later than first post on Tuesday, the 13th day of May next.

The Council do not bind themselves to accept the lowest or any Tender, and any Tender accepted will be subject to the sanction of the Local Government Board, otherwise to be void.

JOHN J. NELSON,
Clerk to the Council.

Burslem, Staffs.
April 15, 1913. (381)

WOLSTANTON UNITED URBAN DISTRICT COUNCIL.

Tenders are invited for the Supply and Delivery of 2-in. and 2½-in. machine-broken Clee Hill Basalt, Leicester Granite or Welsh Granite, delivered as follows:—

Brampton siding, N.S.R.	Longport station, N.S.R.	Hartshill siding, N.S.R.	Silverdale station, N.S.R.	Chesterton station, N.S.R.
Tons	Tons	Tons	Tons	Tons
575	300	100	500	200

forwarded as required during the twelve months from April 1st last. Also for 11,200 gallons of Tar, prepared for spraying macadamised roads, delivered as follows:—

Brampton siding, Newcastle, N.S.R.	Silverdale station, N.S.R.	Chesterton station, N.S.R.
Gallons	Gallons	Gallons
7,200	2,000	2,000

The Tenders to be in the hands of the undersigned not later than April 26th, 1913. The Council does not bind itself to accept either the lowest or any Tender, and reserves to itself the right to accept the whole or any portion of a Tender.

W. F. SLATER,
Engineer and Surveyor.

Burslem,
Staffs.
April, 1913. (382)

INSTITUTION OF MUNICIPAL AND COUNTY ENGINEERS.

President—Mr. R. J. Thomas, M.Inst.C.E., County Surveyor, Buckinghamshire.

METROPOLITAN DISTRICT MEETING.

A Metropolitan District meeting of the Institution of Municipal and County Engineers was held at the offices, 92 Victoria-street, S.W., on Wednesday, April 2nd, when there were present Messrs. T. W. A. Hayward (Battersea), J. Sutcliffe (Deptford), P. G. Killick (Finsbury), O. E. Winter (Hampstead), J. Killick (Road Board), P. Dodd (Wandsworth), W. Nisbet Blair (St. Pancras), T. Cole (secretary of the institution) and Norman Scorgie (hon. district secretary, Hackney). In the unavoidable absence of the chairman (Mr. J. Patten Barber, Islington) through illness, Mr. T. W. A. Hayward (Battersea), vice-president, was elected chairman of the meeting.

The Minutes of the last district meeting, held on December 13, 1912, at the offices of the institution, were read, confirmed and signed.

Arising out of the Minutes a question was asked as to why a district meeting had not been held in January as suggested, and the district secretary reported that owing to the numerous other district meetings of the institution held in the metropolis it had not been possible to fix on a convenient date.

The absence of the district chairman having been explained to be due to severe indisposition, it was, on the motion of Mr. T. W. A. Hayward, seconded by Mr. Killick (Finsbury), resolved that the district secretary be instructed to forward a vote of sincere sympathy to Mr. J. Patten Barber, and to express the hope for his speedy recovery.

On the proposition of Mr. Dodd (Wandsworth), seconded by Mr. Blair (St. Pancras), it was resolved that a hearty vote of thanks be accorded to the officers of the district for their services during the past year.

Mr. O. E. Winter (Hampstead) replied on behalf of the officers.

Chairman.—The chairman having invited nominations for the office of district chairman, it was unanimously resolved that Mr. J. Patten Barber be nominated as chairman of the Metropolitan District.

District Secretary.—It was proposed by Mr. Blair (St. Pancras), and seconded by Mr. T. W. A. Hayward (Battersea), and unanimously resolved that Mr. Norman Scorgie (Hackney) be elected district secretary.

District Representatives.—On the motion of Mr. Killick (Finsbury) it was resolved to nominate Mr. Scorgie (Hackney) and Mr. Winter (Hampstead) as district representatives, and it was further resolved to urge the members of the district to support the foregoing nominations.

Executive Committee.—It was resolved that the executive committee consist of chairman, secretary and the two district representatives as *ex-officio* members of such committee; six persons to be elected from the members of the district, two of whom shall be associate-members.

It was proposed by Mr. Killick (Finsbury), seconded by Mr. Killick (Road Board), and resolved that the following be elected as members of the executive committee—viz.: Messrs. E. B. B. Newton, P. Dodd, J. Sutcliffe and J. Rush Dixon; as associate-member G. Sturgess (Chelsea). The election of the second associate-member was deferred until the next meeting.

With a view to a suitable name being submitted to the next meeting it was resolved that the district secretary forward a list of the associate-members of the district to the executive committee as above named.

Mutual Defence Fund.

The hon. district secretary read a communication received from the secretary of the institution on the question of the formation of a Mutual Defence Fund, and the chairman of the meeting gave particulars of the result of the appeal made to the members of the institution generally by Mr. Prescott on behalf of the council of the institution, and it was resolved: "That in the opinion of this meeting the members of the Metropolitan District should be urged to give the Mutual Defence Fund their cordial support, and that the district secretary address a communication to all members of the district to this effect, and expressing the hope that each and every one would tender a favourable reply to the proposition." It was further resolved: "That in the event of the first appeal not being successful, it was to be followed up by a second communication."

Meetings of Council.

The district secretary read a communication received from the North-Eastern District, dated March 12, 1913, and after discussion it was proposed by Mr. Dodd (Wandsworth) and seconded by Mr. Killick (Finsbury), and resolved: "That in the opinion of this meeting the question as to the place of meeting of the council of the institution is one for the members of the council to determine, and not one upon which a district meeting should express any decision."

A vote of thanks having been accorded the chairman, the meeting terminated.

SOUTH-WESTERN DISTRICT MEETING.

A meeting of the South-Western District of the Institution of Municipal and County Engineers was held at the Guildhall, Exeter, on Saturday, April 5th. Those present were Messrs. H. T. Chapman, chairman of the district (in the chair), W. P. Robinson, Albert S. Brookes, R. Stephens, Francis Parr, D. Edwards, J. Siddalls, S. Hutton, C. O. Baines, S. F. C. Churchward, R. F. Rogers, Reg. J. Hake and Thos. Moulding (hon. district secretary).

The Chairman explained that the meeting had been called for the purpose of deciding upon the names of the members to be nominated for district chairman, representative, and hon. secretary, but that, unfortunately, the nomination papers had to be sent in to the secretary of the institution the previous Thursday.

After some discussion, however, it was proposed by Mr. Moulding, seconded by Mr. Brookes, that the following names be supported for the positions when the voting papers were sent round: District chairman, Mr. H. T. Chapman; district representative, Mr. T. Moulding; district secretary, Mr. D. Edwards. It was also resolved that the members of the institution in the South-Western District not present should be informed of the resolution.

Orphan and Mutual Defence Funds.

The Chairman stated that he had been requested to mention the Orphan Fund to the members of the district with a view of increasing the numbers of subscribers to the fund from the South-Western District. After some discussion, it was understood that the members present would endeavour to help the fund in the future more than in the past.

The District Secretary read a letter from the secretary of the institution with reference to the formation of a Mutual Defence Fund. After some discussion it was resolved: "That this meeting is of opinion that such a fund would be advantageous to the members in general, and that it would be desirable that all members of the institution should subscribe to such a fund."

Mr. Siddalls mentioned that he was trying to arrange a meeting of the institution at Tiverton in September.

Mr. Brookes offered to prepare a paper for discussion if arrangements could be made for a meeting of the South-Western District to be held at Truro during the Bath and West Show Week.

Mr. Baines then brought up a matter for discussion in connection with the appointment of surveyors to local authorities. This was discussed at some length, but no resolution was come to in the matter.

The meeting then closed.

EASTERN DISTRICT.

District Chairman. Mr. Alfred Fidler, M.Inst.C.E., Northampton.

An Eastern District meeting is to be held at the Building Trades Exhibition, Olympia, to-morrow (Saturday), immediately after the conference of engineers which is being held—probably at about 4.30 p.m.

Business.—To consider the formation of the Mutual Defence Fund. Any other business of interest introduced by the members.

GERRARD'S CROSS MEETING.

A meeting of the institution will be held in the Eastern District at the Assembly Rooms, Oak End Way, Gerrard's Cross, on Saturday, April 26th.

Programme.

11.15 a.m.—Reception by Dr. J. H. Waters, chairman of the Sanitary Committee of the Eton Rural District Council.

11.30 a.m.—District business.

11.40 a.m.—Discussion on paper to be read by Mr. A. Gladwell, engineer and surveyor to the Eton Rural District Council, descriptive of the new sewerage and sewage disposal works at Gerrard's Cross.

12.15 p.m.—Proceed by motor omnibus (tickets 2s. 6d. each) to the Gerrard's Cross sewage outfall and purification works, which will be formally opened by Colonel the Hon. W. Le Poer Trench, C.V.O., R.E.

1.15 p.m.—Return to Gerrard's Cross for lunch (tickets 2s. 6d. each) at the schoolroom, Gerrard's Cross Common.

2.30 p.m. — Drive to Beaconsfield and Burnham Beeches.

5 p.m.—Tea at Burnham Beeches, by invitation of Mr. A. Gladwell.

6 p.m.—Return to Gerrard's Cross or Slough, as may be more convenient (a party will be made up for each place on returning).

NOTICES.

In order that the necessary arrangements may be made, members must give notice of their intention to be present not later than Monday, April 21st, when copy of the paper will be sent in due course.

E. J. ELFORD, M.INST.C.E.,
Hon. District Secretary.

Borough Surveyor,
Southend-on-Sea.

NEWCASTLE-UPON-TYNE MEETING.

District Chairman—Mr. FRANK MASSIE, M.INST.C.E., Wakefield (Rural).

A meeting of the institution is to be held in the North-Eastern District at Newcastle-upon-Tyne on Friday and Saturday, May 2nd and 3rd.

PROGRAMME.

Friday.

9.50 a.m.—Assemble in the council chamber, town hall.

10 a.m. Reception by the Right Honourable the Lord Mayor and the Sheriff.
District business.
Paper by Mr. W. J. Steele, M.INST.C.E., city engineer, "Notes on Municipal Works in Newcastle-upon-Tyne."
Paper by Mr. Hubert Laws, "Newcastle Quayside Extensions."
Discussion on papers (which will be taken as read).

12.15 p.m.—Luncheon at the kind invitation of the Right Honourable the Lord Mayor.

2.15 p.m.—Cruise down the river Tyne on the steamer "Sir W. H. Stephenson," kindly placed at the disposal of the institution by the River Tyne Commissioners. Tea will be provided on board. The members will be landed at the North Pier, Tynemouth, at about 5 p.m., and return by train to Newcastle at their leisure. The electric train service between Tynemouth or Whitley Bay is every fifteen minutes. The coast and beach at Tynemouth and Whitley Bay are interesting, and well worth a visit.

Saturday.

10 a.m.—Paper by Mr. F. I. Morgan, ASSOC.M.INST.C.E., "Ouseburn Valley Works, Newcastle-upon-Tyne."
Paper by Mr. J. McKellar, "Newcastle-upon-Tyne Tramway Extensions."
Discussion on papers (which will be taken as read).

2 p.m.—Leave town hall and visit—
Quayside,
Ouseburn Valley Works,
Benton Bank Bridge widening and tramway,
Jesmond Dene.

4.45 p.m.—Banqueting hall, Jesmond Dene, kindly lent by the Town Moor and Parks Committee of the City Council, where tea will be provided.

J. P. WAKEFORD, ASSOC.M.INST.C.E.,
Hon. District Secretary.

Town Hall, Wakefield.

SCOTTISH MEETING.

A meeting of the institution will be held in the Scottish District at Dundee on June 6th and 7th.

ANNUAL MEETING.

The annual meeting of the institution will be held from July 16th-19th.

THOMAS COLE,
92 Victoria-street, S.W. *Secretary.*

INSTITUTION OF MUNICIPAL ENGINEERS.

President—Mr. FRANK LATHAM, M.INST.C.E.I., F.S.E., Borough Engineer and Surveyor, Penzance.

VISIT TO OLYMPIA.

An informal meeting of the members of the Institution of Municipal Engineers, followed by a round of visits to the various exhibits, took place on Saturday at Olympia. A large number of members (including Messrs. E. A. Stickland, past-president, H. C. Adams, vice-president, H. Boot, vice-president), and friends attended, and were afterwards entertained to tea by Mr. H. Greville Montgomery, the managing director of the exhibition.

SOUTHERN AND SOUTH-EASTERN DISTRICTS.

A visit will be paid to the Portland cement works of Messrs. Martin, Earle & Co., Limited, Wickham, Rochester, on Saturday, April 26th.

PROGRAMME.

9.20 a.m.—Train leaves Cannon-street station for Strood.

10.33 a.m.—Arrive Strood station, where chars-à-banc will be in waiting to take members to the works.

10.45 a.m.—Assemble at works.

12 noon.—Leave works and return to Rochester.

12.15 p.m.—Assemble at Rochester Bridge and inspect, by courtesy of Mr. David Anderson, the resident engineer, the works of reconstruction. The existing structure is being used as a staging on which to build the new steel bridge, one longitudinal half being dealt with at a time so as to maintain the traffic. After the two halves of the new work have been completed and united the existing cast-iron arches will be removed in sections by lowering them down into barges beneath.

ARTHUR PALMER,
J. W. BROOK,
Hon. District Secretaries.

The following council meetings have been arranged: April 30th, London; May 31st, Manchester; June 28th, London; July 30th, London.

B. WYAND,
39 Victoria-street, S.W. *Secretary.*

INSTITUTION OF WATER ENGINEERS.

At the council meeting of the Institution of Water Engineers, held on Friday, March 14th, the following candidates were elected:—

As Members—Messrs. B. Mackenzie, works manager, Hayfield reservoir, Stockport Corporation; G. S. Morgan, consulting water engineer, Pontypridd; J. Parker, corporation water engineer, Hereford; H. P. Raikes, consulting water engineer, Birmingham, and J. E. Willcox, consulting water engineer, Birmingham.

As Associate-Members—Messrs. A. G. Beaumont, resident engineer, Leighton reservoir, Leeds Corporation; W. F. Bickford, engineer, Camborne Water Company; B. M. Lal, assistant engineer, Llwyn-On reservoir, Cardiff Corporation; E. C. Lemon, assistant to water engineer, Wakefield Corporation; T. Shand, assistant engineer, Kinder reservoir, Stockport Corporation, and R. V. Toms, assistant to water engineer, Torquay Corporation.

As Associates—Messrs. R. S. Hankinson, director of water company, Southampton; W. Paterson, patentee and manufacturer of filters, and L. Richardson, inspector of technical education, Gloucestershire.

Transferred from Associate-Member to Member—Messrs. H. W. B. Cotterill, resident engineer, Llwyn-On reservoir, Cardiff, and N. J. Peters, deputy waterworks engineer, Cardiff Corporation.

APPOINTMENTS VACANT.

Official and similar advertisements received up to 4.30 p.m. on Thursdays will be inserted in the following day's issue, *but those responsible for their despatch are recommended to arrange that they shall reach* The Surveyor *office by noon on* **Wednesdays** *to ensure their inclusion in the weekly list of summaries. Such advertisements may, in cases of emergency only, be telephoned (No. 1359 Holborn), subject to later confirmation by letter.*

CHIEF ENGINEERING ASSISTANT.—April 19th.—Corporation of Northampton. £193—£225.—Mr. Alfred Fidler, borough engineer and surveyor.

CHIEF ENGINEERING ASSISTANT.—April 21st.—Corporation of Coventry. £200 per annum.—Mr. J. E. Swindlehurst, city engineer and surveyor.

CITY ENGINEER AND SURVEYOR.—April 21st.—Corporation of St. Albans. £300 per annum.—Mr. E. R. Debenham, town clerk.

FOREMAN.—April 21st.—Corporation of Barrow-in-Furness.—Borough Engineer and Surveyor.

ENGINEERING ASSISTANTS (3).—April 21st.—Corporation of Halifax. £120, £100 and £90 per annum.—Mr. Percy Saunders, town clerk.

SEWAGE FARM ATTENDANT.—April 23rd.—Blaby Rural District Council. 30s. per week.—Mr. B. A. Shires, clerk.

INSPECTOR OF NUISANCES.—April 24th.—Keswick Urban District Council. £80 per annum.—Mr. J. Broatch, clerk.

SURVEYOR.—April 24th.—Hereford Rural District Council. £130 per annum.—Mr. R. Moore, clerk, St. John-street, Hereford.

OUTDOOR FOREMAN.—April 24th.—Corporation of Macclesfield. £2—£2 10s. per week.—Mr. S. C. Baggott, borough surveyor.

JUNIOR SURVEYING ASSISTANT.—April 25th.—South of England county surveyor's office. £100—£130.—The Surveyor, 24 Bride-lane, Fleet-street, London, E.C.

INSPECTOR AND SURVEYOR.—April 25th.—Porthcawl Urban District Council. £140 per annum.—Mr. W. Chorley, clerk.

ENGINEERING ASSISTANT.—April 25th.—Municipality of Port Elizabeth (South Africa). £20 per month.—Messrs. Davis & Soper, agents, 54 St. Mary-axe, London, E.C.

CHIEF ASSISTANT TO BOROUGH SURVEYOR.—April 26th.—Corporation of Darlington. £230—£250.—Mr. H. G. Stevenson, town clerk.

INSPECTOR OF NUISANCES.—April 26th.—Corporation of Bradford. £90 per annum.—Mr. F. Stevens, town clerk.

JUNIOR ASSISTANT TO BOROUGH SURVEYOR.—April 26th.—Corporation of Darlington. £90—£110.—Mr. H. G. Stevenson, town clerk.

ENGINEERING ASSISTANT.—April 26th.—Corporation of Birkenhead. £100—£110 per annum.—Mr. C. Brownridge, borough engineer and surveyor.

INSPECTOR OF NUISANCES.—April 28th.—Corporation of Wolverhampton. £100 per annum.—Mr. H. Brevitt, town clerk.

TEMPORARY ASSISTANTS (2).—April 28th.—Devon County Council. £3 3s. and £2 2s. per week.—Mr. Edward Stead, county surveyor, No. 1 Division.

INSPECTOR OF NUISANCES.—April 29th.—Ryton Urban District Council. £100—£150.—Mr. H. Dalton, clerk.

WORKING FOREMAN.—April 30th.—Tavistock Urban District Council.—Mr. E. Warran, clerk.

ASSISTANT ENGINEERS.—May 1st.—Indian Public Works and State Railway Departments.—Secretary, Public Works Department, India Office, London, S.W.

SURVEYOR, INSPECTOR AND COLLECTOR.—May 2nd.—Buckfastleigh Urban District Council. £150 per annum.—Mr. Edward Windeatt, clerk.

ASSISTANT ENGINEER.—May 15th.—Board of Trustees for the Improvement of Calcutta. 500—700 rupees per mensem.—Mr. C. H. Bompas, chairman, 5 Clive-street, Calcutta.

CLERKS OF WORKS (4).—Rivers Committee of the Corporation of Manchester. £3 3s. per week.—Mr. Thomas Hudson, town clerk.

ASSISTANT ENGINEER.—Public Works Department of the Gold Coast. £300—£350.—Crown Agents for the Colonies, 4 Whitehall-gardens, London, S.W.

GENERAL ASSISTANT.—Corporation of Boston, Lincs. £110 per annum.—Mr. G. E. Clarke, borough engineer and surveyor.

MUNICIPAL COMPETITIONS OPEN.

Official and similar advertisements received up to 4.30 p.m. on Thursdays will be inserted in the following day's issue, *but those responsible for their despatch are recommended to arrange that they shall reach* The Surveyor *office by noon on* **Wednesdays** *to ensure their inclusion in the weekly list of summaries. Such advertisements may, in cases of emergency only, be telephoned (No. 1359 Holborn), subject to later confirmation by letter.*

NORTHAMPTON.—April 21st.—Designs for a school. Limited to local architects. Premiums, 20 and 10 guineas.—The Clerk, The Education Committee.

BARNET.—April 29th.—Designs for new municipal offices, for the urban district council. Premiums £25, £15, £10.—The Clerk

BLACKBURN.—June 2nd.—Schemes for the improvement of the streets in the centre of the town.—Mr. J. L. Beard, town clerk.

EXETER.—June 7th.—Designs for a hostel for male students, for the corporation. Assessor, Mr. Edwin Cooper, F.R.I.B.A.—The Town Clerk.

DEVONPORT.—June 14th.—Designs for municipal buildings and a guildhall, for the Corporation of Devonport. Premiums of £350, £150, and £100 are offered. The assessor is Mr. Ernest Newton, A.R.A., F.R.I.B.A.—Mr. R. J. Fittall, town clerk.

NEWCASTLE-ON-TYNE.—June 14th.—Designs for proposed public baths, for the corporation. Mr. H. W. Wills, F.R.I.B.A., has been appointed as assessor.—Mr. A. M. Oliver, town clerk.

NEWCASTLE-ON-TYNE.—June 19th.—Designs for laying out portion of the Walker estate, for the corporation. Premiums £50, £30, and £20.—Mr. A. M. Oliver, town clerk.

CHEPPING WYCOMBE.—September 1st.—Designs for town-planning the borough and an area immediately adjoining. Premiums, £25, £10 and £5.—Mr. T. J. Rushbrooke, borough surveyor, High Wycombe.

MUNICIPAL CONTRACTS OPEN.

Official and similar advertisements received up to 4.30 p.m. on Thursdays will be inserted in the following day's issue, *but those responsible for their despatch are recommended to arrange that they shall reach* The Surveyor *office by noon on* **Wednesdays** *to ensure their inclusion in the weekly list of summaries. Such advertisements may, in cases of emergency only, be telephoned (No. 1359 Holborn), subject to later confirmation by letter.*

Buildings.

PORTSMOUTH.—April 21st.—For building an isolation hospital, for the Committee of Visitors.—Mr. S. B. Jones, architect, 21 Hampshire-terrace, Portsmouth.

SOMERSET.—April 21st.—For the partial rebuilding of a bridge, for the county council.—Mr. H. T. Chapman, county surveyor, Wells.

WILTS.—April 21st.—For the reconstruction of Bulford Bridge, for the county council.—Mr. J. George Powell, county surveyor, Trowbridge.

BARKING.—April 22nd.—For the erection of six cottages, for the urban district council.—Mr. C. J. Dawson, architect, Clock House Chambers, Barking.

CROYDON.—April 22nd.—For additions and alterations to offices, for the corporation.—Mr. F. C. Lloyd, town clerk.

DUNDEE.—April 23rd.—For the reconstruction of a school, for the School Board.—Mr. J. E. Williams, clerk.

LAMBETH.—April 24th.—For the erection of a pavilion, for the borough council.—Mr. B. Penny, town clerk.

GLASGOW.—April 24th.—For supplying and erecting ironwork and galvanised corrugated sheeting, windows and doors at refuse destructor works, for the corporation.—Mr. J. Lindsay, town clerk.

PENZANCE.—April 24th.—For deepening the entrance to the Penzance harbour and dock, for the corporation.—Mr. T. H. Cornish, town clerk.

PORTSMOUTH.—April 24th.—For erecting gas-testing stations, for the corporation.—Borough Engineer.

LANCASHIRE.—April 24th.—For the erection of an elementary school, for the Education Committee.—Mr. H. Littler, county architect, 16 Ribblesdale-place, Preston.

WEST RIDING.—April 25th.—For the erection of a new school, for the Education Committee.—The Clerk, County Hall, Wakefield.

DURHAM.—April 25th.—For the erection of a police station, for the county council.—County Surveyor, Shire Hall, Durham.

MACCLESFIELD.—April 26.—For the erection of a filter house, for the corporation.—Mr. F. R. Oldfield, town clerk.

SPENNYMOOR.—April 26th.—For the erection of public hall and offices, for the urban district council.—Mr. G. T. Wellburn, 115 Albert-road, Middlesbrough.

BEVERLEY.—April 28th.—For the erection of an infants' school, for the corporation.—Mr. J. Willis Mills, town clerk.

WALSALL.—April 29th.—For the erection of a boiler house, for the Electricity Committee.—Borough Electrical Engineer, Wolverhampton-street.

LONDON.—April 29th.—For structural alterations at the Battersea pumping station, for the county council.—Mr. G. W. Humphreys, engineer, County Hall, Spring-gardens, S.W.

WOOD GREEN.—April 30th.—For the erection of a central fire station, for the urban district council.—Mr. W. P. Harding, clerk.

LYNN.—April 30th.—For extensions to the electricity station, for the corporation.—Mr. A. J. Smith, borough surveyor.

CAMBRIDGE.—April 30th.—For the erection of additions to the Guildhall, for the corporation.—Mr. J. E. L. Whitehead, town clerk.

Iron and Steel.

BURRY PORT.—April 21st.—For laying water mains, for the urban district council.—Mr. A. J. Oborn, Somerset House, Burry Port, Carmarthenshire.

NORTHMOOR.—April 22nd.—For supplying and fixing two wrought-iron Lancashire boilers, for the Drainage Board.—Mr. George Lovibond, clerk, Bridgwater.

EXMOUTH.—April 26th.—For the supply of cast-iron water mains, 9-in., 6-in., 4-in. and 3-in. diameter, supply of valves, valve hydrants and other fittings, and for the necessary labour and materials required in laying 9-in. and 6-in. mains and fixing valves, for the urban district council.—Mr. Samuel Hutton, engineer.

YORK.—April 26th.—For the supply of iron and steel work required during the ensuing year, for the corporation.—Mr. F. W. Spurr, city engineer.

CHIRBURY.—April 29th.—For the supply of cast-iron pipes and specials, laying and jointing water pipes, and construction of tanks and filters, for the rural district council.—Mr. Charles S. Pryce, clerk.

Roads.

BEXHILL.—April 19th.—For making up a certain road, for the corporation.—Mr. G. Ball, borough surveyor.

WESTHAMPNETT.—April 19th.—For the supply of Guernsey granite, for the rural district council.—Mr. W. D. Rasell, clerk, 5 South-street, Chichester.

REIGATE.—April 21st.—For making up a portion of Station-road, Redhill, for the corporation.—Mr. Alfred Smith, town clerk.

MAIDENHEAD.—April 21st.—For laying 40,000 yds. of tarred footway, for the corporation.—Mr. H. E. Davies, town clerk.

BROADSTAIRS.—April 21st.—For the supply of Guernsey granite chippings, for the urban district council.—Mr. H. Hurd, surveyor.

SKIPTON.—April 21st.—For making up certain streets, for the urban district council.—Mr. Richard Wilson, clerk.

AIRDRIE.—April 21st.—For the supply of kerb and channel work, granolithic paving and carting, for the town council.—Mr. H. Inglis, burgh surveyor.

BURGESS HILL.—April 22nd.—For the supply of broken granite and fine granite, for the urban district council.—The Surveyor.

MOUNTAIN ASH.—April 22nd.—For carrying out private street works, for the urban district council.—The Surveyor.

WHEATLEY.—April 22nd.—For carrying out private street works, for the urban district council.—Mr. J. Simmons, surveyor, 10 High-street, Doncaster.

MACCLESFIELD.—April 22nd.—For making up a street, for the corporation.—Mr. S. C. Baggott, borough engineer.

AUDENSHAW.—April 22nd.—For work of road construction.—Mr. F. Hamer, clerk.

SCUNTHORPE.—April 22nd.—For the supply of broken granite and chippings, for the urban district council.—Mr. C. Curtis Gray, engineer and surveyor.

ENFIELD.—April 23rd.—For providing and laying about 4,300 yds. of artificial stone paving, for the urban district council.—Mr. T. W. Scott, clerk.

WALLASEY.—April 23rd.—For the supply of 400,000 creosoted wood-paving blocks, for the corporation.—Mr. W. H. Travers, borough engineer and surveyor.

FULHAM.—April 23rd.—For making up the carriageway of a street, for the borough council.—Mr. F. Wood, borough surveyor.

CARSHALTON.—April 23rd.—For treating 80,000 yards super. of road with bituminous dust-preventing material, for the urban district council.—Mr. C. P. Lovelock, clerk.

ELY.—April 23rd.—For the supply of coarse clunch and coarse-screened gravel, for the rural district council.—Mr. F. W. Firby, district surveyor, Sutton, Isle of Ely.

MIDDLESBROUGH.—April 23rd.—For making up certain streets, for the corporation.—Mr. S. E. Burgess, borough engineer.

ROCHDALE.—April 23rd.—For work of making up, for the corporation.—Borough Surveyor.

WEST RIDING.—April 23rd.—For work of excavating, rubble pitching and macadamising, for the Highways Committee.—Mr. F. G. Carpenter, West Riding Surveyor, County Hall, Wakefield.

EAST SUFFOLK.—April 24th.—For the supply of granite, flints, local gravel, sand, grit, tools, road implements, cartage and team labour, for the county council.—Mr. A. Townshend Cobbold, clerk.

STOCKPORT.—April 24th.—For making up certain streets, for the corporation.—Mr. J. Atkinson, borough surveyor.

GLOUCESTER.—April 24th.—For the supply of stone and for hauling, for the rural district council.—Mr. F. E. Weaver, district surveyor, Berkeley House, Berkeley-street.

ISLE OF THANET.—April 24th.—For the supply of 2,081 yds. of broken flints and 1,815 tons of broken granite, for the rural district council.—Mr. Charles Taylor, clerk.

RHONDDA.—April 25th.—For making up a certain road, for the urban district council.—Mr. W. J. Jones, surveyor.

ALTON.—April 25th.—For the supply of flints and team labour, for the rural district council.—Mr. A. F. M. Downie, clerk.

ROMFORD.—April 25th.—For the supply of 11,500 gallons of Tarvia, or other similar material, for the urban district council.—The Surveyor.

MERTON AND MORDEN.—April 25th.—For road-making and sewering works, for the urban district council.—Mr. G. Jerram, surveyor.

PETWORTH.—April 26th.—For the supply and carting of materials, for the rural district council.—The Surveyor, Fox-hill, Petworth.

SOMERSET.—April 26th.—For the deviation of a road, for the county council.—County Surveyor, Wells.

GRANTOWN-ON-SPEY.—April 26th.—For forming kerbs and footpaths, for the corporation.—Mr. W. Forsyth, town clerk.

WANDSWORTH.—April 28th.—For making up and paving part of Cavendish-road, Clapham South, for the borough council.—Mr. D. A. Nicholl, town clerk.

DURHAM.—April 28th.—For making up certain streets, for the corporation.—Mr. John T. Pegge, city surveyor.

TIVERTON.—April 28th.—For tar-spraying 40,000 super. yards during the coming season, for the corporation.—Mr. J. Siddals, borough surveyor.

LEWISHAM.—April 29th.—For street works, for the borough council.—Borough Surveyor.

GLANFORD BRIGG.—April 29th.—For the supply of two 10-ton steam rollers, for the rural district council.—Mr. F. C. Hett, clerk.

GATESHEAD.—April 29th.—For carrying out cement path work, for the corporation.—Mr. W. Swinburne, town clerk.

MIDDLETON.—April 29th.—For re-surfacing a street with tar-macadam, Rocmac, Pitchmac, or other bituminous materials, for the corporation.—Mr. W. Welburn, borough surveyor.

SHOREHAM.—April 29th. For the supply of granite quartzite or Elvan stone, for the urban district council.—Mr. Harold Brown, clerk.

NEW SARUM. April 30th. For the execution of street work, for the corporation. -Mr. W. J. Goodwin, city engineer and surveyor.

WIDNES. April 30th. For making up certain streets, for the corporation. Mr. H. S. Oppenheim, town clerk.

STAMFORD. April 30th. For the supply of broken granite, for the corporation. Mr. F. R. Ryman, borough surveyor.

SALISBURY. April 30th. For the execution of private street works, for the corporation.—Mr. W. J. Goodwin, city engineer and surveyor.

EAST DEREHAM. May 3rd.—For the supply of broken granite and granite chippings, for the urban district council.—Mr. F. L. Burch, surveyor.

ECKFIELD. May 6th.—For the supply of quartzite or Penmaenmawr granite, flints and gravel, for the urban district council.—Mr. Charles Dawson, clerk.

Sanitary.

BARNSTAPLE. April 19th. -For the execution of drainage work, for the corporation.—Mr. E. V. Saunders, borough surveyor.

WALLASEY.—April 19th. -For the erection of a public convenience, for the corporation.—Mr. W. H. Travers, borough engineer and surveyor.

TROWBRIDGE.—April 19th.—For the conversion of primary and secondary contact beds to percolating filters, including the erection of sewage distributing machinery also the construction of humus tanks, sludge-water and sludge drains, manholes, chambers and other work, for the urban district council. Mr. H. G. Nicholson-Lailey, engineer.

WESTHAMPNETT. April 21st. For the removal of refuse, for the rural district council.—Mr. W. D. Rosell, clerk, 5 South-street, Chichester.

HEBDEN BRIDGE.—April 21st. -For work of laying new sewers, for the urban district council. -Mr. F. Waddington, engineer and surveyor.

WARE. -April 21st. -For laying cast-iron sewer and constructing manhole, for the rural district council Mr. H. J. Jackson, surveyor, Rye-road, Hoddesdon.

EASTLEIGH AND BISHOPSTOKE.—April 23rd. -For laying storm water sewers, for the urban district council. Mr. W. Wallace Gandy, surveyor.

WATFORD.—April 23rd. For the construction of a cast-iron sewer and manholes, for the urban district council. -Mr. W. Hudson, clerk.

ST. MELLONS. April 23rd.—For the completion of the sewerage scheme for the drainage area of Rumney, consisting of storage sewer, screening chamber, pumping station, pumps, engines, cast-iron rising main, and about 2¼ miles of 6-in. and 9-in. stoneware and cast-iron pipe sewers, for the rural district council. Mr. A. H. Rees, clerk.

DAVENTRY. April 23rd. For the construction of sewers, sedimentation and storm-water tanks, percolating filter beds, pumping machinery, manholes and other works, for the rural district council. Mr. J. D. Spearing, clerk.

BILSTON. April 24th. For the construction of about 600 yd. of pipe sewers and manholes in various streets, for the urban district council. Mr. Vincent Turner, engineer and surveyor.

GATESHEAD. April 26th.—For the supply of disinfectants, for the corporation. Mr. W. Swinburne, town clerk.

HINCKLEY. April 29th. For laying outfall sewer and manholes, for the urban district council. Mr. E. H. Crump, engineer and surveyor.

HEPTON. April 30th. For the construction of 9-in. stoneware and cast-iron sewers, with manholes and accessories, also the erection of engine house, screening chamber, pump well tanks, filters, sludge lagoons, the supply and fixing of engines and pumps, and other works, for the rural district council.- Mr. C. F. Chamberlin, clerk.

BURNLEY.—May 3rd.—For laying earthenware pipe sewers, manholes, concrete tanks and percolating filters, for the rural district council.- Mr. H. Pritchard, engineer, 1st Nicholas-street, Burnley.

BUNCORN.—May 5th.—For laying stoneware and cast-iron pipe sewers, and supplying pipes and specials, for the rural district council. —Mr. George F. Ashton, clerk.

STROUD. -May 6th. For the construction of sewage disposal works, for the urban district council. —Mr. G. P. Milnes, 7 Roweroft, Stroud.

NORTH BROMSGROVE.—May 6th.—For the construction of about 2,477 lin. yds. of 6-in. diameter stoneware pipe sewers, with manholes, flushing chambers and ventilating columns, for the urban district council.—Mr. Robert Green, engineer, 37 Waterloo-street, Birmingham.

EPSOM. May 6th.—For the construction of engine house, bacteria beds, storm-water tanks, and other works, for the rural district council.—Mr. Arthur R. Cotton, clerk.

STALYBRIDGE AND DUKINFIELD. -May 7th. For the supply and erection of No. 5 rotary sewage sprinklers, with all necessary pipes and fittings, for the Joint Sewerage Board.—Messrs. J. P. Wilkinson & Son, 301 Cathedral-street, Manchester.

Stores.

TROWBRIDGE. April 21st. For the supply of steam rolling, hauling, team labour, coal, ironmongery and brushes, for the urban district council. —Mr. H. G. Nicholson-Lailey, surveyor.

GLASGOW.—April 22nd.—For the supply of materials, for the gas department.—Mr. A. Wilson, gas manager, 45 John-street.

MIDLOTHIAN. May 1st.—For the supply of tools, ironmongery, brushes, oils, paints, rubber goods, explosives, bricks, pipes, cement, coals, and fencing materials, for the county council.—Mr. A. G. G. Asher, county clerk, County Buildings, Edinburgh.

SOUTH SHIELDS.—May 1st.—For the supply of materials for the tramway department, for the corporation.—Mr. J. Moore Hayton, town clerk.

RICHMOND (Surrey).—May 12th.—For the supply of coal, lime, sulphate of alumina and green copperas and filter cloth, for the Main Sewerage Board.—Mr. W. Fairlie, engineer, West Hall-road, Kew Gardens.

Miscellaneous.

MANCHESTER. April 21st.—For painting iron bridges, for the corporation.—Mr. Thomas Hudson, town clerk.

WEST HAM. April 24th.—For painting, cleansing and repairs to public buildings, for the corporation. -Mr. Fred. E. Hilleary, town clerk.

GRIMSBY.—April 30th.—For culverting 990 lin. yds. of open stream in (1) brickwork, (2) reinforced concrete or (3) concrete tubes, for the corporation.—Mr. H. Gilbert Whyatt, borough engineer and surveyor.

CONWAY. May 3rd.—For cleaning, scraping and painting the suspension bridge, for the corporation. Mr. Hugh Parry, town clerk.

TENDERS FOR MUNICIPAL WORKS OR SUPPLIES.

The Editor invites the co-operation of Surveyor *readers with a view to making the information given under this head as complete and accurate as possible.*

* Accepted. † Recommended for acceptance.

BEXHILL-ON-SEA.—For the supply of imperial blue quartzite macadam, for the corporation.—Mr. G. Ball, borough surveyor:—

	Per ton. s.	d.
H. L. Cooper & Co., Mark-lane, E.C.	16	2
A. & F. Manuelle, Gracechurch-street, E.C.	16	0
Penlee and St. Ives Stone Quarries, Limited, Queen-square, Bristol	15	9
Enderby and Stoney Stanton Granite Company, Limited, Narborough, Leicester	15	6
Brookes, Limited, Caxton House, S.W.	15	4
Hudsons, Limited, Terminus Gates, Brighton	15	0
British Macadams, Limited, Cannon-street, E.C.	14	9
Road Maintenance and Stone Supply Company, Limited, Cannon-street, E.C.*	14	11

DORCHESTER.—For extensions to surface-water drainage, for the corporation.—Mr. H. D. Strange, borough surveyor:—

Saunders & Co., Bournemouth, £278.

DRIFFIELD.—Accepted for the supply of road material for the year ending March 31, 1914.—Mr. T. Cassop Beaumont, surveyor:—

Machine Broken Whinstone.—Ord & Maddison, Limited, Darlington; R. Summerson & Co., Limited, Cockfield, R.S.O., co. Durham; J. F. Shackleton & Son, Goole; Cradock, Allison & Co., Limited, Eaglescliffe, R.S.O., co. Durham; Hanson, Brown & Co., Limited, Middlesbrough.

Unbroken Whinstone.—G. & W. Schofield, Grosmont, Yorks.

Belgium Granite.—Sommerfeld & Mead, Limited, Hull.

Broken Slag.—Gladstone & Co., Grosmont, Yorks; W. Schofield & Son, Grosmont, Yorks; Sir B. Samuelson & Co., Limited, Middlesbrough; Clokes Extension, Limited, Leeds.

Tarred Chippings.—Cradock, Allison & Co., Limited, Eaglescliffe, R.S.O., co. Durham.

CANNOCK.—The tender of Mr. J. Owen, of Wolverhampton, has been accepted for making up certain streets—viz.:—
Booth-street, Hednesford, £120.
Ebenezer-street, £167.
Florence-street, £200.
Queen-street, £173.
Stonefield-road, £209.
Market Hall-street, Cannock, £79.
George-street, Hednesford, £378.

EAST GRINSTEAD.—Accepted for the supply of road materials, for the urban district council.—Mr. W. E. Woollam, surveyor:—
Quenast Granite.—London Granite Company, Water-lane, E.C.
Tar-Macadam.—Tarred Granites, Limited, Water-lane, E.C.
Granite Screenings.—London Granite Company, Water-lane, E.C.
Flints.—Hillman, North-street, Portslade.
Ragstone.—Hudsons, Limited, Terminus Gates, Brighton.
Brick Rubble.—Hall & Co., London-road, East Grinstead.
Steam Rolling.—Fosters, Limited, Chequer-road, East Grinstead.

GOSFORTH.—For road widening, for the urban district council.—Mr. G. Nelson, engineer and surveyor:—

T. G. Usher & Co., Newcastle-on-Tyne	£173
G. E. Simpson, Newcastle-on-Tyne	140
W. C. Flech, Gosforth	137
E. Weatherley, Newcastle-on-Tyne	125
W. Robson, Newcastle-on-Tyne	116
W. Tulip, Gosforth	112
J. W. Henderson, Gosforth	109

HARWICH.—For making up two roads, for the corporation.—Mr. F. H. French, borough surveyor:—

ST. GEORGE'S-AVENUE.

Z. Fairclough, Clacton-on-Sea	£592
James & Ling, Dovercourt	545
E. E. Newton, Harwich	534
Fisher & Woods, Elmhurst-road, Dovercourt	525

Borough surveyor's estimate, £553.

ELMHURST-ROAD AND WESTERN END OF LEE-ROAD.

Z. Fairclough, Clacton-on-Sea	£1,030
James & Ling, Dovercourt	986
E. E. Newton, Harwich	951
Fisher & Woods, Dovercourt	926

Borough surveyor's estimate, £965.

NEWMARKET.—Accepted for the supply of Leicester-hire granite, Tarvia granite chips, granite chips and slag chips, for the urban district council.—Mr. W. H. Eley, surveyor:—
1½-in. and 2-in.—2½-in. Granite.—Whitwick Granite Company, Limited, Whitwick, near Leicester (part); Croft Granite Company, Limited, Croft (part).
Granite Chips and Tarviated Chips.—Whitwick Granite Company, Limited, Whitwick, near Leicester.
Slag Chips.—Lavender & Bateman, Sutton Bridge, Lincs.

PONTYPRIDD.—For executing private street works, for the urban district council:—

NIAGARA-STREET.

G. L. Morgan, Lanwood, Pontypridd	£245
D. Russell, Wood-road, Pontypridd	228
A. J. Collins, Cadoxton, Barry	219
H. Murray, The Common, Pontypridd	217
W. J. Davies, Hopkinstown, Pontypridd	205

Surveyor's estimate, £225.

ALEXANDRA-ROAD.

G. L. Morgan, Lanwood, Pontypridd	£361
D. Russell, Wood-road, Pontypridd	327
A. J. Collins, Cadoxton, Barry	313
H. Murray, The Common, Pontypridd	307
W. J. Davies, Hopkinstown, Pontypridd	288

Surveyor's estimate, £319.

TYFICA-CRESCENT.

G. L. Morgan, Lanwood, Pontypridd	£257
A. J. Collins, Cadoxton, Barry	241
H. Murray, The Common, Pontypridd	239
W. J. Davies, Hopkinstown, Pontypridd	232

Surveyor's estimate, £240.

LANELAY-CRESCENT.

E. Jones, Pwllgwaun, Pontypridd	£650
D. E. Rosser, Maesycoed, Pontypridd	670
G. L. Morgan, Lanwood, Pontypridd	622
A. J. Collins, Cadoxton, Barry	538
H. Murray, The Common, Pontypridd	500
W. J. Davies, Hopkinstown, Pontypridd	481

Surveyor's estimate, £551.

TURSTON-ROAD.

A. W. Julian, Bonvilston-road, Pontypridd	£1,744
G. L. Morgan, Lanwood, Pontypridd	1,539
A. J. Collins, Cadoxton, Barry	1,399
H. Murray, The Common, Pontypridd	1,378
W. J. Davies, Hopkinstown, Pontypridd	1,250

Surveyor's estimate, £1,367.

RALPH-STREET.

A. W. Julian, Bonvilston-road, Pontypridd	£640
G. L. Morgan, Lanwood, Pontypridd	591
A. J. Collins, Cadoxton, Barry	528
H. Murray, The Common, Pontypridd	521
W. J. Davies, Hopkinstown, Pontypridd	483

Surveyor's estimate, £530.

DOROTHY-STREET.

A. W. Julian, Bonvilston-road, Pontypridd	£418
G. L. Morgan, Lanwood, Pontypridd	388
H. Murray, The Common, Pontypridd	355
A. J. Collins, Cadoxton, Barry	348
W. J. Davies, Hopkinstown, Pontypridd	320

Surveyor's estimate, £347.

WANDSWORTH.—For making up and paving Genoa-avenue, Putney, for the borough council.—Mr. P. Dodd, borough engineer:—
Paving Genoa-avenue, Putney, with Aberdeen Adamant Paving.—E. Parry & Co., £1,015 and schedule prices for extras or omissions.
Executing Necessary Works of Repair in Welham-road, Streatham.—J. Mowlem & Co., Limited, £1,069 and 5 per cent above schedule prices for extras or omissions.

ROYSTON.—For works of sewerage and sewage disposal, for the urban district council.—Mr. T. W. Witts, engineer and surveyor:—

F. Hodson & Co., Nottingham	£2,300
A. Tompson, Finchley	2,261
S. Redhouse & Son, Stotfold, near Baldock	2,066
E. J. Bloomfield, Tottenham	1,996
T. W. Pedrette, Enfield	1,980
W. Wright, Chesham, Bucks	1,893
Simon, Johnson, Son & Marsh, Strand	1,845
Jacklin & Co., Royston	1,823
F. J. Bailey, Ashwell, near Baldock	1,690
C. Ball, Letchworth, Herts	1,630

Surveyor's estimate, £1,895.

SOUTH SHIELDS.—For the erection of a bowl house and shelter, for the corporation.—Mr. L. Roseveare, borough engineer:—
G. R. A. Lawes & Co., Marsden-street, South Shields.

MEETINGS.

Secretaries and others will oblige by sending early notice of dates of forthcoming meetings.

APRIL.

18.—Institution of Mechanical Engineers: Ordinary General Meeting. President's Address. 8 p.m.
19.—Association of Managers of Sewage Disposal Works: Meeting at Guildford.
19.—Institution of Municipal and County Engineers: Eastern District Meeting at Olympia.
19.—Municipal Engineers' Day" at Olympia.
21.—Institution of Civil Engineers (Students' Meeting): Mr. A. T. Walmisley, M.INST.C.E., lectures on "Production of Steel Sections and their Application in Engineering Structures."
21.—Institute of Sanitary Engineers: Mr. Frank R. Durham on "House Drainage on the Continent." 8 p.m.
21.—Royal Institute of British Architects: Messrs. F. W. Jackson and Bernard Dicksee, on "Modern Steel Construction." 8 p.m.
21.—Surveyors' Institution: Mr. R. G. G. Reed on "Site Value Deductions for Construction of Appropriation of Land for Roads." 8 p.m.
23.—Royal Sanitary Institute: Dr. C. W. Daniels on "Insect Carried Diseases and their Prevention" at Buckingham Palace-road. 5 p.m.
23.—Royal Sanitary Institute: Ordinary General Meeting. 4 p.m.
26.—Institution of Municipal and County Engineers: Meeting at Gerrards Cross.
26.—Institution of Municipal Engineers: Visit to Messrs. Martin, Earle & Co.'s Cement Works, Wrekham, Roochester.
28.—Quantity Surveyors' Association: Mr. A. Burnaby Howes, Barrister-at-Law, on "Trades Unionism for Professions." Caxton Hall, Westminster. 8 p.m.
30.—Institution of Civil Engineers: London Students' 38th Annual Dinner, Trocadero Restaurant. 7.45 p.m.

MAY.

2-3.—Institution of Municipal and County Engineers: Meeting at Newcastle-on-Tyne.
3.—Institution of Municipal and County Engineers: Bohemian Concert, Holborn Restaurant. 8 p.m.
3-11.—Institution of Municipal and County Engineers: Visit to Amsterdam and the Hague.
14-18.—Royal Institute of Public Health: Annual Congress in Paris.
19.—Institute of Sanitary Engineers: Dr. H. R. Kenwood on "Micro-Organisms and Public Health." 8 p.m.
21-24.—Institution of Electrical Engineers: Meeting in Paris.
23-24.—Surveyors' Institution: Meeting at Oxford.
24.—Association of Managers of Sewage Disposal Works: Meeting at Kettering.

JUNE.

1.—Royal Institute of British Architects: Annual Dinner, Whitehall Rooms.
6-7.—Institution of Municipal and County Engineers: Meeting at Dundee.
23-28.—International Road Congress in London.

APPOINTMENTS OPEN.

Official and similar advertisements received up to 4.30 p.m. on Thursdays will be inserted in the following day's issue, *but those responsible for these densities are requested to observe that they shall reach* THE SURVEYOR *office by noon on* **Wednesdays** *to ensure their inclusion in the weekly list of summaries. Such advertisements may, in cases of emergency only, be telephoned (No. 1353 Holborn), subject to later confirmation by letter.*

ASSISTANT ENGINEER required for the Public Works Department by the Government of the Gold Coast for two tours of twelve months, with possible extension. Age 25 to 40. Salary £300—£10—£350. Free quarters and 1st class passages. Four months' leave in England on full pay after each tour of service if returning to the Colony. Candidates who have had experience in the design and construction of large engineering works, in the preparation of plans, specifications, bills of quantities and estimates, in surveying, levelling, the use of the theodolite, and in building construction should apply at once to the Crown Agents for the Colonies, 4 Whitehall-gardens, London, S.W. (368)

BOROUGH OF DARLINGTON.

CHIEF ASSISTANT TO BOROUGH SURVEYOR, &c., AND JUNIOR ASSISTANT.

The Darlington Corporation invite applications from suitable persons for the appointment of Chief Assistant to the Borough Surveyor and Waterworks Engineer, at a salary of £230 per annum, rising, subject to satisfactory service, by two annual increments of £10, to a maximum of £250 per annum.

Applications are also invited for the appointment of a Junior Assistant, at a salary of £90, rising, subject to satisfactory service, by two annual increments of £10, to a maximum of £110 per annum.

The persons appointed will be required to devote the whole of their time to their respective duties, and preference will be given to those who have had previous experience in the office of a Municipal Authority.

Applications (on Forms which will be supplied by the Borough Surveyor, Town Hall, Darlington), in candidate's own handwriting, and accompanied by copies of not more than three recent testimonials (which will not be returned), must be sent to me, the undersigned, not later than Saturday, the 26th day of April next, endorsed "Chief Assistant to Borough Surveyor," or "Junior Assistant to Borough Surveyor," as the case may be.

Canvassing, either directly or indirectly, is prohibited.

H. G. STEAVENSON,
Town Clerk.

Houndgate, Darlington.
April 4, 1913. (343)

WANTED, in a county surveyor's office in the South of England, a Junior Surveying Assistant, at a salary of £100, rising to £130 per annum, to include the provision and upkeep of a bicycle. Age not to exceed 27 years. The duties of the person appointed will be to assist with making surveys, the calculation of stresses, and the design of bridges. He must also have a knowledge of architecture and the getting out of quantities, and must be a good draughtsman. When working outside the office reasonable out-of-pocket expenses will be allowed. The appointment will be determinable by one month's notice on either side. Applications, stating age and experience, giving references and enclosing copies of three recent testimonials (which will not be returned), to be sent to Box 1,233, office of The Surveyor, 24 Bride-lane, Fleet-street, E.C., not later than the first post on April 25th. (353)

ENGINEER, Architect and Surveyor (A.M.I.C.E.), in charge of a large Garden Suburb near London, has vacancy for a pupil. Moderate premium. Write, Box 1,225, office of The Surveyor, 24 Bride-lane, Fleet-street, E.C. (336)

WANTED—Qualified General Assistant with practical experience in Surveying, Sewerage, Harbour and Dock Work. None other need apply. Salary, £110 per annum. Reply, stating age, experience, and enclosing copies of three recent testimonials, to G. E. Clarke, M.Inst.C.E., Municipal Buildings, Boston, Lincs. (376)

PORT ELIZABETH (SOUTH AFRICA) MUNICIPALITY.

TOWN ENGINEER'S DEPARTMENT.

ENGINEERING ASSISTANT.

An Assistant is required in the Town Engineer's Department, experienced in Sewerage and Drainage details, and practical construction work. Good and quick draughtsmanship is essential.

Salary, £20 per month, for one year from date of arrival at Port Elizabeth, the Municipality having the right of renewal for a further twelve months. Second-class passage will be provided.

Applications, stating qualifications and experience, and accompanied by copies of three testimonials, to be delivered at the offices of the undersigned not later than Friday, 25th instant.

DAVIS & SOPER,
Agents of the Port Elizabeth Municipality.

54 St. Mary Axe,
London, E.C.
April 14, 1913. (374)

HEREFORD RURAL DISTRICT.

SURVEYOR WANTED.

The Council require the Services of a Surveyor for the 16 Parishes on the South side of the River Wye, containing 26 miles of Main Roads and 90 miles of District Roads.

The person appointed will be required to have a thorough knowledge of Road-making, including steam rolling and the management of a steam roller; to keep all such accounts as may be necessary under the Highway Acts or be required by the Council; to reside at such place within the district as the Council shall approve, to devote his whole time to the duties of his office (which will be strictly enforced); and to give security in the sum of £200.

The salary will be £130 per annum, and the appointment will be terminable by two months' notice by either party. Candidates must not be less than 24 nor more than 45 years of age.

Applications, in the candidate's own handwriting, stating age, present and previous occupation, with copies of recent testimonials (not exceeding three), which will not be returned, must be sent to me on or before Thursday, the 24th inst.

Selected candidates will receive notice to attend on the day of election.

Canvassing in any form will disqualify.

(By order of the Council)

R. MOORE,
Clerk.

8 St. John-street,
Hereford.
April 12 1913. (364)

PORTHCAWL URBAN DISTRICT COUNCIL.

APPOINTMENT OF INSPECTOR OF NUISANCES AND SURVEYOR.

The above Council invite applications for the joint Appointment of Inspector of Nuisances and Surveyor, at a salary of £140 per annum. The duties will be in accordance with those prescribed by the Local Government Board, and such other duties as may be prescribed from time to time by the Council.

Candidates must have had proper training and municipal experience, and must hold the certificate of the Royal Sanitary Institute, and be fully competent to discharge the duties appertaining to the respective offices, including those under the Housing and Town Planning Act and Petroleum Acts. No private practice will be allowed.

Applications, in Candidate's own handwriting, stating age, qualification and previous experience, accompanied by copies of not more than three recent testimonials, to be sent to the undersigned by twelve noon on Friday, the 25th April, 1913, endorsed "Surveyor and Inspector."

Canvassing, either directly or indirectly, will be a disqualification.

Dated this 14th day of April, 1913.

WM. CHORLEY,
Clerk.

Council Offices,
Porthcawl. (378)

CORPORATION OF MACCLESFIELD.

APPOINTMENT OF OUTDOOR FOREMAN.

Applicants for the position shall not be under 28 years nor over 40 years of age, and in every way physically strong.

He shall have had a proper training as working foreman and superintendent under another Corporation Highway Authority.

His previous experience must include the management of workmen, road making and maintenance in all its branches, private street works and sewering.

He must ride a cycle, to be provided by the Corporation.

The salary will be at the rate of £2 per week, rising by four annual increments to a maximum of £2 10s. per week.

Forms of application and list of duties can be had on application to the undersigned, to whom the same must be returned not later than noon on the 24th inst., marked outside "Outdoor Foreman."

S. C. BAGGOTT,
Borough Surveyor.

Town Hall.
April 10, 1913. (363)

BLABY RURAL DISTRICT COUNCIL.

BLABY AND WHETSTONE JOINT COMMITTEE.

SEWAGE FARM ATTENDANT.

The above Committee invite applications for the position of Farm Attendant at their Farm at Whetstone.

Candidates must have had practical experience in the management of Gas Engines, Shone's Pneumatic Ejectors, the management of Irrigation Areas, and must be able to do all running repairs.

Age not to exceed 40. Wages, 30s. per week.

The person appointed will be required to devote the whole of his time to the service of the council, and must be prepared to enter upon his duties within one month of his being appointed.

The appointment will be held subject to one month's notice on either side.

Selected candidates will have notice to attend a meeting of the Committee, and third-class railway fare will be allowed.

Applications, stating age, with full particulars of qualifications and experience, accompanied by copies of two recent testimonials, to be sent to the undersigned, endorsed "Farm Attendant," on or before the 23rd day of April, 1913.

Canvassing is strictly prohibited.

B. A. SHIRES.
Clerk to the Council.

1 Friar-lane,
Leicester.
April 8, 1913. (348)

CITY OF COVENTRY.

CHIEF ENGINEERING ASSISTANT.

The Corporation of the City of Coventry are prepared to receive applications for the position of Chief Engineering Assistant in the office of the City Engineer and Surveyor.

Candidates must be thoroughly qualified persons, between the ages of 28 and 40, and must have had experience in important general works of a municipal engineer's office; none others need apply.

The salary will be at the rate of £200 per annum. Applications, in candidate's own handwriting, stating age, full details of experience, past and present employment, accompanied by copies of not more than three recent testimonials (which will not be returned), and endorsed "Chief Engineering Assistant," to be sent to the undersigned not later than Monday, the 21st April, 1913.

Canvassing, directly or indirectly, will be deemed a disqualification.

J. E. SWINDLEHURST, M.INST.C.E.,
City Engineer and Surveyor.

St. Mary's Hall,
Coventry.
April 3, 1913. (333)

COUNTY BOROUGH OF BIRKENHEAD.

The Corporation of Birkenhead invite Applications for the position of Junior Engineering Assistant in the Borough Engineer and Surveyor's Department, at a salary of £100 per annum, rising by annual increments of £5 to £110 per annum.

Candidates must have had experience in a Municipal Engineer's Office, and be not less than 21 years nor more than 25 years of age.

Preference will be given to candidates who have passed Studentship Examination of Institution of Civil Engineers or similar examination.

Applications, in Candidate's own handwriting, stating age and experience, and accompanied by copies of not more than three recent testimonials, sealed and endorsed "Junior Assistant, Surveyor's Department," must be delivered at the Office of Mr. Chas. Brownridge, M.INST.C.E., Borough Engineer and Surveyor, Town Hall, Birkenhead, by 12 noon on Saturday, the 26th April, 1913.

Canvassing will be deemed a disqualification.

Borough Engineer and Surveyor's Office,
Town Hall, Birkenhead.
April 10, 1913. (362)

Have you Seen

OUR

STEEL SHEET PILING
PILE DRIVING PLANT

AND

BLAW STEEL CENTERING

AT THE

Building Trades Exhibition, Olympia,

APRIL 12th to 26th.

?

IF NOT, DON'T DELAY.

THE BRITISH STEEL PILING CO.,

TELEPHONES—
1414 Avenue.
1414 Central.

DOCK HOUSE, BILLITER STREET,
LONDON, E.C.

TELEGRAMS—
"Gramercy, London."

DEVON COUNTY COUNCIL.

MAIN ROADS.

No. 1 DIVISION.

A temporary assistant is required immediately for reconstruction work by direct control of about 12 miles of road. Salary, £3 3s. per week; the work will occupy not less than twelve months. Applicants must be competent surveyors who have had experience in road construction by modern methods, and be accustomed to the management of men. Preference will be given to a motor cyclist.

A junior temporary assistant is required for the general work of the office. Salary, £2 2s. per week. Applicants must be able to survey, take levels, and prepare drawings and tracings.

Applications, in candidate's own handwriting, endorsed "Assistants," and accompanied by copies of not more than three recent testimonials, should be received by the undersigned on or before Monday, the 28th April, 1913.

EDWARD STEAD, Assoc.M.Inst.C.E.,
County Surveyor,
No. 1 Division.

Barnstaple.
April 14, 1913. (372)

ENGINEER AND SURVEYOR, South of England, has vacancy for Pupil. Large sewerage scheme projected.—Box 1,238, office of The Surveyor, 24 Bride-lane, Fleet-street, London, E.C.

ENGINEER AND SURVEYOR to large Urban District requires the Services for six months of a thoroughly qualified and efficient Assistant. Salary £2 2s. per week.

Apply, with copies of three testimonials, to Box 1,237, office of The Surveyor, 24 Bride-lane, Fleet-street, London, E.C. (360)

APPOINTMENTS WANTED.

MAIN ROAD SURVEYOR, well up in tar-painting, tarmac and ordinary work, desires temporary post immediately, preferably under County Surveyor. Highest references. Personally known to Editor of The Surveyor.—Box 1,236, office of The Surveyor, 24 Bride-lane, Fleet-street, E.C.

REPRESENTATIVE, with good connection in London and districts with Surveyors, Architects Builders, Plumbers, Builders' Merchants, and H.M. Government, desires re-engagement. W. J. B., 6 Clonmel-road, Fulham.

COMPETITIONS OPEN.

BOROUGH OF CHEPPING WYCOMBE.
TOWN-PLANNING COMPETITION.

The Corporation invite competitive designs for Town-planning the Borough and an area immediately adjoining.

Premiums of £25, £10 and £5 are offered for designs elected by the Assessors.

Particulars and copy of plan may be obtained at the Borough Surveyor's Office on payment of the sum of £1, which will be returned on receipt of a *bonâ-fide* design.

Designs, endorsed "Town-Planning Competition," to be delivered at the Town Hall, High Wycombe, not later than noon on the first day of September, 1913.

T. J. RUSHBROOKE,
Borough Surveyor.

High Wycombe.
April, 1913. (357)

TENDERS WANTED.

BOROUGH OF PENZANCE.

Tenders are invited for deepening the entrance to the Penzance Harbour and Dock.

Specification, Plans, Sections and all necessary information can be obtained by Contractors on application to the Borough Engineer, Mr. Frank Latham, M.Inst.C.E.I., Public Buildings, Penzance.

Sealed and endorsed Tenders to be delivered to the undersigned on or before the 24th instant.

The lowest or any Tender will not necessarily be accepted.

T. H. CORNISH,
Town Clerk.

Town Clerk's Department,
Public Buildings,
Penzance.
April 10, 1913. (358)

BOROUGH OF MIDDLETON.

The Corporation of Middleton require Tenders for the surfacing of the Carriageway in Rectory-street, Middleton, with Tar-macadam, Roemac, Pitchmac or other bituminous materials.

Area about 1,980 sq. yds.

Further particulars may be had from Mr. W. Welburn, Borough Surveyor, Town Hall, Middleton.

Tenders to be sent in official envelope addressed to the Chairman of the Surveyor's Committee, and to be delivered at my office not later than April 29th

FREDERICK ENTWISTLE,
Town Clerk.

Town Hall,
Middleton. (376)

Where to stay during the Building Trades Exhibition at Olympia.

Established 1885.

TURNER'S HOTEL

(First-Class Temperance),
73-76 Guilford Street, London, W.C.
One Minute from Russell Square Tube Station.

Accommodation for 100 Guests. Central for Business, Shops, and Theatres. Electric Light. Night Porters. Tel. 2820 Central.

BED, BREAKFAST and ATTENDANCE from 5/-

SYDNEY TO MELBOURNE RELIABILITY TRIAL.

Organised by the Automobile Club of Australasia.

RESULT

Received by Cablegram April 3rd.

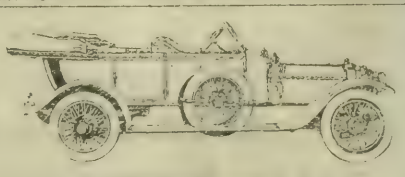
ONLY TWO TALBOT CARS COMPETING

PLACED FIRST AND SECOND.

Winning Talbot was awarded:
Maximum points for RELIABILITY,
" " " HILL CLIMBING,
" " " PETROL ECONOMY.

INVINCIBLE TALBOT

The first Car in the world to cover 100 miles in one hour



Catalogue on request.

CLEMENT TALBOT, LIMITED,

Automobile Designers and Engineers,

BARLBY ROAD, LADBROKE GROVE, LONDON, W.

The Surveyor

And Municipal and County Engineer.

Vol. XLIII. APRIL 25, 1913. No. 1,110.

Minutes of Proceedings.

Street Lighting. During recent years a fundamental change has come over the question of public lighting. The introduction of vastly improved gas and electric lamps has not only raised the standard of lighting indoors, but has also in large measure influenced the public mind with regard to the lighting of the streets, and the enterprise of shopkeepers in providing lavish and too often glaring displays of light inside and outside their windows has not been without effect in accentuating the dimness of the adjoining streets. Another factor of great weight is the remarkable acceleration of traffic resulting from the development of the motor vehicle, which has rendered better lighting of the roadways an absolute necessity. These considerations, together with the keen and level competition between the two rivals, gas and electricity, have revealed the urgent need for new and definite criteria of efficiency in public lighting, and led to the formation of a joint committee, nearly two years ago, to formulate a specification of general applicability to govern the conditions and to standardise the methods of measurement to be adopted in street lighting contracts. The Institutions of Municipal and County Engineers, Electrical Engineers, and Gas Engineers were all represented on the committee, as well as the Illuminating Engineering Society, which, like the municipal body, was considered impartial and open-minded. A draft specification was drawn up last year, and exhaustively discussed, but unfortunately at the outset the committee failed to reach agreement on a crucial point—namely, whether the criterion of adequate lighting should be the illumination of the roadway or the candle-power of the lamps employed. This question still remains a stumbling-block in the way of a final settlement, for, although the other bodies by a large majority are in favour of the illumination standard, the representatives of the Institution of Gas Engineers hold out manfully for the candle-power standard.

In order to thrash out the question *coram publico*, a paper was presented by Mr. A. P. Trotter, one of the foremost authorities on the subject, before the Illuminating Engineering Society last week, and the matter was debated at length, without, however, a conclusion being arrived at. The discussion will be resumed on Tuesday next week. It was very unfortunate that the Institution of Gas Engineers was very inadequately represented, in point of numbers, on the joint committee, as the advocates of the candle-power standard were thus in a small minority throughout the deliberations; but they have the opportunity to present their views fully during the discussion on the paper, and intend to take full advantage of it. As regards the merits of the question, which were ably expounded by Mr. Trotter, it certainly would seem that what the public really wants is illumination, and that the candle-power of the lamps by which it is produced is a matter wholly beside the mark; but there are undoubtedly certain considerations which tend in the opposite sense—for instance, some say that the illumination on a horizontal plane is no measure at all of the effectiveness of a system of lighting in preventing collisions between the users of the roads. We shall not attempt the formidable task of summarising the arguments advanced on either side, but one fact brought out by Mr. Trotter seems to us to be of considerable significance; in the course of the investigations, the municipal engineer members of the committee (Messrs. G. F. Carter, Croydon; T. W. A. Hayward, Battersea; G. B. B. Newton, Paddington; and Norman Scorgie, Hackney) perambulated certain streets, and classified their illumination under three heads; afterwards the photometrists measured the minimum illumination in the same streets, and it was found that in every instance the measurements placed the respective streets in the same classes as the surveyors had placed them in by eye. This appears to bear out the contention that experienced men judge of street lighting, consciously or unconsciously, by the minimum illumination on the roadway, and it will be difficult to avoid the natural deduction from this unexpected result.

* * *

The Surveyors' Institution and its Examinations. The increasing respect in which the Surveyors' Institution is held is evidenced by the steady and continuous growth in its membership. At the examinations which recently took place the number of candidates reached the exceptional figure of about 1,400. Doubtless this will be found to be practically the high-water mark, for the reason that there has been something in the nature of a stampede on the part of would-be members to obtain their qualification before the coming into force of the new regulations next year. Hitherto it has been possible to obtain the right to nomination for election as professional associate, given the necessary practical experience, by passing a single examination, there being then a further examination to qualify for the fellowship class. Under the new regulations it will be

necessary for a candidate to pass both these examinations before he is allowed to go forward for election as professional associate, and promotion to the fellowship will be governed solely by increased practical experience; and there will be no further examination in regard to this class. The regulations as to the preliminary examination will remain unaltered; this will still continue to be an optional test, and those who by passing it are enabled to become students of the institution will be allowed, as has for long been the case, a little advantage, as compared with non-students, in the matter of the percentage of marks required to constitute a pass in the intermediate examination.

The effect of the new regulations in regard to the obtaining of the professional associateship will undoubtedly be to raise the value of this qualification to a very considerable extent. This will be to the benefit of the existing members, and doubtless also to the profession as a whole. The institution has now attained such a powerful position that it can afford to stiffen up the conditions of future membership without very much fear of a decrease in the annual number of new members. The type of person, however, who habitually sees in any stiffening up of professional qualifications an attempt to keep down the younger men may be inclined to descry the customary cloven hoof. But nothing could be more far removed from the truth. The movement, having as its object the improvement of the status of the professional associate class, originated with the younger members of the institution, and it was some little time before the governing body could be brought to see things in the same light. The principal argument in favour of the alteration was the anomalous position of a large number of the professional associates who had passed the examination qualifying for nomination to the fellowship, but who had not obtained the very considerable amount of experience which would enable them to become elected as fellows. Under the old regulations such men often had for many years nothing to show for the trouble taken in working for and passing the final examination. Under the new scheme the professional associateship will become a much higher qualification than has hitherto been the case, and there will not be the same heartburnings in the case of members who, for reasons beneficial in the long run both to themselves and the profession, are kept for some years in the subordinate class, pending the obtaining of greater experience.

* * *

The Country Roads Act of Victoria, Australia.

In our issue of March 11th we gave some particulars relating to the personnel of the Country Roads Board of the State of Victoria. For the present issue we have prepared a summary of some of the main provisions of the Act itself, with running comment upon the possible effect of these provisions as suggested by experience of highway administration in different countries. The Act clothes the board with very wide powers for the carrying out of duties of a very important nature. It must not be supposed that the Country Roads Board of Victoria is merely a body which to some extent combines the duties and powers of our own Road Board and those of the very different bodies which are appointed in American States. It is true that as a central intelligence department the Country Roads Board of Victoria will play a part similar to that played in this respect by a highway commission in an American State. On the other hand it has with regard to the construction of roads some of the powers of our own Road Board. The latter, however, are small indeed when compared with those of the Victorian Department. The single fact that the Country Roads Board is itself, with the approval of the Governor in Council, the authority charged with the duty of deciding which roads are to be main roads, places it in an administrative position altogether superior to that of our own Road Board. Besides this, the Country Roads Board of Victoria has the very important power of carrying out works the cost of which will be partly allocated to the local authorities concerned, and not only, be it noted, to those authorities through whose administrative areas the roads in question pass, but also such authorities as may benefit, or may in the opinion of the board be expected to benefit, by the works carried out. It will thus be seen that what has been created is in effect a department of State consisting essentially of the Minister of Public Works, the chairman of the Roads Board, two other members of the Roads Board, and, further, all officers and employees of the Public Works Department whose services may be placed at the disposal of the board. This is a very important point, for it is one thing to start work on fresh ground and would be quite another thing to begin that work with the necessity for creating not only an organisation of personnel and procedure, but also that general comprehension of the spirit of co-operation proper to the carrying out of public works which is already in existence in the State of Victoria as the result of the many years' working of the Public Works Department.

Since we have interspersed our summary of the chief provisions of this Act with running comment of our own, we need not further discuss those provisions on this page, but it may be pointed out here that last year the New South Wales State Parliament tried to pass a similar Bill, but failed mainly owing to the opposition of the Shire Councils. Now, however, that the Victorian Act has been passed, it seems very likely that this Bill will, perhaps in an amended form, be introduced into the next session of the New South Wales Parliament.

* * *

Estate Development and the Finance (1909-10) Act, 1910.

At a meeting of the Surveyors' Institution on Monday evening a very interesting paper on "Site Value Deductions for Construction of and Appropriation of Land for Roads" was read by Mr. Richard G. G. Reed. It will be remembered that, in order to arrive at the "assessable site value," the Act provides for certain deductions to be made from the total value of land. In the ordinary case of an estate developed by the construction of roads the deductions to be made fall under two heads—namely, (*a*) any part of the total value which is proved to the commissioners to be directly attributable to the works executed, and (*b*) any part of the total value which is proved to the commissioners to be directly attributable to the appropriation of any land for the purpose of the roads. It was pointed out by Mr. Reed that the official view appears to be that in the ordinary case of roads developing an estate the deduction due to (*a*) is equivalent to the actual amount expended, while that due to (*b*) is *nil*. But the correctness of this interpretation is open to considerable doubt. If the Act had contemplated a deduction equal to the actual amount expended, nothing would have been easier than for it to have said so. Mr. Reed expressed the opinion that deduction (*a*) is to be calculated from the difference between the value of the land immediately before the roads were made and its value immediately after. Subject to this, however: That if the total value should vary with the effluxion of time, the deduction should not be considered as a fixed sum ascertained once for all when the roads were made, but that it, too, should be considered as varying from time to time in proportion to the fluctuations in the total value of the land. In those cases—and they are very many—in which it is impossible for the valuer to ascertain the necessary data for a scientific valuation Mr. Reed suggested an average deduction of 50 per cent. The problems which are raised by the Act are so many and so complex, and they affect the business of surveyors so closely, that

any opportunity for their discussion should be eagerly seized. Mr. Reed's paper was an able contribution towards the solution of an intricate question.

* * *

A Presidential Address. The inaugural address delivered by Sir H. Frederick Donaldson, K.C.B., on Friday last, as president of the Institution of Mechanical Engineers was mainly concerned with emphasising the need for efficiency on the part of the individual engineer in view of the very keen international competition of the present day. In referring to the recent establishment of examinations by the institution, the new president pointed out that the introduction of these educational tests should not only have the effect of raising the average standard of training and scientific attainment, but that it ought at the same time to improve the professional status of the members of the institution. In dealing with such a subject, Sir Frederick was bound to refer to the vexed question of the relative importance of the theoretical and practical sides of the training of an engineer; and in this connection we specially commend to the attention of our younger readers the emphasis which he laid upon the importance of acquiring an extended practical experience, even at the cost of a temporary shortening of salary. Although these observations were made in regard to mechanical engineering, they are, in our view, even more applicable to young municipal engineers, by whom they are worthy of the most careful consideration.

In the course of his address, Sir Frederick Donaldson referred to two desiderata for meeting foreign competition—namely, (*a*) our quality of output should continue to be superior to that of our competitors, and (*b*) our selling prices should be if possible actually, but at any rate relatively, lower than theirs. It will at once be seen that this involves not only the best appliances and highly trained engineers, but also skilled organisation, so as to avoid all waste of material or energy in production. In order that this high standard may be achieved it is absolutely necessary that considerable sums shall be expended in experimental and research work, and to enable this to be done on broad lines Sir Frederick advocated the establishment of a Central Engineering Research Committee, to be supported by the various professional societies and institutions.

* * *

The Conference at Olympia. The attendance at The Surveyor conference held at Olympia last Saturday was both large and representative in its character, and the constitution of the meeting was such as to direct the attention of all road surveyors to the opinions expressed and the conclusions arrived at. The proceedings of such a conference, presided over by Sir George Gibb, who is recognised as one of the foremost administrators of the present day, are to be reckoned with in their bearing upon the problems with which road surveyors are faced in view of further developments which may be expected to take place in the near future. With respect to such changes as are now imminent, Sir George Gibb's opening remarks should be read with close attention, and surveyors should make up their minds to some course of action which will ensure that due regard will be paid to their interests in the future. Those who took part in the discussions on the five propositions submitted are to be congratulated on the high intellectual and professional level on which the proceedings were conducted, as well as upon the definiteness of the conclusions arrived at, and we would only add that if there be among those who were unable to attend the conference any who may be desirous of expressing their views on the matters which came before the conference, they are heartily welcome to the use of our correspondence columns.

A Liskeard Appointment. The members of the Liskeard Rural District Council have been opportunely taught the lesson that there are two sides to the question of economy so far as salaries are concerned—one which concerns themselves and another which concerns the official. To the office of highway surveyor for the North district they decided to appoint Mr. W. L. B. Smale, assistant surveyor to the St. Thomas Rural District Council, at a salary of £100 a year. Mr. Smale, however, refused the offer on the ground that the salary was insufficient. Then they sought to effect a compromise by appointing a younger man, to whom £100 a year would presumably be more acceptable, but the county council refused their sanction. When the matter again came before the rural council on Saturday Mr. F. Williams described the salary of £100 and travelling expenses as "not a living wage." The clerk explained that the official would have the spending of £4,000 per quarter, and added that "the very minimum they should pay a man who would have to keep a motor-bicycle should be £120 a year." So Mr. Smale is to be invited to reconsider his refusal and accept the appointment at the revised salary of £120. The ruling passion for economy is strong in the worthy councillors. It will be noted that they have refused to improve upon the figure which their own chief officer described with justice and accuracy as "the very minimum."

* * *

Paint for Ironwork. The protection of ironwork by paint is one of those matters of detail for which engineers are responsible, but to which they do not always perhaps devote so much attention as its importance demands. In another place will be found an article dealing with this subject from the pen of Mr. G. Basil Barham, A.M.I.E.E., in which he discusses the real functions of a coating of paint on metal work, and the possible effects of the various ingredients. His conclusion as to the ideal paint for use on metal work exposed to varying atmospheric conditions is that it must have as a pigment some substance or combination of substances that will amalgamate with the vehicle employed so thoroughly that when spread over the surface which is to be treated a tough, flexible, leathery skin shall be formed which is indifferent to either chemical or electrical action. How is this ideal to be attained? It excludes the use of many of the more ordinary ingredients, and leads to the conclusion that the engineer must not only abandon entirely the older forms of paints, but will be forced to pay attention to the claims of the specialist paint firms who have given close and serious attention to the special requirements of paint for metal work. Mr. Barham's article will be found to contain much useful information of a practical character.

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Ad Medium Filum. The House of Lords have just decided a rather curious point arising from the legal presumption that, in the absence of evidence to the contrary, the soil of a highway, *ad medium filum viae*, belongs to the owner of the adjoining property. The question to be determined was whether, when the land tax payable in respect of premises adjoining a highway in the City of London has been redeemed, it has also been redeemed in respect of the soil of the highway; and the point was a substantial one, inasmuch as a tube railway had been constructed beneath the road under discussion. Mr. Justice Swinfen Eady held that the redemption of the tax on the half of the public street could not be presumed so as to confer future exemption. This decision was, however, reversed by a majority of the Court of Appeal, and their judgment was confirmed by the House of Lords. Of course, this case does not affect the usual presumption as to the ownership of the soil, nor the statutory vesting in a local authority of so much of the surface of the street as is necessary to enable them to carry out their statutory duties.

Municipal Engineers' Day at Olympia.

"THE SURVEYOR" CONFERENCE: FULL REPORT.

Important matters connected with highway engineering and administration came in for discussion at the conference, which, presided over by Sir George Gibb, chairman of the Road Board, took place at Olympia on Saturday afternoon last. Although at the commencement of the proceedings the attendance can only be described as moderate, within the ensuing quarter of an hour the commodious room in which the gathering was held was well filled, those present including Sir Herbert Praed, Colonel R. E. Crompton, J. E. Aldersley (Earby), W. V. Anderson (Winchester), R. J. Angel (Bermondsey), C. R. Berry (Westminster), W. Bevan (Haverfordwest), H. D. Blake (Westminster), F. M. Bond (Westminster), H. Percy Boulnois (Westminster), A. E. Brookes (Cornwall County), Reginald Brown (Westminster and Southall-Norwood), J. G. Carey (Hounslow), F. T. R. Carter (Heston and Isleworth), A. A. Catchpole (London), S. H. Chambers (Hampton-on-Thames), Robert Chart, junr. (Croydon Rural), W. A. Clarke (Westminster), H. F. Coales (Sunbury-on-Thames), J. W. Cockrill (Great Yarmouth), Richard Collins (Enfield), W. R. Collins (Enfield), C. Fitzroy Cooper (Westminster), P. C. Cowan (Local Government Board, Ireland), James W. Croxford (Brentford), W. J. Dibdin (Westminster), D. J. Diver (Marple, Cheshire), S. R. Drake (Leatherhead), A. Dryland (Surrey County), R. Dudley (Lahore, India), E. J. Elford (Southend-on-Sea), W. B. Fairchild (Cosford), C. B. Fairchild (Hailsham), W. A. Farnham (Foots Cray), W. W. Gandy (Eastleigh), C. F. Gettings (Worcester), Robert Gibson (Gayton, Norfolk), A. Gladwell (Eton Rural), W. H. Grieves (Sutton, Surrey), Frank Grove (Surrey), T. W. A. Hayward (Battersea), T. Henry (Retford), T. W. E. Higgens (Chelsea), W. M. Hudson (Chipping Sodbury), R. H. Jeffes (New Malden), T. T. Johnson (Grays), Robert R. Jones (Milnrow), W. Jones (Thetford), W. Lionel Jenkins (West Suffolk County), R. J. Jenkins (Portsmouth), J. S. Killick (Road Board), L. L. Kropf (London), W. H. Lintern (Malmesbury), A. James Meeson (Brentford), T. G. Marriott (Westminster), H. B. Marten (Westminster), W. H. Maxwell (Tunbridge Wells), T. H. Negus (Birmingham), T. Orchard (Clutton), A. E. Peake (Essex), J. W. Pearce (Twickenham), R. S. W. Perkins (Isle of Ely County), W. B. Purser (Kesteven County), R. Read (Gloucester), R. H. Reeves (Walton-on-the-Naze), A. Rodger (Glasgow), W. A. Rogerson (Downham, Norfolk), Reginald Ryves (Croydon), Norman Scorgie (Hackney), G. N. Seels (New Malden), L. Seraillier (London), C. Chambers-Smith (Westminster), J. E. Sharpe (Cheshunt), W. E. Sharp (Ludlow), E. J. Silcock (Westminster and Leeds), E. A. Slater (Colchester), L. J. Small (Woodford Green), C. F. Soanes (Westminster), E. F. Spurrell (Holborn), J. Sutcliffe (Deptford), Charles Vawser (Herts), H. T. Wakelam (Middlesex County), J. W. Walsham (Peterborough), Arthur W. Ward (Portsmouth), J. Washdown (Maidstone), James A. Webb (Hendon), Francis Wood (Fulham), F. J. Wood (East Sussex County), W. S. Woodcock (Oakham), and J. Young (Ayr).

CHAIRMAN'S ADDRESS.

The Chairman, in opening the proceedings, said he was pleased to take the chair on that occasion. He did not propose in those preliminary observations to say anything about the questions that were to be discussed. He would begin by saying a few general words about the value of this conference to surveyors. The subject of road administration was passing through a critical stage of transition. The public were making new demands upon roads and road authorities, and an immense increase of expenditure upon the roads was taking place. If they regarded only the roads outside London and outside county boroughs, which, of course, were subject to special conditions, the expenditure in the year 1890 was £3,000,000. It had now more than doubled, and one was bound to think whether that money was being wisely and well spent. Those who had studied the subject of road organisation were probably almost unanimous in the opinion that the organisation was not adequate to meet the new demands. There were a number of very highly important questions both of administration and engineering which required to be particularly studied, and he thought nothing but good could come of a conference of this sort, which drew together men with special knowledge and experience so that they could discuss subjects and formulate their views upon them. Of course, the formulation of views on a wide subject like road organisation and administration could be best done through the agency of organised societies. He supposed most of them were members of some society—the County Surveyors' Society or the Institution of Municipal and County Engineers—and societies of that sort were, he thought, doing a most desirable work throughout the country. Personally, he always liked to see members of a profession joining and supporting the action of these organised societies, but one must remember also that there was a certain body of unorganised opinion which it was very desirable to ascertain and concentrate upon a subject of professional interest, and a conference such as this was useful to that end. They were no doubt on the eve of considerable changes in regard to road organisation. A great step forward was taken in 1788, when the county councils were formed, and that step was bound to lead to very important consequences in the future, some of which had already occurred, and some of which had yet to be developed and worked out. A good many people thought—rather he would say people who did not think—that road making was a somewhat simple and easy matter, but he confessed the more one looked at it and studied it the more was one impressed with the number of very difficult questions which were involved. What was wanted was the application of the scientific mind and scientific method to questions of road engineering, and he found, now that he was in touch with a great many chairmen of highway committees and local authorities, quite a general opinion among them that there was great need for more information and better technical guidance than was at the disposal of a certain percentage of highway authorities. There was one point of view—a common point of view in approaching road questions—and that was the all-important aspect of finance. Authorities were apt to look simply at the amount of expenditure, and anything that led to increased expenditure they naturally shrank from. Now economy was very important, but it was a wrong starting point. One should never attach too much importance to the question of expenditure at the beginning. Economy was an end, not a beginning. The beginning should always be efficient work, and if efficient work was secured then economy would be the result. He had made just those few general remarks, and he would now call upon Mr. Wakelam to move the first resolution.

ORGANISATION OF HIGHWAY ENGINEERING DEPARTMENTS.

Mr. H. T. Wakelam (Middlesex County) proceeded to move the first resolution as follows:—

"That in order to satisfy modern requirements in connection with the maintenance and improvement of roads it is essential that every highway authority having the charge of important roads should possess an efficient engineering organisation, and that great attention should be paid to the selection, conditions of employment and organisation under each authority of a thoroughly trained and adequate engineering staff."

He stated that as time was short it was his intention to be as brief as possible. There were a number of resolutions on the printed list, and it was therefore necessary that as little time as possible should be taken up with this motion. Everybody present, he thought, would agree with the terms of the resolution. It was well framed, it concisely set forth all that it was intended to convey, and he was quite sure that members of the engineering profession would recognise its importance. It was more necessary now than hitherto that proper statistics and careful notes should be kept in regard to road maintenance, and also in connection with road charges. As he stated some time ago, and he was glad to hear Sir George Gibb confirm the statement, they were on the fringe of a new road era, and it was necessary and desirable that the parties concerned should take all the steps

they could to provide themselves with efficient staffs of men who were competent to carry on the work which would, no doubt, in the future fall to their lot. They wanted in road work men of education who were trained to their business, and it was necessary that they should have a proper organisation to deal with modern road requirements. The principle of road construction was quite different now to what it was even a short time ago. The principles of Macadam, Telford, Brindley and others were altogether superseded, and in the road of the future the principles applied would become more and more important and of a higher scientific nature. Municipal authorities must recognise as time went on that engineers and their staffs must be paid according to the importance of their work, and he was quite sure Sir George Gibb would be the last man to deny proper assistance for the work municipal engineers were doing. Personally he should like to see the Road Board giving a percentage on the amount expended towards the services rendered by the local officials. He never missed the opportunity of advocating increased pay and increased recognition of the officials engaged in this work, and he was glad to hear Sir George Gibb say that the members of the different highway authorities with whom he was brought into contact recognised the fact that it was more necessary than ever to have properly trained officials. He had no hesitation in putting the resolution to the meeting, and he was quite sure it would be accepted with acclamation.

Mr. W. B. Purser (Kesteven County) seconded the resolution, and observed that very few words were necessary to commend it to the meeting. He was pleased to hear that the organisation was to be improved, but he thought it was time that the objects of the organisation should be brought to the attention of the controlling authorities—namely, the councils who were called upon to pay the money. They were bound, he thought, to recognise the importance of geographical position, for they had to deal with counties of unequal populations, and some with a high rating, while others were mainly agricultural, with a long mileage of main roads and a large amount of foreign traffic. This traffic passed through the main roads, and the county derived little for the cost of maintenance. It seemed to him that in such a case the county should be relieved, and that when the grant was made the geographical position should be considered more than it had been in the past. He belonged to an agricultural county where they had a great deal of traffic and very few villages or towns, and the county authorities felt they did not get the help they ought to get compared with others who were more fortunately situated. The point raised with respect to organisation seemed to be one to be carried further. The text of many of the speeches by candidates, in so far as it was intended for newspaper reading, was to keep the rates down as far as possible, and in some counties the trunk roads were kept in a bad state in order to keep through traffic away. If the position of counties could be considered from their geographical as well as from the rateable point of view, and the amount of foreign traffic, it would be better for everybody. There was no doubt that if they could get better construction of the roads it would be better in the long run, but when they attempted to convey that idea to a council they found that the members had not the same thought for posterity as Sir George Gibb. They thought only of the time being, and that they had to meet the expenditure. While they could not help recognising the failings of local authorities, it must be admitted that these ought to get some government help by way of contributions. If they could press upon the Government that if they wished to see better trunk roads they should meet some of the expenditure of the county councils, it would be a great step in the right direction.

Mr. R. J. Angel (Bermondsey) thought every engineer held the opinion that he should have an efficient staff, and every council held the same view to some extent. It seemed to him there was an opportunity for the Road Board to take the same view of municipal engineers and their staffs as the Local Government Board took with regard to medical officers of health and sanitary inspectors by contributing a moiety of their salaries. Medical officers and sanitary inspectors were of such a class as were approved by the Local Government Board, and were irremovable without the sanction of the board, and municipal engineers would be glad if the same conditions were applicable to them. A great many local authorities appointed the members of their engineering staff—he was not referring to county or borough engineers' staffs but to those of lesser grade—from some one who probably had a friend on the council, and if it could only be brought home to the various councils that preferential treatment should not necessarily be given to local residents, or to people who were well known to the council, but that the appointments should be thrown open and people refused who canvassed councillors in the way they knew it was so often done in their own boroughs; if all this was stopped and the engineering staff supervised by the Road Board he thought it would help all the more effectually to carry out the terms of the resolution. Otherwise he confessed he did not see how the resolution was to be carried out.

Mr. A. Gladwell (Eton Rural) supported the text of the resolution in order that he might to some extent disagree with the reasons given by Mr. Purser in seconding it. He was entirely at issue with that gentleman on the question that the Road Board, or any contributing authority, should have regard to geographical position. He would rather urge the point that geographical position was a secondary matter; the actual traffic passing over the roads, or any part of the district, was of far more importance. And this brought him to the point he had urged for many years—viz., that until a comprehensive classification of the roads of the country in relation to their traffic importance, quite apart from their geographical situation, was undertaken—no serious advance would be made on the question of administration from the contributing point of view. They had a Government authority set up which had power to make grants in aid of the improvement of roads, and it appeared to him that this authority was working at the present time more or less in the dark. Until that authority had undertaken a complete and comprehensive classification of all the roads in relation to the work they had to do, it would be unable to fairly and equitably distribute the money at its disposal.

Mr. A. Dryland (Surrey County) said he cordially agreed with the resolution, but he was wondering how it was to be put into effect—how it was to be brought to the notice of the persons really concerned —viz., the public road authorities. Even if they passed the resolution, unless they took some steps to convey it to the road authorities of the country, they would not do much good. He would suggest that some steps should be taken to bring the resolution to the notice of every highway authority in the country.

Mr. P. C. Cowan (Dublin) considered that the issue depended largely upon area. They could not expect a small authority to have a perfectly organised staff. Fortunately, of late years the number of authorities was reduced one-fourth, but it was still too great. No doubt the difficulties were due to a want of recognition by the authorities of the value of skilled professional service in connection with the roads. The need for such aid was growing rapidly, but it would not probably be fairly recognised until some central body was created not to interfere with the local authorities, but to help them. They had the Board of Trade controlling railways, the Local Government Board the Poor-law authorities, and the Education Board the school authorities. A great step in advance was made by the creation of the Road Board, but that authority had not yet enough power. It should be strengthened in order to see that the areas were proper areas, with proper staffs, and that the money was properly spent. It would be said that this meant paralysing the road authorities, but he did not think this would be so. In Ireland they had had an examination for county surveyors for twenty-five years, and it had worked very well. The old Grand Jury Act settled the salary—from £400 to £600 a year. He was a surveyor in Ireland for thirty years, so that he could speak with knowledge and with no direct interest, and it appeared to him that the resolution was so obvious that they need not hesitate to pass it.

Mr. W. A. Farnham (Foots Cray, Kent) said this resolution was something like the pious resolution passed at a similar conference two years ago. On that occasion he moved a rider that the authorities should keep a staff for the compilation of statistics. He did not think there was anybody in the room who would disagree with the resolution, but what was the good of passing pious resolutions unless they did something to carry them into effect They

realised the necessities of the case, but the local authorities did not; they did not realise that ample supervision made for economy. Let them take the Local Government Board and the officials under their control. They exercised the right of appointment, and saw that the official appointed was competent. The municipal surveyor, who was spending millions, was absolutely ignored by the Government. He thought it should go to the local authorities that qualified and experienced surveyors made for economy, and also that ample supervision also made for economy.

The Chairman said that before putting the resolution he would like to say a word. Mr. Purser and Mr. Gladwell had brought into the discussion questions relating to the distribution of funds. He did not think that, in considering this resolution, they ought to stray into questions of that sort, as they were not relevant. He always thought it was well to do one thing at a time. The resolution advocated efficient engineering organisation under local authorities who were responsible for the maintenance of roads. The question whether there should be further Government supervision over local authorities was as irrelevant as the questions raised by Mr. Purser and others. Railways had been mentioned, but he was not sure that railways particularly sighed for more Government control. It seemed to him that what was wanted was better and more efficient and better paid technical engineering organisation. Mr. Wakelam had referred to Macadam's ideas as being superseded in modern times. He (Sir George Gibb) was not sure this was so. Macadam got great fame from his engineering ideas as to the construction of stone road surfaces, but there was one point to dwell upon, even with more emphasis than his technical engineering experience, and that was the absolute necessity that the road work should be in the charge of expert road engineers. That was the principle affirmed in this resolution, that was the fundamental requirement of good road work, and if they settled those fundamentals rightly they would find that the rest would smooth itself by itself.

The resolution was then put from the chair, and declared to be carried unanimously.

ADVICE AND ASSISTANCE FOR SURVEYORS OF SMALL DISTRICTS.

Mr. H. Percy Boulnois (Westminster) proposed:

"That it is desirable that facilities should be afforded and some form of organisation adopted to enable surveyors of small districts to obtain official advice, assistance and supervision from county surveyors, and that county surveyors should, where necessary, be provided with special engineering assistance to enable this advice and assistance to be effectually afforded."

He said he was able, not being a county surveyor, to submit this to the meeting absolutely disinterestedly, although it was likely that as a consulting engineer in private practice if the county surveyors took over the work there would be nothing left for him to do in that direction. Some of them might say: "Leave the district surveyors alone; they know their job quite as well as county surveyors." The Americans said that one man was as good as another, and sometimes a d sight better. But that was not quite true, because there were specialists in every profession, and where a man was engaged in work of a particular kind, it was usual to seek his advice on the matters with which he dealt, so that district surveyors need not feel aggrieved or think there was any suggestion that they were incapable of doing their work. They should look at it in a broader light and regard the county surveyors as men who, with their intimate knowledge of road engineering, were in a position to assist them very considerably in their work. It was true that in some cases a man was a prophet in his own country, but as a rule the surveyor of a small district did not have much power with his council, their confidence in him being affected by meeting him so often, and their feeling consequently being that a stranger could advise them better. It was much the same with a sermon; one always appreciated a sermon from a preacher one did not hear very often. That was his opinion. He thought they would agree that it would be an extremely good plan if facilities were afforded district surveyors for obtaining advice upon matters connected with road construction, and if backed up by the county surveyor it was far more likely that he would get his way than if he were single-handed. He had been through the mill himself, having served under various authorities, and he knew how difficult it was to get a really good scheme through a council. They knew the dislike local authorities had of putting their hands in their pockets—though, by the way, they were not their own pockets—for generally they appealed to the ratepayers on the plea that they were going to institute all sorts of economies.

Mr. Cowan, in seconding, asked by whom was the organisation to be adopted.

Mr. Gladwell remarked that the only gratification or pleasure he had in listening to the proposition was in seeing the obvious reluctance which occurred in seconding it, and to find that nobody could be found to second it except for the purpose of acquiring information. He spoke with indignation, for he declared that a more insulting or ill-conceived resolution as far as surveyors were concerned was never proposed at any meeting. He trusted Mr. Boulnois would acquit him of any personal feeling as regarded himself, and accept his extreme sympathy that he had as mover been placed in a ridiculous position.

Mr. Boulnois: I was only asked yesterday to second it, as the original proposer was ill. I came here absolutely in order that somebody should propose it.

Mr. W. H. Grieves (Sutton) said he could not support the resolution under any consideration. It seemed to go contrary to the resolution already passed. This (the first resolution) stated that it was essential every highway authority having charge of important roads should possess an efficient engineering organisation, and in the second resolution now moved it was suggested that the highway authority should be limited to the county council officials, and that the only efficient organisation could be supplied by the county surveyor. His friends who knew him would know that he was not speaking from any personal standpoint, but he would point out that already the district surveyor had to go to the county surveyor for grants towards his roads, and even the grants from the Road Board were generally got through the county surveyor. It was now asked by this resolution that the poor rate, which every district had to pay, must be increased by increasing the staff of the county surveyor in order to carry out the work, when they had already suggested that each highway authority should have an efficient engineering organisation. This meant that every district would have its poor rate increased, and that the district surveyor would have to ask advice from the man to whom he had appealed for grants. No doubt the county surveyors would give this advice freely if asked for it, but he did not think the resolution was a proper resolution to put before them in the face of the first resolution. He did not wish to move an amendment, but he would not be able to support the resolution.

Mr. Wakelam did not think county surveyors would desire the resolution to be passed in the form in which it had been drawn. He believed the relations between the county and district surveyors were such that no such resolution was required. When district surveyors came to county surveyors they laid schemes before them, and he did not think there was any county surveyor who would not give all the help he could without any resolution of this kind.

Mr. Farnham proposed to move an amendment affirming the desirability of providing facilities and adopting some organisation to enable surveyors to obtain official advice, assistance and supervision, and that the Road Board should provide this assistance and advice.

The Chairman said he rather gathered that the feeling was against the resolution, and this being so it would be more satisfactory that they should simply vote upon it without attempting to alter it.

Mr. Farnham explained that his object was to form some organisation by which statistics could be tabulated. They would all profit by that.

The Chairman thought the best plan would be that the mover should be invited to withdraw the resolution. The resolution raised quite an important question, and one upon which he would like to express his views; but it appeared to him that those who were criticising it were not giving it a fair chance. As he read it, it referred to surveyors of small districts. There were small districts. They could not have surveyors in small districts paid the same salaries as surveyors of larger and more important districts. Then, again, they might be in favour of either the revision of the size of the districts, the areas for road maintenance, and the areas for rating

for the cost of road maintenance. But that was a matter for the Legislature, and meanwhile there were the small districts to be considered. He did not read the resolution except as giving suggestions for enabling surveyors of small districts to get assistance and supervision from the nearest source from which they could obtain it. He said that not to support the resolution as drawn, but simply to point out that it did not go as far as either Mr. Wakelam or Mr. Gladwell seemed to suggest. They would seem, as far as he could gather, to be in favour of Mr. Boulnois being invited to withdraw it.

Mr. Boulnois said he had no wish to insult district surveyors. Personally he thought it was an absolutely harmless resolution. He had gone through the mill and knew the value of advice, and any man who refused advice had a great deal to learn.

It was then agreed, with the consent of the mover and seconder, to withdraw the resolution.

CIRCULATION OF OFFICIAL REPORTS: INSPECTIONS OF WORKS.

Colonel R. E. Crompton proposed: -

"That it is desirable to encourage the publication and dissemination throughout the profession of annual reports by highway surveyors setting forth full particulars, arranged under heads as uniform as possible for purposes of comparison, in regard to work done, including all essential details as to materials, methods and costs, together with summaries of practical results obtained on different roads classified according to amount and character of traffic; that these reports should be circulated and exchanged between all surveyors of important highway authorities, and that arrangements should be made by highway authorities to enable their surveyors to visit and inspect work carried out in other districts, so that by frequent conference and interchange of experience among road engineers the science of road construction and maintenance may be advanced."

Consideration of the last few words of his proposition would, he thought, make clear to all the value of the object in view. He was sure that Sir George Gibb for one would agree that it would be in every way helpful to them if there were a simple and well-established system of reports, so classified that they could be compared one with another and the results made available to everyone. He was aware that attempts to accomplish something of this kind had been made in the past, but he took it that the great difficulty with which they were confronted was the time that would be occupied in the preparation of the reports, another obstacle being the inadequate staffs in many surveyors' offices. Therefore, it might be that it was a case in which a central organisation could render good service, and he suggested that the meeting might either then or later on select a number of gentlemen to act for them and assist in the labour of preparing these returns. It was obvious that at present none of them could learn anything from distant parts of the country unless they were acquainted with all the conditions of a particular locality. Far too little, for instance, was known about traffic, and the result was that ill-considered opinions were frequently expressed as to the condition of roads without regard to the amount of traffic which passed over them. It appeared to him much more easy to carry into effect the proposition he had submitted than either of the two previous ones which had come before the meeting, because it largely rested with themselves as to whether its objects were attained.

Mr. A. W. Ward (Portsmouth) asked what would be the position of the district surveyor if he suggested one kind of road and the county surveyor another. He thought the publication of reports was a necessity. He supposed that, like himself, most of them had from time to time been told by a member of their committee: "I was motoring in such and such a road, and the surveyor told me it cost next to nothing." Those false reports, he thought, were encouraged by societies not having the interests of the road at heart. Information as to what was going on in neighbouring districts was what was required by a surveyor; it did not matter what was going on farther afield. He personally should like to have information of the kind suggested placed at his disposal, and he thought the proposal before them would, if it could be made effective, prove of infinite value to them all.

Mr. Farnham suggested that the word "important" before "highway authorities" might well be omitted. It was a question of degree, and also one whether the surveyor of an important highway authority might not learn something from the surveyor of an unimportant highway authority.

Colonel Crompton expressed himself as agreeable to the deletion of the word, and the discussion was continued by Mr. Purser, who expressed regret at the spirit of antagonism which had been shown during the proceedings, and insisted that county surveyors had no desire to dictate to the district surveyors.

Mr. Gladwell thought that the work which the carrying into effect of the resolution involved should not fall entirely either on the local surveyors or their authorities. If there were any value in what was sought to be done, surely it was a matter not merely of local but national importance, and it could therefore very well be made the subject of consideration by the Road Board as to whether they might not take the lead in the matter. He might mention that the Institution of Municipal and County Engineers actually had in hand the collection and classification of information of this description. As to the complaint that county surveyors should be under suspicion of desiring to do other than afford the utmost assistance to their humbler brethren, he would only say that as a class they were the finest body of men that any country could wish to possess. They had a pride in their work, but so had the little surveyor, who worked in a more circumscribed area and under greater difficulties, and it might be that with the advent of the county surveyor friction would occur without anyone wishing it to occur.

The Chairman said the proposition before the meeting seemed to him to be a most excellent one. What particularly struck him was the suggestion that highway authorities should give facilities for their surveyors to visit and inspect works carried out in other districts. He had often been impressed in talking to surveyors with their lack of knowledge of that character. He confessed he had always attached the greatest importance to engineers travelling about and seeing what was going on outside their own districts, and he was perfectly certain that the expenditure entailed in enlarging the experience of their technical advisers was in every way justified. As regarded the reports of highway surveyors, some officials already compiled most admirable and well-arranged reports, giving all possible information, but a great many did not, and it seemed that that state of affairs should be remedied. Therefore he was perfectly in sympathy with the suggestion which the resolution made that such reports should be universal; and, of course, if they were universal, it would probably be desirable that there should be conferences, as suggested, between surveyors as to the form of their reports. He did not favour the appointment of a committee by that conference, but preferred to look to the organised societies. The question had been raised as to who, if the dissemination of these reports was to be encouraged, was to bear the expense, and it had been suggested that the Road Board should be invited to undertake the duties. He was unable, of course, to give any assurance that the Board could do that, but if highway authorities throughout the country arranged to publish these reports, the Board would be perfectly willing, not only to be responsible for their collection, but subsequent publication. Mr. Boulnois had suggested to him that if highway authorities themselves did incur expense in circulating such reports, there might be a question as to whether the Local Government Board auditor would authorise it. That was one of the difficulties of Government audits, but if there were a general feeling among the members of their profession that the reports should be made available as had been suggested, he had no doubt that means would be found to get the Road Board to undertake the work.

The proposition, as amended, was carried unanimously.

DRAINAGE OF SUBSOIL WATER.

Mr. Dryland next proposed:—

"That the question of drainage of subsoil water from roads as distinguished from surface drainage is of pressing importance on many roads and in many districts, and should receive the special attention of road engineers."

This, said Mr. Dryland, applied to a great proportion of country roads. While in some cases, owing to the nature of the subsoil, such provision was un-

necessary, there were many in which proper provision for a firm road bed with adequate arrangements for keeping the subsoil a sufficient depth from the surface would be an economy. He had seen many roads considerably improved in that way. It frequently happened that although a road might have been drained in the past, the drains became ineffective as a result of the invasion of tree roots and crushing.

Mr. Purser seconded the proposition.

Mr. Reginald Ryves said that in supporting he wished to add a very short amendment or addition, because he thought that if they were considering the subject of drainage they ought to consider it as a whole. Owing to the unfortunate restrictions under which surveyors worked in this country, very few of them had any chance of attending properly to the drainage of the roads. So he proposed they should add to the proposition a few words that brought into consideration not only the subsoil water, but the water intercepted by the road as a work carried across the country, the addition he suggested being "and that the effective control of surface-water flows intercepted by the road is a matter of equal importance, both in itself and in its relation to subsoil and local surface drainage." That point was brought out by the heavy rains of last winter, when one did not have to go far from London to find roads that were nothing but watercourses for days and sometimes for weeks together. Yet in many cases it had nothing to do with the qualifications of the surveyor of the district as an engineer. It was the want of the necessary ground to take a ditch, and for the want of proper and suitable administrative arrangements that rendered impossible the provision of the necessary culverts. When engineers wanted to protect their roads by catch-water drainage they required some simple procedure for taking in the necessary width of land. There was an enormous amount of criticism of highway engineers at the present day, and there were those who pushed forward the view that the whole business of road engineering was badly managed, and that the present system would be superseded by something different. People who complained of a certain section of road did not stop to consider whether the highway engineer responsible for it had ever had an opportunity of taking a ditch along the hill-side above the road, but simply said how badly the roads were managed. His feeling was that if surveyors would insist on having the necessary facilities for carrying out their work, making known their requirements in no uncertain way, there would be no difficulty. Present-day procedure for widening roads practically involved recourse to the Road Board, and he saw no reason why, when a road passed along the flank of a hill, catch-water drains should not be provided. Many surveyors knew perfectly well that the lack of drainage of that kind gave rise to serious difficulty in many cases. He hoped his addition to the proposition would be accepted; the resolution itself, however, was of great importance, because the matter of subsoil drainage was one that was not very often faced on account of the expense.

Mr. Purser, rising on a point of order, observed that the motion dealt with subsoil water as distinct from surface water.

The Chairman said he did not think there was any question of order involved. What was proposed was simply to add to the resolution something to the effect that the drainage of surface water was also important.

Mr. Dryland intimated that he had no objection to the addition.

Mr. Cowan moved, as an amendment, "That the question of the improved drainage of roads is of paramount importance in many districts, and that greater facilities for such improved drainage should be afforded by suitable amendments of the law."

Mr. Gladwell, in seconding the amendment, observed that it was all very well passing these pious resolutions, but he thought Mr. Cowan's amendment was a constructive one which was certainly far in advance of any academic resolution.

Mr. Wakelam pointed out that under the highways law of 1835 they were already provided with the power to drain water from roads to any place they might choose, and he therefore questioned the necessity for any such amendment.

Mr. Ryves said he did not think the law gave them power to drain the roads effectively.

The Chairman suggested that the resolution might be passed as follows: "That the question of the improved drainage of roads is of pressing importance on many roads and in many districts, and should receive the special attention of road engineers."

This was accepted without opposition, and the meeting passed to the next business.

DEFINITIONS OF ROAD MATERIALS.

Mr. Reginald Ryves moved:—

"That the terms asphalt and bitumen and other terms used in connection with tar-bound or bituminous-bound roads should be defined by some authoritative body, and that the attention of the Road Board be directed to the matter."

Mr. Ryves said he thought he had hit upon something which was neither personal nor administrative nor even a matter of controversial engineering. He was sure that anyone faced with a question of definition was always willing to put the responsibility on someone else's shoulders, so that he did not anticipate much opposition to the proposition; but he thought the question was an important one, and one which occupied a great deal of the time of some people at the present day. It was important to know what was asphalt and what was bitumen, and when asphalt could correctly be described as pure, and so on.

Mr. H. Percy Boulnois, seconding, said there was no doubt they were in a state of great confusion on many engineering terms. He took exception to the word asphalt being spelt without a final "e"; it was a French word with an "e" at the end. The speaker instanced the variety of terms applied to the cross-fall of a road, that being called, among other things, camber, barrel, contour and head. Other words were similarly misapplied. The whole nomenclature required revision, and if the Road Board could take up the question and give them definitions of the various terms it would be a great benefit.

The following communication was received from Mr. A. E. H. Dussek: "I notice in The Surveyor of the 11th inst. that one of the five propositions to be submitted for discussion at the conference at Olympia 'asks the Road Board's assistance towards the definition by some authoritative body of the terms asphalt and bitumen in their relation to road engineering.' As I am afraid it will not be possible for me to attend this conference, perhaps you will allow me to repeat what I have previously stated in your columns—viz., that the correct definitions of asphalt, bitumen, asphaltum, pitch, etc., have been known since the introduction of these materials a great many years back. I think, however, that an authoritative body composed of a number of experts might with advantage—as I have also previously suggested—be formed to advise the Road Board in these matters, but for many reasons I am of the opinion that it would be advisable to leave manufacturers to make known their own particular goods to those who may be interested in same. Presuming, for instance, that some product sold under a registered trade name was by some chance wrongly officially classified, this could only result in confusion, and there are many materials being sold on the market at the present time under registered names that no one, I suggest, has the power to classify except the manufacturers or suppliers. In a pamphlet now being issued by my firm the classification of natural bitumens, asphalts, &c., has been dealt with, and copies of this pamphlet can be obtained by anyone applying for them. As this question of definitions of asphalt, bitumen, &c., is a matter in which I have already taken much interest, and hope to continue to do so, I trust you will kindly allow me to make known the views I should have been only too pleased to have expressed had I been able to attend the conference."

Mr. H. T. Wakelam observed that the matter was already before the Roads Committee of the Engineering Standards Committee.

Mr. Farnham agreed as to the confusion that existed, and thought it might be left to the Road Board to supply the definitions required. It was his hope that the question would be on the agenda at the forthcoming International Road Congress, and that a result of this would be that the terms at present in use in this and other countries would be standardised for international use. As the Road Board had started the work they might ask them to continue it.

Mr. Wakelam said he understood the Engineering

Standards Committee were working under the ægis of the Road Board.

The Chairman said that to a certain extent the last speaker was right. The Engineering Standards Committee had been requested by the Road Board to standardise quarry materials, and the board were meeting the cost of the work. He believed the committee also looked forward, after dealing with quarry materials, to attacking the question of the standardisation of bituminous materials, but whether the committee would require any pecuniary assistance from the Road Board he did not know.

Colonel Crompton said they would not. Sooner or later the committee would have the matter forced upon them. No one had suffered more than himself from the existing unfortunate confusion of terms, and there was no doubt they must come to a pronouncement on the question.

On being put to the meeting the proposition was agreed to unanimously.

The Chairman said they now had to consider how the several resolutions could be brought to the attention of highway authorities. It was, he thought, important that that should be done, and he suggested that the Editor of The Surveyor, who had made all the arrangements for the meeting, should be asked to send copies to all the interested bodies.

It being understood that this would be done, the meeting then closed with a cordial vote of thanks to Sir George Gibb for his taking the chair, this being proposed by Mr. Wakelam and passed with enthusiasm.

DUST ABATEMENT IN THE UNITED STATES.

NOTES FROM SUPPLEMENTARY REPORTS ON THE EXPERIMENTAL WORK OF THE UNITED STATES OFFICE OF PUBLIC ROADS.

Supplementary reports, describing the results of experimental work done by the United States Office of Public Roads from 1907 to 1910 inclusive, form the subject matter of a bulletin recently issued by that department. Attention is here directed to a number of passages from the reports, some of which throw light on the behaviour of particular materials or of road crusts made in particular ways, while others are of value as illustrating important considerations affecting road design generally.

Oil-cement Concrete.—The trials show the importance of making some change in the manner in which these crusts are put down, since furrows were formed at the joints separating the portions of the crust put down on different days. The principle here involved is, of course, that a road crust needs other than purely lateral support; the sudden change from pyramid support to sheer edge support with lateral resistance results in wear at the joints. It seems that the material has some merits as regards durability, and the wear-resistance of undisturbed parts of the crust was satisfactory.

Tar Crusts and an Oil-asphalt Crust.—At one place three experimental sections were put down, one being made with a crust grouted with refined coal tar, another being made with a "refined tar preparation," and the third with oil-asphalt. The two former set hard and smooth, and gave out a ringing sound under horses' hoofs. The oil-asphalt crust was, after more than a year, still soft and malleable when dug out with a knife.

Blast-furnace Slag.—Some of the sections made with blast-furnace slag become loose in the Spring thaw, but afterwards pack down to a smooth surface. A crust in which lime was used as a binder withstood the effects of wheels better than those of horses' hoofs, this being a road with defined wheel tracks. With a binder of waste sulphite liquor a slag crust was better binded than in some other sections. A slag crust bound with coke-oven tar was in better condition generally than any of the companion sections.

Sand-clay Crusts.—Several sand-clay crusts are described as giving satisfactory results. A road made in 1908 and inspected in 1911 was found to be "very hard, smooth, free from ruts or dust, and with uniform surface and crown." That such roads allow of continual maintenance is shown by the fact that this section had improved since the previous inspection twelve months before. This was also the case with another road, which gave a ringing sound under horses' hoofs, was in generally good condition, and responded well to proper attention and repair. Another road, recently repaired, was packing well, and a section which had been lately repaired by the addition of new material spread unevenly, was, nevertheless, closely binded and free from ruts.

SOME MATTERS OF PRINCIPLE.

Several sections are described as being, at the time of the inspection, free from mud or dust *although* there had just been heavy falls of rain. One expects to find roads dusty after drought and muddy after drizzle, or free from mud or dust *because* there has recently been a heavy fall of rain. The observers seem to have been at fault in this matter.

A point which is brought out prominently in some of the passages in the reports is the great importance of avoiding sudden changes in the nature of the crust. This was shown in several cases by the large amount of wear at junctions of road crusts with bridges, but the principle extends to corner patching, the vicious practice of patching road crusts with materials harder or tougher than the crust itself being only too frequently followed in England.

In several cases damage was done at the edges of the trial sections, or the shoulders of the road were rutted. In one such case the road was described as not wide enough for the traffic, while in another case the shoulders were "nothing more than dust heaps." On this road no repairs were done during the year before inspection, and there was no systematic maintenance. It is often overlooked that an economical road may, in some cases, be one with a narrow carriageway proper, the *shoulders* being systematically maintained in order that they may not be worn below the edges of the crust or be deeply rutted.

A number of the sections required, or seemed to require, no regular attention. Some engineers are definitely aiming at such results, but it is not yet evident whether the constantly maintained crusts or those that hardly need any attention will have the wider range under the traffic conditions of the immediate future. Generally, however, and the point is very important, newly made crusts of certain types laid on *good foundations* seem, for a few years, to need less attention than is ultimately found necessary. Whether this will lead to a type of crust the *whole* of which will be renewed every three or four years remains to be seen.

THE PREPARATION OF BILLS OF QUANTITIES.

QUANTITY SURVEYORS' ASSOCIATION CIRCULAR.

The following circular has recently been issued to the leading public authorities:—

"The council of the Quantity Surveyors' Association has repeatedly had its attention called to the growing and objectionable practice of public authorities advertising for tenders from surveyors for the preparation of bills of quantities. The association has therefore recently adopted a by-law under which any member tendering for or undertaking public work below the scale issued by the association in 1906 will be considered guilty of conduct prejudicially affecting the reputation of the association. The council thinks the time has arrived to check a practice so directly opposed to the production of responsible and accurate work, a practice unknown in any other profession, and totally inconsistent with the policy of those authorities who insist upon all workmen being paid the standard rate of wages. The council is at all times prepared and willing to confer with any public authority, and to advise them as to a reasonable fee to be paid for the preparation of bills of quantities, and it hopes this course may be the means of protecting public authorities from the consequences which frequently result from the employment of unqualified men who undertake work at a low rate of remuneration."

The Dominions and Town Planning.—A party of Australasian politicians visited Letchworth on Saturday on the invitation of the Garden Cities and Town Planning Association, which intends to organise lectures in New Zealand and Australia next year.

"Stellorite" Steel.—Mr. Herbert G. Coales, engineer and surveyor to the Market Harborough Urban District Council, writes: "Will any of your readers who have had steel for repairing picks, &c., from the Stellorite Company, Paris, give me the benefit of their experience?"

Paint for Ironwork.

By G. BASIL BARHAM, A.M.I.E.E.

The question as to the suitability or otherwise of various paints used in connection with ironwork has not received that degree of attention on the part of engineers which its importance undoubtedly merits. Every engineer, it is true, receives from time to time leaflets or brochures from one or other of the many paint-making firms. It frequently happens, however, that the subject is not of immediate interest, or that the information given is of a transparently biassed character. In either case the result is the same—the publication is either destroyed or filed away and forgotten.

It is, unfortunately, a fact that many paints recommended are quite inadequate for the protection of steel or iron structures; further, there are very few that will resist for any length of time the atmospheric conditions which art met with in many Midland and Northern towns. Electrical engineers are now turning their attention to protecting overhead transmission lines with some form of flexible varnish or paint, and in view of the extensive use which is being made, and which will continue to be made, of pigment as a protective of metal from atmospheric and electrical influences, it may be of interest to review the subject as briefly and concisely as possible.

The opinion is commonly held that, whatever paint is used for metal work, a very thick coating should be applied to ensure thorough protection. This idea is quite erroneous; a thin paint may be applied, as the vehicle will not sink into the surface of the metal, and a thin coating is far more flexible, and better able to give, not only to the expansion and contraction of the metal work, but to the strains arising from vibration. A hard coating is unable to follow the movements set up, and myriads of hair cracks are formed into which damp creeps and causes corrosion beneath the coating. The paint peels off, or becomes discoloured by rusty stains, and not only is the metal deteriorating beneath the paint, but the appearance of the structure is so bad that additional outlay in repainting will become necessary.

The pigment which a few years ago was almost invariably used for metal work was oxide of lead mixed with linseed oil in the proportion of from 18 lb. to 24 lb. of oxide to 1 gallon of oil. It was considered advisable to mix this immediately before using, and to cover it, after it had thoroughly dried, with two or more coatings of any other kind of paint that took the decorator's fancy from an artistic point of view. Everyone now is familiar with the objections which have been successfully urged against the use of lead oxide, and it is a fact that many other paints of a metallic character have been introduced from time to time which, so far from protecting the metal work, have set up electrical action and have had a worse effect even than lead oxide paint. It may be further stated that few mineral paints are free from acids, and very few indeed are durable, owing to their chemical composition. It has been pointed out that their constituents may enter into other combinations when dry and exposed to the atmosphere, and so induce corrosion. For these, as well as for other and more obvious reasons, it is of great importance that any paint used should be chemically indifferent both in a wet and a dry condition, in order to protect the metal work from chemical and electrical as well as atmospheric influences.

A further objection to metallic paints in which linseed oil is used as a vehicle is that the oil dries, not by evaporation, as many suppose, but by absorbing oxygen from the air and chemically uniting with it to form an entirely new substance. If a drier of any kind is contained in the paint the risk is greater than ever, as the function of the drier is to promote oxidation, with the result that the oil becomes burned, and what toughness and elasticity it possessed are seriously impaired. For these reasons no paint used for metal work should contain linseed oil as a binding material, more especially when it is remembered that the oil coating is not impervious to gases. While this feature renders a linseed oil paint very suitable for woodwork, it makes it quite valueless for construction work, as it permits air and moisture to have access to the surface. The linseed oil paints are formed, as a general thing, either with red lead, oxide of iron, or metallic brown, oxide of iron combined with sulphate of lime or venetian red, graphite or soft plumbago, or carbon.

These same pigments mixed with what are called "paint oils" are also obtainable. Expert opinion is to the effect that such paints are worse than useless for ironwork. They almost invariably contain such turpentine substitutes as benzine, petrol, or other petroleum products mixed with resin spirits or wood distillates to conceal the odour. The gum is generally provided from turpentine remnants, and is soon rendered inoperative by the petroleum; further, such paints frequently contain a large percentage of water, and actually act as rust producers. It may be said, therefore, that paints mixed with "paint oils" are unsuitable for metal work, inasmuch as they contain within themselves all the elements necessary to transform any gases present in the atmosphere into free acids.

As a vehicle for pigment, bisulphide of carbon occupies a high place, and is far superior to either paint oils or linseed oil. It would appear to act as a vehicle only, having no effect upon the pigment mixed with it. Tests show that it has no effect upon the metal work, and does not, as has been asserted, part with a portion of its sulphur when used on iron. Its chief drawback is its extreme inflammability, for which reason it cannot be used in a confined or ill-ventilated place for fear of explosion. The vapour given off is poisonous, and said to give rise to acute dementia in those who have been forced, by reason of their work, to inhale it diluted with air for any length of time.

With regard to pigments themselves, it must be remembered that these are subject, quite as much, if not more, than the vehicle in which they are carried, to the action of free gases in the atmosphere, as well as to electrical influences. Red lead, or lead oxide, is a pigment that is most liable to rapid deterioration when used on structural work where exposed to weather, as, for example, on a bridge or on steel supports for transmission lines. Sulphurous and carbonic acid gases eagerly attack lead oxide, and where steam containing such combustion gases or rain can condense or settle on iron work protected by red lead paints, the sulphuretted hydrogen and sulphuric acid formed quickly attack the metallic oxide as well as the metal surface which the paint is supposed to be protecting. It may be mentioned that red lead has a very great affinity for sulphurous and carbonic acid gases.

Iron oxides, which form the majority of paints of a red-brown colour, as tuscan red, venetian red, indian red, &c., are far from suitable for metal work. It may be said at once that the great majority of iron oxide paints are imperfectly oxidised, and contain sulphuric acid. Oxide of iron has a drying effect on the vehicle, and if this be of oil the result is that superoxidation occurs and the paint cracks, blisters, and peals away in flakes, in bad cases being actually washed off by rain. There is a further danger with iron oxide or rust paints used on steel or iron work. Unless the surface of the latter is quite free from rust when the paint is applied, or if the porosity of the oilskin has allowed atmospheric influence to set to work and corrode the surface, the rust applied as a pigment will unite with the rust formed through oxidation or corrosion, and the whole surface of the metal will thus be covered with a layer of active oxidising agent. This is more especially true when the pigment, as is generally the case, contains sulphur.

Graphite or plumbago is in itself a suitable pigment for metal, as it remains unaffected by any chemical or electrical action that may be brought to work. The trouble is to find a suitable vehicle for black lead, as with linseed oil it is merely gummed on to the metal work by the oil, and falls or washes off as soon as the latter loses its body. It is doubtful, moreover, if a paint composed of flake graphite covers a surface properly. The probability is that

minute portions would be left exposed to the atmosphere. It is held by some that the flakes of graphite will be certain to overlap one another much after the manner of the tiles or slates on a properly constructed roof. As a matter of fact it can be seen, under a microscope, that the flakes do nothing of the kind, but stand off from the metal at every angle from 1 to 90. Further, many spots will be found only covered by a thin and perishable film of oil.

Asphaltum, coal-tar, and petroleum refuse can only be considered as substitutes for pigments, and paints made with any of these substances are seldom reliable. Almost every bituminous paint will soften under the influence of the sun, and when the protecting layer is soft it is, as a general thing, porous. It has been said, and the statement has not been contradicted, that a thin layer of active rust will be found under all kinds of asphaltum paint exposed to an atmosphere containing acid gases, even where the surface appears to be perfect. This rusting continues until eventually the paint is caused to peel off in patches, disclosing the fact that the metal work is in bad condition.

Oxide paints not only afford no protection, particularly against electrical influences, to the metal to which they are applied, but, where the acid-laden damp is encountered, accelerate the pitting and decomposition of the metal work, producing, as they do, a galvanic action and a flow of current which is measurable.

To sum up, it will be seen that a paint, to be suitable for use on metal work exposed to varying atmospheric conditions, must have as a pigment some substance or combination of substances that will amalgamate with the vehicle employed so thoroughly that when spread over the surface which is to be treated a tough, flexible, leathery skin shall be formed which is indifferent to either chemical or electrical action. As such a combination might be difficult to obtain in practice, that paint must be chosen which conforms most fully to the requirements outlined. The ingredients must be capable of withstanding very severe atmospheric conditions, and consequently no oxides of iron, zinc, lead, nor other metal must be allowed to enter into its composition; and, further, neither petrol, water, benzine, turpentine, nor other liquids of a like nature must be present in the vehicle.

It would appear, therefore, that the engineer must not only abandon entirely the older forms of paints, but will be forced to pay attention to the claims of the specialist paint firms who have given close and serious attention to the subject of painting metal work. In connection with the question, the following table, showing the amount of materials of the ordinary kind that are required to make a gallon of paint, and the square yards of surface that can be treated therewith, will be useful to check the statements of such firms as to the economy in first cost that would result from the use of their patent or secret process paints. In connection with this table it should be remembered that light structural

Paint.	Vehicle: volume = one gallon.	Pounds of pigment.	Weight and volume of paint.	Square ft. covered first coat.	Square ft. covered 2nd coat.
			lb. galls.		
Red lead	Linseed oil	22·4	30·4 = 1·4	630	375
White ,,	,,	25·0	33·0 = 1·7	500	300
Iron oxide	,,	24·75	32·75 = 2·6	600	350
Graphite	,,	12·5	20·50 = 2·0	630	375
Asphalt	,,	17·5	30·0 = 4·0	500	300

work will average about 250 sq. ft. to the nett ton of metal, and heavy structural work will run about 150 sq. ft. per nett ton, while light corrugated steel (No. 20) has 2,400 sq. ft. of surface to the ton. Roughly, ¼ a gallon of paint per ton of structural steel is required for a first coat, and ⅜ gallon for the second coating, under average conditions.

Electric Lighting for Lytham.—The Board of Trade have signified their approval of the application by the Lytham Urban District Council for an electric lighting order. St. Annes opposed the application, and intimated that they were prepared to supply the Lytham area. A scheme has been prepared for Lytham which, if adopted, will entail a capital outlay of £27,500.

THE WHEEL AND THE ROAD.

DISCUSSION OF COLONEL CROMPTON'S PAPER.

In last week's issue was reproduced a paper entitled "The Wheel and the Road," which Colonel R. E. Crompton, C.B., R.E., submitted at a recent meeting of the Institution of Automobile Engineers. We now give a report of the discussion which followed its presentation.

Sir George Gibb said he had listened with great pleasure to the admirable paper by Colonel Crompton. The main purpose of that paper was constructive suggestion, though no doubt it contained some criticism. These road problems were at present in a transitional and very important stage of development, and it always seemed to him that they must keep before their minds the undoubted fact that they had a theoretical as well as a practical side. Colonel Crompton began with an allusion to the question of taxation, but he dropped the subject at once. He (the speaker) did not want to express an opinion on that point, but he ventured to point out that there was a little bit of fallacy in the idea embodied in one of the paragraphs. Colonel Crompton made use of an analogy and said that the road was maintained by one authority in the case of the railway. In the case of the railway, however, it must be remembered that the cost of maintaining the traffic and the vehicles was paid for out of the charges imposed on the passengers and goods that were carried on the vehicles. He was not quite sure, therefore, that Colonel Crompton's analogy would quite stand the test of examination. In his paper the author advocated very strongly the adoption of the carpeting method of dealing with road surfaces. The evolution of the road surface had been from water-bound to a bituminous-bound road, and now Colonel Crompton was advocating another step in advance by putting what he described as a carpet on what he described as a strong crust. The whole crust he divided into two strata, one a strong crust and the other the carpet, the function of which was to wear. He was not expressing an opinion as to the fitness or otherwise of the author's views; he was accustomed to weigh evidence, and he did carry him (the speaker) along with him, and he felt disposed to accept the accuracy of his view that it would be a distinct step in advance if the strong crust was made of bituminous-bound material always strong enough to carry the whole weight, and resist the strain put upon it, or nearly so, and then that the wearing carpet, which was capable of easy and cheap renewal, should be placed on the strong crust. Colonel Crompton was an advocate of wheels of large diameter and rubber tyres. Those were, he understood, the practical suggestions which he made, and it would be very interesting to hear what the designers of vehicles had to say with respect to them. He was sure they would all be interested in the picture they had seen on the screen of the road testing machine. Colonel Crompton was very hopeful of the success of that machine, and so far as he (the speaker) could judge he thought there was ground for his hopefulness. There was no doubt that one of the difficulties in connection with road work was the long time which it took to get to the end of the experimental work. A road surface lasted quite a long time, in some cases at all events, and time was an element in the problem which it was difficult to get over. The conditions of the actual road were so various and fluctuating that it was difficult to obtain the uniformity that was almost essential for working out certain results in experimental work. He thought, therefore, it was very important to combine laboratory experiment with practical work. With respect to the question of the road authorities, there was no doubt that they and the ratepayers had had to bear, and were bearing, a heavy burden, but he was afraid that a great many of them, if they had the privilege of reading the paper, would be surprised at Colonel Crompton's description of them as authorities who were cheerfully bearing the burden. He (the speaker) had not recognised much cheerfulness in their attitude. It was unquestionable that motor traffic had introduced new factors and burdens in connection with the maintenance of roads, and he thought there was a general recognition that that necessitated a reconsideration of the many wants in connection with the roads, and did entitle the ratepayers to equitable consideration by assistance to some extent from the national funds. Of course the best assistance which could possibly be given was assistance which it was in the power of engineers to

give, that was to say inventions and discoveries which would enable the road surface to be reconstructed with some financial assistance, so that the wear and tear of the new vehicles would not impose any undue strain on them or undue cost to the ratepayers. He knew that Colonel Crompton was most hopeful that engineers would be able to solve this problem, and he thought this paper would form a valuable contribution to that end.

Mr. Lanchester observed that one of the points raised in the paper was as to what extent designers were to consider the roads from the point of view of their work. The author stated that they (the designers) ought to build wheels to vehicles of 120 in. in diameter. A 10-ft. wheel! If any designer were to attempt to put 6 in. on the diameter of the wheel, and if it did not turn out to be a commercial proposition from the point of view of the road user, he would soon cease to be employed. It was, he thought, the duty of the road maker to adapt himself to the practical side of the motor. The author of the paper had something to say about making the surface of the road waterproof, but he did not deal with the question of frost, which was a very important one. He had seen the whole of the road from Coventry to Birmingham absolutely destroyed, with 4 or 5 in. of the road surface just as loose as if the material had been shovelled from a cart, entirely due to a severe frost coming on the top of wet weather. As to the road machine, how did it imitate road roller conditions? How could Colonel Crompton be sure that in building the track the conditions under the machine would be the same as roadmaking in actual construction? He had seen in wood-paved roads a line of wood have a groove as if the water had drifted with the traffic in one direction. If it were fast traffic they would expect the backward push to be the leading factor. Was it due to the horse or the motor, or how was it explained?

Sir J. Macdonald remarked that in considering the question of the road it was too often forgotten that we did not have good roads in the times when there was nothing but water-bound macadam. They could never have a good road with what was called water-bound macadam, and these were about as contradictory expressions as could be used. Macadam's principle was to use no water, if this was possible, his idea being that the road became homogeneous and tight bound by the traffic. When we came to road rolling this policy was altered. We began to use large stones, many as large as a man's fist, and bound the road with a quantity of dirt—he had seen it taken off the fields. It was not possible to make a good road in that way which would remain a good road in wet or dry weather. If it was given sufficient time to dry, and a slight amount of moisture was left to hold the dirt together, the result might be tolerably good; but if the weather was wet, the heavy traffic squeezed the stones down and the dirt up, so that the road became a mud field at once. After this the road man came along with a big, heavy scraper to spread the dirt to the side, to be used when the road was to be made up again. He did not know whether they remembered what the Thames Embankment was like in the days when it was made of water-bound macadam. It was about the worst road in Great Britain, so bad, indeed, that as a rule a driver preferred to go along the Strand with its congestion of traffic. At the present moment the traffic on the Embankment amounted, at the busy part of the day, between 10 and 12 o'clock, to not less than 1,600 vehicles per hour. He did not know whether any of them had examined the road, because it was a specimen of the road Colonel Crompton had referred to, with what might be called a carpet on the top of the crust. Passing from Northumberland avenue, where wood was laid, they came to the Embankment without meeting with the slightest change of the level on the asphalt, nor any change of level when they left the road. It was a very remarkable fact in connection with this road that there was no tendency to give way where they passed from one material on to another. They had seen a crossing where they passed from a macadamized road, and noticed the ruts filled with loose stones. Now, as was proved at the Thames Embankment, they could make a junction from one material to the other with the certainty that the surface would remain the same. Another remarkable fact in connection with this particular road was that there was never any mud or dust. Formerly it was a sea of mud and dust, except at odd times when it was not quite dry enough for dust. Now it never had any water during the day. The year before last, the driest we had had for a generation, that road was never watered during the day. Nobody had ever noticed this fact, nor had they been grateful. A great deal of damage was necessarily done to the roads, especially if they were heavy, by heavy horse traffic, because the horse picked out small holes. Potholes were said to be caused by motor traffic, but he passed over a road during the summer of 1911 where no motor traffic went in a month, and he found it full of potholes. Potholes were caused by the picking action of horses, or by large stones being used, the result being that water lodged, and matters were made worse when something came along and plunged into the holes. There were plenty of ruts in the days when there was nothing but horse traffic, and if they still wished to see them they need only turn off from many a main road. As a matter of fact, the rut was the best part of the road when it had been well rolled down. But they must not provide this sort of thing in the future, and he could say that in this and other respects Colonel Crompton had taught him a good deal, while also teaching him that a good deal more was to be learned by study. If they got a road sufficiently drained, and a road crust into which water could never enter, they got what was practically a perfect road. If a loose end occurred in part of the road it should be taken out and repaired by ordinary appliances, and the only breakdown of such a road would be when the carpet came to be worn down and it had to be renewed. They were now getting roads which could not be disintegrated by frost—that was to say, if they could keep the water out. What was wanted was a surface which was resilient, and a basis which would not be pushed one way or the other, and he would like to know whether experiments could be made to see how a macadam road was worn. They must get rid of the wearing action. Some friends of his own, particularly Mr. E. P. Hooley, county surveyor of Nottinghamshire, had done great work in that direction, while Colonel Crompton was one of the best investigators who ever lived, and they owed a debt of gratitude to all those gentlemen for what they had done, and for the promise of greater successes in the future.

Dr. W. C. Unwin did not think there was any doubt that by the study of materials in laboratories a kind of elasticity could be obtained at a reasonable cost. He had glanced through the other paper read that evening, and he confessed that the problem of the wheel was much more complicated than the author seemed to assume.

Mr. E. Shrapnell Smith, speaking from the point of view of the owner of commercial vehicles, said the problem of wheel diameter was one not easily solved, for if they got a 10-ft. or 6-ft. wheel there would be no end of difficulty in the matter of street obstruction, and also as regarded loading and unloading. If Colonel Crompton got a perfectly carpeted road, would he hold the same brief for the large diameter wheel, or would a small wheel be admissible?

Mr. Thorneycroft thought that means should be taken to prevent water from entering the road near the gutters by the construction of a narrow trench on each side for drainage purposes.

Mr. Wood said there did not seem to be any real difficulty in constructing a suitable road for motor traffic. The real problem was the construction of such a road as would be within the means of road authorities who had not much money to spare. If the new roads could be constructed on the lines suggested by Colonel Crompton with a surface of a bituminous mixture, he had no doubt that the income of the Road Board would be sufficient to maintain the whole of the main roads of the country. As to the road-testing machine, he did not think they could, as practical men, expect that such a machine would serve the purpose of testing what would happen to a road under actual conditions. A road was very much like a human being in so far that it could be trained up to a certain point, but beyond that it might collapse. The road-testing machine might be worked under circumstances which could never apply on a real road, and the test would not, of course, supply actual conditions.

Mr. Taylor observed that the road-testing machine was on the same principle as the tyre-testing machine used by tyre makers. They had accustomed themselves to the idea that the road and the car were indivisible, and he thought the paper had brought that out pretty strongly.

The Chairman (Mr. T. B. Browne, president of the Institution of Automobile Engineers) remarked that the matter of large wheels, to which Colonel Crompton had referred, had received the close consideration of designers. The size of the wheels at present used was, of course, a compromise.

Colonel Crompton, in reply, remarked that as to the size of wheels, Messrs. Fowler made 10-ft. wheels years ago, and reduced the damage to the roads enormously. His object was to call attention to the fact that rigid tyres, to do less damage to the road, would have to be increased in diameter. He believed 8-ft. wheels were the proper size for transport in new countries or crossing soft ground. Long-distance heavy traffic was really a burden to the roads, and he believed something should be done to reduce the "push" and damage done by it even if some little sacrifice were made in the loading facilities. As to the road-testing machine it would not, of course, do everything; but they hoped it would do a great deal. He felt certain the results would be such a year hence that they would say they ought to have had the road-testing machine many years ago.

NATURAL AND ARTIFICIAL BITUMENS.

VIEWS OF A MANUFACTURING FIRM.

We have received from the Dussek Bitumen Company a pamphlet setting forth very definite views as to the relative values of natural and artificial materials of bituminous nature, as well as some opinions in reference to the best ways of using bituminous materials in the making of road crusts. The fact that these expressions of opinion are presented in a pamphlet which is at the same time intended to advertise the special materials prepared by the firm does not necessarily deprive them of force, though it is desirable that the connection in which the views are expressed should be clearly understood.

The main points may be summarised as follows:—

Though there is no one ideal road, it is recognised that the best results are obtained when the stone is firmly bound up and held in place with a suitable bitumen matrix, and when an upper crust or carpet is laid on a solid and substantial foundation.

"Speaking with nearly thirty years' experience in the manufacture and handling of all kinds of bitumens, pitches, &c., we are fully convinced that in the case of road work—when questions such as durability, length of life, effect of cold, heat and wet, resiliency, softening and melting points, &c., have to be taken into consideration, and are of such great importance — materials prepared from natural bitumen will, in course of time, displace all artificial and perishable products. The natural bitumen used in the manufacture of matrix and for forming an upper crust or carpet must not only be of a tough, resilient and pliable nature, and yield slightly to pressure, but it must at the same time be sufficiently hard without being brittle. It is most important that it should also have a suitably high melting point, so that it is not easily affected by heat or variations in temperature. It must not, for instance, become hard in cold weather so that it will chip, nor in the summer must it become unduly soft."

However good a natural bitumen may be, it is necessary for it to be properly refined and suitably prepared for the manufacture of matrix and for use as a carpet or upper crust.

"Each natural bitumen has its own peculiar properties and characteristics, and the material that is suitable for one certain class of work would not necessarily be suitable for another, and for road construction certain bitumens are entirely unsuitable for this purpose, and although some of the materials that have been used in various ways answer temporary requirements it is apparent to anyone having had experience with different kinds of bitumen that the nature of many of them prevents them making a lasting success."

The term bitumen has been used in a somewhat loose manner, and distinction should be made between materials that are produced artificially and those that are natural.

The bituminous matter obtained from the distillation of petroleum oil has been said to be "pure bitumen," but Mr. D. A. Sutherland, F.I.C., F.C.S., says:—

". . . Bitumen is a natural product as opposed to bituminous products obtained as the result of destructive distillation or by other artificial means. . . . The characteristics of native bitumen are not shared by artificial products, and the natural product even at a higher price is preferred to the artificial."

Artificial bitumens obtained from the distillation of petroleum oil are in many ways inferior to natural bitumen.

"The melting point of many of them is low, and they accordingly become hard in cold weather and in the summer the heat of the sun softens them considerably. Artificial bitumen, in our opinion, is an altogether misleading term, and the proper definition, and the one by which peroleum residuum has always been known before the introduction of this for road work is petroleum pitch. Americans were the first to give this substance the title of 'pure bitumen,' but we do not think engineers in this country will readily agree to pay the same price, if not more, for an artificial material than for a satisfactory natural product."

Before it is possible to offer the correct and most suitable article it is necessary to know the class of bitumen required, or the purpose for which it is intended. No one kind of bitumen could be employed for the many purposes for which this substance is used.

In a material such as Trinidad bitumen the presence of mineral matter toughens the bitumen and enables it to withstand vibration, and the melting point is also largely influenced by it. It is impossible to make artificially materials which are the same as that produced by Nature, and all that can be done by hand is to imitate the analysis of natural bitumen, and for such work bitumen should not be judged by analysis.

"There is nothing either that has longer life or withstands climatic conditions better than natural bitumen, and as this is a very important point it is advisable to ascertain where the bitumen contained in any particular preparation is derived from, and seeing that all the natural bitumen deposits in existence in the world are known, and as these materials can be recognised by their properties and characteristics, it is possible, therefore, and a simple matter for those of experience, to trace whether the bitumen in question has been produced by Nature or is, say, a residuum from oil distillation."

The various native products contain different proportions of mineral matter, and it is impossible to say where asphalt begins and bitumen leaves off. In any case the correct terms for natural products of this kind are native bitumen or asphalt, and they may be of either hard or soft nature.

"*Rock Asphalt*—that is, limestone or sandstone naturally impregnated with a small percentage of bitumen — is found in France (Seyssel), Germany (Limmer), Switzerland (Val de Travers), Sicily, &c. The prefix of the word 'rock' is quite sufficient to distinguish this from the above native bitumens or asphalts, and there is no necessity to refer to the latter as asphalt without an 'e,' and the rock asphalt as asphalte with an 'e.' The difference in spelling is only liable to cause confusion, although it might be mentioned that asphalt is the English spelling, and asphalte and asphaltum the French and Latin words repectively.

"*Asphaltum and Manjak.*—These terms are applied to hard and practically pure forms of native bitumen. They are used in small quantities for the manufacture of varnish, &c., and are of a coal-like nature, being found underground, and in most cases are mined in the same way as coal. The cost of these materials is, for instance, about three to five times that of Trinidad bitumen, but they are not likely to be of much interest to those connected with the construction of roadways.

"*Pitch.*—Tar and coal tar pitch have, of course, been used so far more extensively for road work than any other materials, and no other pitch can compete with the latter in price. It is altogether inferior to bitumen, low initial cost being its only advantage. It has sometimes been given the fancy name of 'British bitumen,' and described as 'bituminous' or 'asphaltic.' The presence of this and other products of the tar still can always be detected by smell alone.

"*British Asphalt.*—This material, perhaps little known to road engineers, at one time was made extensively and used in place and as an imitation of mastic asphalt—a material prepared from rock asphalt —for dampcourse in buildings, &c. It is a composition of coal-tar pitch and sand, and is still manufactured to a certain extent for the above-mentioned purpose."

Office Conversations.

MORE OR LESS IMAGINARY.

[Contributed.]

XII.—The Intercepting Trap.

You mean to dispense with the intercepting trap? As unnecessary? And not only unnecessary, but dangerous to health? Hum—that's pretty tall. Of course—— The consensus of opinion of the Departmental Committee appointed by the Local Government Board is with you? That's something to conjure with certainly, and it rolls well off the tongue, but—— It's enough for you? Oh, I quite see that, but there's one little hitch. What's that? Oh, merely the local by-laws. You see, I'm here to administer them, and I've got to do it. Do I believe in the necessity for the trap? Don't I think it's an antiquated appliance? Hasn't my experience—— Hold on, Mr. Harlem, you're going a bit too quick. It's not what I think—it's what I'm paid to do without thinking. If we all ran away with the bit, there'd be the very deuce to pay. Whether I believe in the trap or not 's beside the question. The by-laws require it, and that's as far as I can go in a business conversation. Give me a call some evening when I'm off duty, and you can have my honest opinion. Then I don't believe in it? No, I'm not to be drawn. The trap's got to go in, and if you don't put it in the inspector won't pass the drain. That's a plain statement of fact, and not all the reports of all the Departmental Committees of all the Local Government Boards of the universe can shake it.

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Certainly. There's no reason why you shouldn't make an application to the council for special exemption. I don't say it 'll succeed, mind you; but make it by all means. Yes, the council 'll consult me, I have no doubt, and I shall give them my true opinion. And they'll act upon it? Ah, that depends upon what my opinion may be, Mr. Harlem. And there're always the by-laws to consider. Their administration is—— Hang the by-laws? Certainly; but that won't remove them from their indirect inclusion in the statute book. Do I really swallow all the by-laws? Too broad a question, Mr. Harlem—much too broad and sweeping. No man can be quite in agreement with everything upon anything. There will always be certain limitations and exceptions and so forth calling for special consideration, and that's where all hard-and-fast rules and regulations fail. Even in the case of the by-laws? Precisely, and I would be the last to recommend blind obedience to their requirements—— Except as regards the intercepting trap? No, I except nothing; but when I'm speaking to a builder—and I must regard you in that light, Mr. Harlem, seeing that you're building your own house—when, I say, I'm speaking to a builder my lips must be sealed. I've had some bitter experience, Mr. Harlem, and it's taught me to keep my opinions to myself. I may generalise—that's safe enough—but I'm not to be had again on the particular.

* * * *

I remember when I held my first chief appointment. It was in a small urban district, and the builders were an exceptionally bad lot for shameless scamping. One gentleman in particular must have spent the whole of his spare time in considering how to evade the by-laws. It must have taken him hours of careful thinking each week, and I'll confess that he "had" me more than once. I was always in hot water about his confounded buildings, and then, just when I'd resolved to take it out of him, he had me worse than ever. You'd like to hear about it? Well, I'll tell you. He came to me one day, and quite incidentally, in the course of conversation, asked my opinion as to the desirability of carrying party walls through the roof. It was one of my pet theories—and doubtless he knew it—that the requirement was farcical. If a man is putting in the very best work, I told him, there is no positive objection to his carrying a wall through. He'll leave a sound roof in any case, and the wall might as well come through as not. It'll be a waste of money, and that's about the end of it. "But in the case of property such as mine, Mr. Stockforth?" he urged. "You see I shan't go beyond filleting, and you know what that means in a year or two's time. You wouldn't expect me to go to the expense of stepped flashings and all that sort of thing?" In such a case, I replied (and I intended my retort to be withering in the extreme), in the case of property such as *you* put up, it's almost criminal to bring the walls through. The slates should simply be bedded upon the wall, so as to give the houses a chance of being dry at least from their top end. He thanked me with a smile and went away.

* * * *

Well, he was at work then upon a terrace of twelve houses, and bless me if he didn't bring his party walls up as I said and bed his slates upon them. There was the very deuce to pay at the next meeting, and I was instructed to serve him with notices and proceed without further report if the work wasn't done in fourteen days. The time passed and nothing was done, so proceedings were taken, and I duly appeared to prosecute. I gave my evidence in the usual way, just stated the facts, produced a sealed copy of the by-laws, and so on. Then came the builder's turn, and he absolutely twisted me inside out. I hadn't a leg to stand upon. Had I not told him that to bring his walls through would be criminal? Had I not expressly told him that the slates should be bedded upon the walls? I demurred. I was only giving utterance to an opinion, I—— "Yes or no?" thundered the little pettifogger he had engaged. I still objected, but the bench overruled me, and I had to say "Yes." "And now you come here, sir, and ask for the infliction of penalties upon my client for having carried out your instructions." They were not instructions, I argued—and again I floundered in a sea of protestation. It was not for me to give instructions, I said; my duty was to administer the by-laws and to see that they were carried out. I—— "Precisely," sneered the venomous limb of the law, "precisely, and safe (as you thought) in the protection afforded by the letter of the law, you wilfully misled my client, having in view all the time—I hope the bench will make a note of this—the taking of these proceedings." I was done. And those twelve houses remain to this day——

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With the slates bedded on the walls? Oh, no—not so bad as that. The council entered an appeal against the decision of the local bench, and won. No, I was very mercifully handled at the appeal—at least my evidence was—but I've never forgotten the lesson. It was well worth the humiliation I underwent, and perhaps you'll see now why I refuse to express my opinion upon the merits or demerits of the intercepting trap. My colleagues do? Oh, very likely—indeed I know they do; but then it's not when in conversation with a builder! Their words might be brought up against them? Yes, but never as having been conveyed in the form of a specific instruction in any particular case. There's all the difference, isn't there? Send on your protest by all means. Do what I can? No, I can hardly promise that; but I'll do what I feel I ought, and whether that'll be for or against you I must leave you to judge. No, I'm not in the least fearful that you'll treat me as that rascally builder did. But with age comes caution, and I'd sooner risk giving offence than giving myself away. You're not offended? Of course not—you're not *quite* the stamp of man that I have in my mind in these cases. Still, there you are—— Good-bye, Mr. Harlem, and don't forget the appeal!

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Bad smell, Mr. Harlem? Oh, that's a matter for Mr. Bankes. I'm not the sanitary inspector. You'd like my opinion? Yes, I can give you one safely on that, and if you seriously wish to know, I've not the least doubt that it's sewer gas you're suffering from. I should just think the children's throats *were* bad! *My* advice? Why, man, I distinctly refused to offer any opinion. The council? Oh, that was their matter, not mine. They consulted me first? Well, they did and they didn't, if you can understand what I mean. Asked me a lot of questions, got my answers, and then put their own construction upon them. My advice now is, put an interceptor in. The report of the Departmental Committee? Sewer gas purer than ordinary air? When you've had as much experience of these reports as I have, you'll appreciate them at their true worth. Pit my knowledge

against that of an expert committee? Oh, no, not my knowledge, but my experience, when it comes to applying it to individual cases.

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Do you conceive, Mr. Harlem, that your solitary vent pipe has been acting practically as a ventilator to the whole of the sewers of the district? No, of course, you don't. The system here was ventilated at one time, but complaints arose so frequently of this shaft or that grid, that one by one all these points were blocked up. The surface inlets (the grids) went first, and then the shafts, and I don't believe there are a couple left in the district. Consequently, when you gave a free drain, the gas rose buoyantly to the occasion, and your trapped inlets into the house have one by one been forced. I believe I mentioned in my last conversation with you something about limitations and exceptions calling for special consideration, and your case is one in point. Be advised now and have a trap put in. The council are considering the whole question of the interceptors now—it's down on the agenda for the next meeting of the Sanitary Committee—but whatever may be the outcome of it, retain yours until a good many more untrapped drains have been laid or a few score of interceptors removed. I might have told you all this before? You never asked me. Your request was for an expression of opinion on the merits or otherwise of the intercepting trap. I've given it now? Oh, no, I haven't. I've given you advice on your special case, which is quite a different thing. Moreover, the advice I give you conforms with the by-laws. The party walls still bulk ominously in my experience.

INSTITUTION OF MUNICIPAL ENGINEERS.

MEETING AT MANCHESTER.

A district meeting was held at Manchester on Wednesday of last week. Among those present were Messrs. A. R. Bleazard (district chairman), A. Bowes (vice-president), D. Barton (Stockport), A. Dempsey, junr. (Eccles), A. Foster (Salford), J. Howard (Worsley), W. Jackson (Manchester), R. J. McKenn (Heywood), J. Liddel (Stockport), J. B. Nuttall (Heywood), J. Seddon (Little Lever), J. W. Sunderland (Norden), E. Walker (Stretford) and J. W. Gleave (hon. district secretary). The district business was taken first, and at the conclusion of this a paper on "Sewage Treatment," by Mr. R. J. McKenn, Heywood, was presented for discussion. In this the author described at length the construction of a modern sewage works, commencing with the detritus tanks and dealing with each part in sequence, and concluding with a review of the various methods of treatment.

Following his paper, Mr. McKenn explained some drawings of various makes of automatic sprinkler fittings and photographs of Dibdin's slate beds, and in conclusion showed some samples of effluent drawn off a percolating filter at various depths to demonstrate the method of purification.

In proposing a vote of thanks to Mr. McKenn for his very instructive and able lecture, the Chairman (Mr. Bleazard) asked the former to tell the meeting whether he thought it possible to have too large a tank capacity, and what was his opinion as to the continuous flow over the quiescent system. Did he consider automatic valves for feeding sprinklers good? What was the maximum amount of sewage allowed to be treated on a percolating bed? Did he think percolating beds were better aërated from the top or the sides, and would a bed 6 ft. deep give as good results as one 8 ft. deep?

Mr. Arthur Bowes (Newton-in-Makerfield), who seconded, said that Mr. McKenn had compressed into his paper matter which could easily be expanded to half-a-dozen papers. Among the questions he would like the lecturer to answer were: Did he consider that beds 3 ft. deep would give good results, as he—Mr. Bowes—had that difficulty to contend with, and did he think that in such a shallow bed it would be better to lay the filtering medium direct on the concrete floor, or to have some method of holding the material off the floor (which would be conical)? Did he think automatic appliances better than those worked by hand? Alluding to the capacity of septic tanks, Mr. Bowes drew attention to the Royal Commission's recommendation of a 12 hours' capacity in lieu of the Local Government Board's requirement of 24 hours, and also said that he did not greatly favour Dibdin's slate beds.

Mr. J. Howard (Worsley) supported, and asked what was considered the economic depth of beds? Mr. E. Walker (Stretford), who also supported, referred to the land treatment or broad irrigation, and the help which a knowledge of the laws of Nature with regard to evolution gave to those who had sewage treatment to deal with. The proposition having been carried with acclamation,

Mr. McKenn replied, saying that it had given him great pleasure to prepare his paper for the institution, and he had benefited from the discussion. In reply to the various questions raised, he said that land treatment is the natural method of sewage treatment, and one by which the working cost may be considerably reduced. In the North this method was not so much in evidence as in the Midlands and the South, owing to the physical conditions and cost of land. Furthermore, land treatment called for a special knowledge of the science of agriculture. Dealing with the economic depth of a bed, and similar questions raised by Mr. Bleazard and Mr. Bowes, he stated that, generally speaking, the first condition governing the depth of a bed was the fall available. Where the fall was limited and shallow beds had to be adopted, they called for a larger superficial area, a finer filtering medium, a tank effluent practically free from suspended matter, and an even distribution on the surface of the bed. The area and size of medium depended on the composition of the sewage to be treated. A shallow bed, well laid and managed, would yield a good effluent. He did not consider it wise to lay the filtering medium on the floor of the bed, because, owing to any disintegration of the medium, an accumulation would form together with the general humus matter, and thus prevent an equal drainage of the bed, besides helping to reduce the working capacity (which would be aggravated as time went on), and preventing aëration at the bottom. Some method should be adopted, such as special half-round perforated drain pipes, and, better still, the Ames Crosta floor tiles, which made an excellent flooring, and besides providing a thorough drainage, allowed of a good aëration at the bottom of the bed owing to their special construction. Automatic appliances, well made, were, he considered, superior to hand-worked apparatus. The Ames Crosta automatic valves, in connection with their sprinklers, had been in operation at Heywood for eight years, and were working excellently. Mather & Platt, Limited, had an excellent method of automatic distributing apparatus, and Adams Hydraulics had a well-designed arrangement for working their revolving spreaders, besides their well-known syphons for use in contact beds. His own experience was that more reliance, as well as accuracy in timing, could be obtained by a well-designed mechanical apparatus than when the appliance had to be manipulated by hand. Regarding the slate beds, he thought that the saving in cost as the result of decrease in sludge was a strong point in their favour. The initial outlay might be greater, but the results obtained where this method of preliminary treatment was in use showed that the extra cost in the first case was more than balanced by the saving in maintenance when the sludge difficulty was considered. The aëration of percolating beds from the top or sides depended in the first case on the size of the medium used, and so far as aëration from the side went, depended on construction. In a percolating bed of medium filtering material, allowing the surface to be healthy, aëration would take place in a downward direction; but he would place more reliance on a bed being aërated from the side, especially if large clinker was used in the side construction instead of brickwork. The maximum amount to be treated on a percolating bed depended on the total capacity of the bed, the size of the medium, and whether the sewage was "strong," "average," or "weak." These conditions determined the maximum quantity which could be treated. The question of large tank capacity was somewhat indefinite. A tank only required to be sufficiently large to allow the effluent discharged to contain a minimum of suspended matter, and to be in a fit condition for bed treatment. As the capacity depended on these factors, a tank constructed in excess of such requirements was money ill-spent. He favoured the continuous flow through tanks. This method, allowing tanks were constructed as stated in his paper, made for a more thorough equalisation of the strength of the effluent than that from a quiescent tank.

Sewerage and Sewage Disposal at Guildford.*

By C. G. MASON, Assoc.M.Inst.C.E., Borough Engineer and Surveyor.

The drainage of the Borough of Guildford was not commenced until as late as 1893. The reason for the delay of such an exceedingly important work in a healthy and prosperous town like Guildford may be attributed to the fact that most of the residential property of the town is situated upon the chalk, which afforded an easy, economical and convenient means for the disposal of foul matters by allowing them to filter away through an open and porous subsoil, regardless of their ultimate destination. But this did not apply to the low-lying properties in the Wey valley, where the cesspools became waterlogged and overflows had to be made with the surface-water drains in order to mitigate the nuisance of constant clearance, thus allowing crude sewage matters to discharge into the river without let or hindrance.

When the Thames Conservancy obtained their additional powers they immediately began to press the local authority to bring forward a sewage scheme, and after many protracted discussions it was finally decided to invite competitive designs for the drainage of the town. Mr. Nicholson Lailey was the successful competitor, and his plans for the drainage of the old borough of 607 acres were eventually carried out.

In 1904 the borough was extended to nearly 4½ times its original size, making an area of 2,601 acres, and the authority had then to consider the revision of the old system in order to deal with the requirements of the added area.

The original scheme provided for drainage upon the separate system, the borough being divided into high and low level areas, the former gravitating to the sewage disposal works and the latter being raised to a point where it met the high level sewage, discharging through a syphon 1,297 yds. in length to the tanks.

About the time that the borough extension was contemplated the districts of Shalford and Artington, lying to the south and west of the town, were in turn pressed by the Thames Conservancy to undertake drainage schemes, and previous to this Stoke Parish in the north were in the same difficulty, and eventually had to drain the greater portion of their district and construct a sewage disposal works at a cost of £30,000, to satisfy the requirements of the board. The population served by these works was about 4,000 persons.

A year or two after the extension of the borough the Hambledon Rural District Council, under whose jurisdiction the Shalford parish lies, approached the Guildford Town Council to take the drainage from their district, and as the greater portion of the parish of Artington had been added to the borough it became necessary to reconsider the main drainage system in its entirety, especially as regards the low level area.

POWER FROM REFUSE.

The council were about this time considering the desirability of erecting a refuse destructor, and the author was instructed to submit a report showing how the power generated from burning refuse could be applied in the best possible manner. After several reports had been put forward the council decided to adopt a scheme for placing a refuse destructor to the south of the borough to raise the sewage from the district of Shalford into the high-level sewers, but this was eventually negatived on æsthetic grounds, as it was thought it would be a disfigurement of the landscape to place a pumping station anywhere to the south of the town. Further schemes were put forward, and after various proposals had been considered it was decided to build the destructor and power station where it now stands at the sewage disposal works.

Briefly, a description of the scheme is as follows:—

There was to be a four-cell destructor with two Babcock & Willcox boilers sandwiched between every other cell, thus dividing the plant into two units, one unit of which was to be capable of raising sufficient steam to lift the sewage from the town and the parish of Shalford to the tanks at the sewage disposal works. In the adjoining power station three sets of air compressors were to be installed, one set to be capable of dealing with the dry-weather flow (estimated at 700,000 gallons per diem), two sets to deal with the wet-weather flow (practically twice the above quantity), and one set to be held in reserve. Additional beds for a fourth set were also put down when the works were carried out. Air mains of 7 in., 5 in., 4 in., and 2½ in. diameter were laid in the direction of the several ejectors to lift the sewage through rising and gravitating sewers to the main ejector station in Drummond-road (which was the site of the original low-level pumping station), and thence to the new Fieldhouse tank at the sewage works.

By this scheme the low-level sewage, consisting mostly of trade refuse, is kept entirely separate from the high-level sewage, which is entirely domestic.

Before leaving the sewerage of the borough it may be of interest to mention that a detailed description of this scheme was read at the Home District meeting of the Institution of Municipal and County Engineers on October 15th, 1910, and may be seen in the "Minutes of Proceedings" of that body. [The Surveyor, October 21, 1910.]

THE SEWAGE WORKS.

Previous to the extension of the borough the sewage disposal works only included 25 acres, but the corporation have now purchased and obtained by the Extension Order of 1904 a further area of over 209 acres, making a total of 234 acres, the greater part of which is used at one period of the year or another for sewage purification.

I have referred to the area of the sewage farm as 234 acres, but of this area 17 acres is allocated to allotments and building sites, while the buildings, tanks, bacteria beds, &c., cover nearly another 6 acres, thus leaving 211 acres for the purification of sewage inclusive of 50 acres of pasture, which, of course, can only be used lightly.

There are practically two distinct works—viz., the original town works, which is known as Bellfields, and Woodlands, which was taken over when the extension of the borough took place. At the former works the tank accommodation consists of three rectangular tanks having a capacity of 400,000 gallons, and the new Fieldhouse tank, which accommodates 500,000 gallons. As before mentioned, the high-level or domestic sewage which comes from the residential districts of the borough gravitates through two syphons (laid under the beds of two rivers) of 15 in. and 9 in. diameter respectively, to the old rectangular tanks, and after screening is discharged through a double channel into these tanks alternately for natural sedimentation, the supernatant water being either drawn off through a floating arm or weired over into a channel at the end of the tanks, which in turn allows it to pass through iron channels over six roughing filters, thence being applied by an open distributing channel to the land.

It is proposed to reconstruct the six filters at the foot of these tanks, distribute the high-level sewage by means of rotary sprinklers over an increased depth of filtering media, and complete the purification by passing the filtrate over the adjoining land, which has been used rather too excessively in the past for the cleansing of tank effluents.

This refers to about two-thirds of the high-level sewage, as the remaining third is dealt with on bacteriological lines, that is to say, is passed diagonally through the deeper of the three rectangular tanks on to some coarse bacteria beds, in which it is held up for about two hours, and then discharged into a series of finer beds, where the same process is repeated, finally being run through tertiary beds direct to the river. The liquid sludge from these tanks, as well as from the new tank, is discharged on to 17 acres of undrained land through a 5-in. iron pipe, and immediately covered in.

The superintendent informs me that the sludge contains about 90 per cent of water, and that the average quantity per 1,000 gallons of sewage equals ·076 tons.

At times some considerable difficulty is experienced in clearing the small sludge main of the heavier matters, and the only way to overcome this difficulty is to turn on the air pressure through sludge rams—which generally seems effectual.

DISPOSAL OF SLUDGE.

The land upon which the sludge is discharged consists of a light, sandy subsoil, and lies fairly high in

* From a paper submitted at a meeting of the Association of Managers of Sewage Disposal Works on Saturday last at Guildford.

comparison with other land in the immediate proximity. It may be described as an ideal subsoil for the disposal of liquid sludge; in fact, before the corporation became the owners of these 17 acres, the farmer who then tilled the land had never been able to obtain a crop of any description from it, and, when the occasion afforded, gladly took all the sewage the corporation allowed him to have. I believe I am correct in saying that, the first year after the application of sewage to these two fields, he garnered a crop of something like 500 tons of roots where before he could never get a blade of grass to grow.

BACTERIA BEDS.

The following is a description of the five sets of bacteria beds which were constructed in 1900, at a cost of £4,216:—

The primary contact beds (400 sq. yds. each, or a total area of 2,000 sq. yds.) are contained within brick walls 9 in. thick, strengthened by piers and flying buttresses at the corners, the concrete floors and sides of brick walls being rendered in cement. Each bed contains 330 cub. yds. of burnt ballast or clinker (2 ft. 6 in. deep), broken to pass a 3-in. ring, and refused by a ½-in. mesh screen. The beds are drained by brick channels and agricultural pipes to a sump, and the flow controlled by automatic air feeds and syphons, supplied by Messrs. Adams, Limited, of Old Queen-street, London. These beds are capable of dealing with 18·8 gallons per square yard per day, the total contents being 1,650 cube yards.

The secondary beds are constructed in a similar manner to the coarse, the filtering media consisting of burnt ballast and clinker screened to pass a 1-in. ring, and being rejected by a ½-in. screen. The total area is 2,783 sq. yds., 2 ft. 6 in. deep, or about 25 per cent larger than the coarse beds, this being considered necessary by the Local Government Board at the time of their construction. There are also 456 sq. yds. of tertiary beds, varying from 4 ft. to 2 ft. in depth, which complete this part of the process, the water from the latter beds eventually flowing into the subsoil drains to the river. The tertiary beds are composed of the materials passing through the ½-in. and ¼-in. screens specified to be used in the construction of the other beds.

The land for the irrigation of sewage effluents is drained to a depth varying from 7 ft. to 3 ft. 6 in., and 4-in. breeze concrete tubes and agricultural pipes. The distance apart between the subsidiary drains (porous tubes) is 200 ft., and between the herring-bone drains (4-in. agricultural pipes) 100 ft.

The greater portion of the 234 acres consists of gravel and sand overlaid by 9 in. to 12 in. of sandy loam, and is, therefore, a most suitable subsoil upon which to irrigate sewage.

The main distributing carrier consists of half-round pipes laid on a 6-in. bed of concrete, capped with blue bricks, openings being provided at different points by stop-gates, or screw-down valves. This carrier is laid to a gradient of 1 in 1,000.

The other part of the farm is irrigated with sewage by means of an underground carrier consisting of 18-in., 12-in., and 9-in. concrete or stoneware pipes, with manholes built a sufficient height above the surface to enable sewage to be irrigated on the beds where required. These manholes have openings on either side fitted with screw-down penstocks, and a screw-down penstock on the main channel, so that any portion of the land can be used without interfering with growing crops on another portion.

The low-level sewage, including that from the parish of Shalford, discharges through a duplicate 15-in. syphon laid, as in the case of the other two, under the beds of both rivers to the new Fieldhouse tank, and is raised an additional 7 ft. to 8 ft. higher in order to meet the requirements of the Local Government Board, as the inspector who held the inquiry was of opinion the time may arrive when the tank effluent would be required to be treated through artificial filters before being discharged on to the land.

I do not intend to dwell too long upon the construction of the new tank . . . but I must say that the advantages which the patentee claims for this tank . . . have been amply verified during the time the tank has been at work. It is, in my opinion, a perfect sedimentation tank.

In conclusion it may be of interest to state that the largest quantity of sewage applied per hour for twenty-four hours is 20,000 gallons, and the smallest quantity 11,000 gallons, the greater volume, of course, being put on during the summer months — viz., August—and the lesser quantity in January.

CORRESPONDENCE.

For every ill beneath the sun
There is some remedy or none;
If there be one, resolve to find it;
If not, submit, and never mind it.
— Anon., *circa* 1843.

THE DRAINING OF MOOR ROADS.

To the Editor of The Surveyor.

Sir,—I have read with much interest the correspondence in your columns on the above subject. Mr. Maughan's letter is much the best, and the first portion is quite correct, especially with reference to the roadside "verge" grips which take the water from the sides of the road only. The cross channel in dispute is right across the road—wide and shallow—nothing like a V, but more of the nature of a scoop. Mr. Maughan, however, would make a good maker of laws through which the proverbial "coach and four" could be driven. In the first place he says it would be "fatuous" to do away with something, or demands his "pound of flesh," and immediately goes on to say, "it cannot be."

It is practically impossible to provide for the surface drainage or "wash" of the road in question without a grip, channel, or "check," or something of a similar nature to the one in use. I notice it has been described as a ditch, which is most misleading, when the width was 3 ft. 4 in., and its depth from 3 in. to 5 in. only, evenly scooped out.

It would be as well, perhaps, to give a description of the road. . . . Mr. Maughan makes me doubt if he comprehends the nature of the road in question when he talks of "tar-painting" the road surfaces! The road, 14 ft. to 16 ft. wide, leads up on to the moors at the end of the Hamilton Hills, in fact, runs up between the end of the Hamilton and the commencement of the Cleveland Hills, and, starting from the foot of the hill, rises, for a distance of, roughly, three-quarters of a mile, about 350 ft. It is sinuous, and in five or six positions, in coming down, no great distance can be seen in advance. The "grip" or channel where the accident happened is rather more than half way down, and 290 yds. higher up, where the road leaves the actual moor, is a gate across the road which is almost invariably shut. The channel runs obliquely across the road, and is quite easy to negotiate at a slow speed. The road at the point of accident is in cutting, and during the snowstorm of January last was 6 ft. to 8 ft. deep with snow. As you will understand, this snow could not be "ploughed," but was cut out by hand—a roadway of, say, 9 ft. wide. What amount of side draining can convey the water from this 9-ft. roadway in times of rapid thaw, and what about the ice on the road surface if a sharp frost follows?

This being a moor road, with some days scarcely a wheeled vehicle over it, and repaired by soft local stone (the nearest railway station is over 7 miles away down country), the crust is not maintained in that hard condition one expects to find in heavier-trafficked roads; consequently, in wet weather, when the surface is soft and the subsoil saturated, even one heavy-wheeled vehicle may make a track down which the water runs. No side drainage can catch this latter water, or "wash." With regard to camber, we do not find a big camber safe in hilly districts where vehicles, especially of four wheels, are likely to go.

In my opinion, and that of the majority of the people I have spoken to, the hill in question is not safe for, and should never be ridden down by, anyone on an ordinary cycle. There is great strain on the brakes (for which they were never fitted), and should they give out, or fail, woe betide the rider on this particular stretch of road, as well as any other user of the road unfortunate enough to be passing up or down at the time.

Mr. Maughan points out that "our roads should be made as safe as possible." Well, who does not think so? In fact, "everybody's doing it" (even shouting it) who are nowadays wishful of using the highways of England for travelling at speeds from 20 to 50 or 60 miles per hour. But, for my part, I think there is also another side of the question which should be considered first—viz., the very much larger number of individuals—women and children, young men and old men—who still, as in past years, wish to have at least their little narrow strip to walk along with safety, and deserve a share of thought and consideration.

We have in this district some of the finest surfaced roads between London and Carlisle, and I for one

wish to continue, if possible, further to improve them; but I do think some limit or comparison must be drawn between wide main through roads, or even secondary ones, and narrow, hilly, out-of-the-way moorland roads.—Yours, &c.,

Geo. Easdale,
Highway Surveyor to the Northallerton Rural District Council.

April 5, 1913.

ASPHALT AND BITUMEN.

To the Editor of The Surveyor.

Sir,—From the point of view of the manufacturer there was a good deal that was disappointing in the conference of surveyors held under your auspices at Olympia yesterday.

The last proposition, dealing with asphalt and bitumen, opened up common ground whereon the surveyor and the manufacturer might have met, and where some useful discussion could have taken place. Everyone was agreed that there exists a great confusion of terms, and that proper and authoritative definition is required, but all were content to leave it to some future occasion to decide upon the details of what action should be taken to bring that about. It is no injustice to surveyors to state that a very large number of them have the very vaguest ideas as to what really constitutes bitumen and asphalt, and with this lack of expert knowledge so common, it becomes a question as to where the Road Board is going for the information that will guide it in laying down the law.

The Road Board's engineer, Colonel Crompton, is doing a great amount of useful research work, and is undoubtedly an authority on the theory of modern road construction, but his actual experience with and knowledge of bitumens and asphalts does not go so deep, and, indeed, most of the work in which he is interested has been done with one class of material only—viz., petroleum residuum—though it is described as bitumen by Colonel Crompton and those interested in its exploitation for the purpose.

Personally I believe that the best way of settling this very vexed question would be for an advisory body to be appointed, the members of which should be selected from among authorities on the question, and whose expert advice would be at the service of the Road Board to assist it to a decision on a subject on which, at present, it has little information.—Yours, &c.,

Jas. Bastian.

39 Stanhope-gardens,
Highgate, N.
April 22, 1913.

TOWN PLANNING IN AUSTRALASIA.

To the Editor of The Surveyor.

Sir,—A paragraph appearing in several papers yesterday makes it appear that the British Association is sending an expert in town planning to Australasia next year. May I point out through your columns that this proposal emanates from the Garden Cities and Town Planning Association, the pioneer propagandist society in Great Britain, which organised a visit of Australasian statesmen to Letchworth Garden City on Saturday?

This association has asked the British Association to adopt town planning as a subject for discussion while in Australia next year, especially in view of the fact that a great national opportunity has been realised in the new Federal capital, and the Government of New South Wales is now building a garden suburb on the outskirts of Sydney.

It was to the Garden Cities and Town Planning Association's proposal that the Hon. W. A. Watt (Premier of Victoria) and the Hon. W. A. Holman (Attorney-General of New South Wales) referred in expressing the hope that so influential a body as the British Association would be able to adopt the proposal, and thus pave the way for a national movement throughout Australia and New Zealand in favour of the principles contained in "The Housing and Town Planning Act, 1909."—Yours, &c.,

Charles C. Reade,
Organiser, Australasian Town Planning Tour, 1914.

3 Gray's Inn-place,
London, W.C.
April 22, 1913.

INSTITUTION OF MUNICIPAL AND COUNTY ENGINEERS.

COUNCIL MEETING: OFFICIAL REPORT.

At a meeting of the council of the Institution of Municipal and County Engineers held at the offices of the institution, 92 Victoria-street, Westminster, S.W., on Saturday last, there were present Messrs. R. J. Thomas (president, in the chair), J. Young, H. T. Wakelam, W. T. Lancashire, T. Moulding, R. H. Dorman, N. Scorgie, W. H. Prescott, O. E. Winter, G. F. Carter, Chas. Brownridge, J. A. Brodie, J. W. Cockrill, T. W. A. Hayward, W. Harpur, W. N. Blair, Thomas Cole (secretary) and H. A. Giles (assistant secretary).

NEW MEMBERS, ASSOCIATE-MEMBERS AND STUDENTS.

Elected as Members.—Messrs. C. Gillard, chief assistant borough surveyor, Torquay; E. J. Willis, assistant surveyor, East Barnet Urban District Council; W. J. Ball, deputy borough engineer and surveyor, Crewe; J. H. Montgomery, deputy engineer and surveyor, Llanelly Urban District Council; T. Salvin, deputy borough engineer, Rotherham; G. Ross, burgh surveyor, Clydebank; W. Nicol, burgh surveyor, Callander; A. E. Jackson, borough engineer and surveyor, Southport; J. T. Shield, deputy borough engineer, Blackburn; H. Hamer, deputy borough engineer, Accrington; P. Cahill, engineer and surveyor to Dundalk and Ardee Rural District Council; G. Stanley, chief assistant engineer to Director of Public Works, Sierra Leone; H. D. Strange, borough engineer, Dorchester; W. W. Gandy, engineer and surveyor to Eastleigh and Bishopstoke Urban District Council; A. E. Dixon, highway surveyor, Southampton; S. Sills, assistant city surveyor, Rochester; C. C. Brown, resident engineer, Port Said Drainage; E. R. Lewis, surveyor to Cranbrook Rural District Council; R. C. Gordon (junr.), surveyor of highways, Buckingham Rural District Council; H. Blewitt, engineer and surveyor, Mutford and Lothingland Rural District Council; A. C. Wallingford, county surveyor, Soke of Peterborough County Council; F. E. Simpson, surveyor to the Heavitree Urban District Council; D. Mort, surveyor to the Lymm Urban District Council; C. A. Gill, deputy waterworks engineer Peterborough; P. E. Harvey, assistant surveyor, Worthing; E. Holloway, surveyor to the Evesham Rural District Council; R. H. Wyrill, borough engineer, Swansea; M. G. Gurney, engineer and surveyor to Linslade Urban District Council; F. J. Worden, surveyor to the Okehampton Urban District Council; J. J. Kirkland, county road surveyor, Midlothian; and J. J. Hannigan, county surveyor, Monaghan.

Elected as Associate-Members.—Messrs. T. Higgins, engineering assistant to borough engineer, Leicester; F. S. Coburn, engineering assistant to borough engineer, Leicester; T. Wood, engineering and surveying assistant to borough engineer, Leicester; F. W. Mann, assistant surveyor to borough engineer, Leicester; W. Bonn, assistant surveyor of roads, Ayr; A. W. Jakeway, first engineering assistant to the Hereford Town Council; H. S. Thorpe, engineering assistant to city engineer, York; G. Rigby, Public Works Department, Belgaum, India; H. C. Wainwright, assistant to county surveyor, Glamorganshire.

Elected as Students.—Messrs. G. G. Homan, borough engineer's office, Gillingham, Kent; T. W. Phillips, borough engineer's office, Bexhill-on-Sea; R. S. Heath, borough surveyor's office, Ossett; A. E. Lawrence, junior engineering and surveying assistant, Hereford Town Council; T. F. Allen, junior assistant surveyor Portslade-by-Sea Urban District Council; C. R. Brown, borough engineer's office, Douglas, Isle of Man; R. J. Moores, surveyor's office, Public Offices, Hampton; and T. W. Scott, Public Offices, Enfield.

THE LATE MR. WILLIAM WEAVER.

The president referred to the loss sustained by the institution in the death of Mr. Weaver, past-president, and stated that he had attended the funeral on behalf of the institution. It was resolved unanimously that a letter of condolence be sent to the family.

ARBITRATION CLAUSE COMMITTEE.

The committee recommended the council that the clauses submitted by the Confederated National Association of Master Plasterers, Plumbers and Slaters were not such as could be recommended for adoption generally, as the principle of sub-contracting does not apply in the London, South and West of England Districts, and they recommended that the suggested specification be forwarded to the North-Western, North-Eastern, East-Midland and West-Midland Districts for their opinions and recommendations, after which the committee will give the matter their further consideration.

ARBITRATION, STRIKE AND PAYMENT FOR LOSS OF SACKS CLAUSES.

The committee recommend the council to receive a deputation from the Builders' Merchants Alliance on Friday, May 23rd. The report was received and adopted.

INDEX TO "PROCEEDINGS," VOLS. 31-37.

The tender of Messrs. Clowes & Sons for printing the index was accepted.

NEW OFFICES COMMITTEE.

The committee reported the completion of the furnishing of the new offices of the institution at 92 Victoria-street, S.W.

The Surveyor
And Municipal and County Engineer.

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PARLIAMENTARY COMMITTEE.

The committee reported consideration of the Medical Officers Superannuation Bill.

DISTRICT MEETINGS.

May 31st was approved as the date of a meeting to be held in the North-Western District at Rochdale, and in the West-Midland District at Leek on June 28th. NOTE.—The date of the Rochdale meeting will probably be altered to June 14th.

TOWN PLANNING COMMITTEE.

The committee reported receipt of a letter from the Local Government Board sanctioning the payment of delegates' expenses to the Town Planning Conference provided that the authority only send delegates (not more than two, including the surveyor or other officer concerned with the working of the Act) to one meeting in the year, and that the nearest in the neighbourhood of the authority. Resolved: That a copy of the letter be sent to the clerks of districts represented in the institution as well as to the members of the institution; that the papers to be read at the Town Planning Conference be printed and issued before the meeting to members and delegates signifying their intention of attendance; and that a volume containing the papers and discussions be issued to delegates and members at 10s. 6d. and 5s. respectively.

Mr. T. W. A. Hayward was appointed delegate to the Summer School of Town Planning at Hampstead in August next.

AMSTERDAM VISIT.

It was resolved that visitors, being members of local authorities not concerned in any trade connected with municipal engineering, may be introduced to the meeting on application to the president.

INTERNATIONAL ROADS CONGRESS.

The president was appointed the official delegate of the institution to the congress.

STRETFORD MEETING.

The council resolved that Mr. Worrall's paper, read at this meeting, should be included in the "Proceedings."

CONFERENCE ON CONDUCTOR RAILS.

Mr. H. T. Wakelam was appointed delegate to a conference on the method of determining the conductivity of conductor rails.

ELECTION OF DISTRICT OFFICERS.

The president, as returning officer, reported the following gentlemen as elected to the district offices:—

SCOTTISH DISTRICT.—District chairman, F. G. Holmes; District representative, A. H. Campbell; District secretary, D. Ronald; Vice-president, J. Bryce.

IRISH DISTRICT.—District chairman, H. A. Cutler; District representative, R. H. Dorman; District secretary, M. Sellars; Vice-president, H. A. Cutler.

NORTH-EASTERN DISTRICT.—District chairman, F. Massie; District representatives, E. B. Martin, E. R. Matthews; District secretary, J. P. Wakeford.

NORTH-WESTERN DISTRICT.—District chairman, J. S. Brodie; District representatives, C. Brownridge, W. Stubbs; District secretary, A. W. Bradley.

EASTERN DISTRICT.—District chairman, H. T. Wakelam; District representatives, E. J. Elford, W. H. Prescott; District secretary, J. H. Webb.

SOUTH-WESTERN DISTRICT.—District chairman, H. T. Chapman; District representative, T. Moulding; District secretary, D. Edwards.

SOUTHERN DISTRICT.—District chairman, R. Read; District representative, L. S. McKenzie; District secretary, F. R. Phipps.

WEST MIDLAND DISTRICT.—District chairman, A. T. Davis; District representative, A. T. Davis; District secretary, F. C. Cook.

EAST MIDLAND DISTRICT.—District chairman, E. G. Mawbey; District representative, E. Purnell Hooley; District secretary, H. G. Whyatt.

METROPOLITAN DISTRICT.—District chairman, J. Patten Barber; District representatives, N. Scorgie, O. E. Winter; District secretary, N. Scorgie.

SOUTH-EASTERN DISTRICT.—District chairman, A. Dryland; District representative, P. H. Palmer; District secretary, H. W. Bowen.

NORTH WALES DISTRICT.—District chairman, J. P. Evans; District representative, E. Evans; District secretary, J. England.

SOUTH WALES DISTRICT.—District chairman, W. Harpur; District representative, G. A. Phillips; District secretary, H. Alex. Clarke.

INDIAN DISTRICT.—District chairman, H. Lane Brown; District secretary, A. F. Henderson.

SOUTH AFRICAN DISTRICT.—District chairman, W. Ingham; District secretary, T. W. Stainthorpe.

EASTERN DISTRICT MEETING AT OLYMPIA.

In the unavoidable absence of Mr. Alfred Fidler, the chairman of the district, Mr. H. T. Wakelam (Middlesex) was voted to the chair at the above-mentioned meeting on Saturday last.

The minutes of the previous meeting were read, confirmed and signed.

The chairman introduced the subject of the proposed Mutual Defence Fund, and after a full discussion, in which most of those present took part, the following resolution was carried unanimously:—

"That the district secretary be instructed to inform the general secretary that this meeting of the Eastern District members of the Institution of Municipal and County Engineers heartily supports the formation of a Mutual Defence Fund, but they suggest that, with a view to procuring as great a number of members as possible, the minimum annual subscription be fixed at 1s., and that the district secretary be asked to communicate with the members of the Eastern District inviting them to support the fund."

A vote of thanks to the chairman terminated the proceedings.

Business Announcement.—Architects and others will be interested to learn that Messrs. Parker, Winder & Achurch, Limited, of Broad-street, Birmingham, have opened a central showroom and office at 214 Gray's Inn-road, London, W.C., for the display of their door and window fittings, steel casements, hopper cheeks and window gearing.

Lamp-posts as Skittles.—A curious anomaly of the law regarding metropolitan management is that lamp-posts can be knocked down by vehicles with impunity, the *Standard* points out. At present only the drivers of the vehicles are liable, and as they rarely have the means, the local authorities can seldom force them to pay for damage done. In the old days of the horse, when vehicles were not so heavy and did not travel very quickly, the total of the damage was not of great moment. Now motor traffic is not only speedier, but heavier, and a slight collision will put a street lamp out of the perpendicular. Moreover, modern lamps are expensive, and an arc lamp-post costs the ratepayers £50 or £60. Hence the repair of damaged lamps has now become a serious burden, and local authorities are once more agitating for placing the legal responsibility on owners instead of drivers of vehicles.

Assistants' and Students' Section.

Conducted by SYDNEY G. TURNER, Assoc.M.Inst.C.E.

All communications in regard to this page must be addressed to The Editor, St. Bride's House, 24 Bride-lane, Fleet-street, E.C. *Envelopes must be marked "Assistants' Section" in the top left-hand corner. Correspondents are invited to submit questions for consideration and answers to the questions which appear. For the contributions considered to be the most meritorious, one or more premiums in books will be awarded monthly. Diagrams must be drawn to scale on separate sheets, ready for reproduction.*

THE MONTHLY PREMIUM.

Mr. D. G. Bevan, of Darlington, to whom the premium for March was awarded, has selected the following books:—

"Mechanics Applied to Engineering," by Goodman (Longmans).

"Practical Surveying," by Usill (Crosby Lockwood).

"Tables for Calculating the Discharge of Water in Pipes," by A. E. Silk (Spon).

These have been duly forwarded to him.

QUESTIONS.

This week answers are invited to the following questions:—

314. Concrete Roof.—It is desired to construct a semi-circular barrel roof in concrete of 50-ft. span, reinforced with expanded metal. Show the dimensions of the supporting walls, which are to be 15 ft. high from the top of the footings. The roof is to be ribbed with an extra thickness of concrete over the piers. (H. V. A., *Clapton.*)

317. Strength of Beam.—A rolled steel I beam of British Standard Section, 12 in. by 6 in., and weighing 54 lb. per foot, is capable of sustaining a load of 15 tons uniformly distributed over a span of 20 ft. What would be the safe load uniformly distributed which could be placed on either half of the lower flange? ("Pupil.")

320. Water Tower Design.—Design a small water tower to hold 8,000 gallons, top water level being 30 ft. above ground level, tank of cast-iron, framework of tower of steel. Show full calculations, including wind pressure allowances. (W. H. B., *Bocking.*)

321. Paving.—What is the correct method of setting out a paved road? Show how to work out the heights and cross-fall for a road 54 ft. wide, to be paved with a camber of 1 in 48 (channels each side are level). (P. G., *Chichester.*)

324. Oil Engines.—Assuming two engines of equal horse-power (4-h.p.), one an oil engine and the other a petrol, what would be the aproximate cost for running each engine for fuel and repairs? How would the costs compare with each other, including first outlay and oil, repairs, &c.? In regard to efficiency, which engine would be the more efficient from an economic standpoint? ("Griffo.")

325. Air Compressors.—How is the size of an air receiver calculated in connection with an air compressor? Of what thickness of metal would it be made if (1) of cast iron, (2) wrought iron, assuming it had to withstand a pressure of from 15 lb. to 40 lb.? Give any further particulars regarding same. ("Griffo.")

[The Editor is at all times glad to hear from readers who desire to submit questions regarding matters of general interest, points of daily practice, &c., for insertion in the "Assistants' and Students' Section." Questions which are published are taken into consideration, as well as other matter, in awarding the Monthly Premium.]

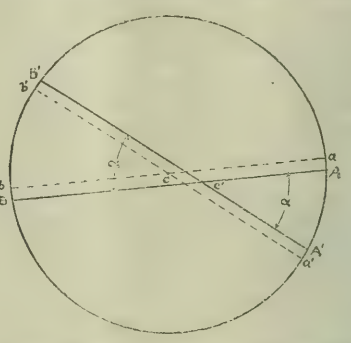
REPLIES TO QUESTIONS.

315. Surveying: Theodolite.—If the graduated plate of a theodolite is not correctly centred, how may the error arising therefrom be eliminated? Prove that the method adopted does eliminate the error referred to. (T. W. P., *Bexhill-on-Sea.*)

The effect of incorrect centering of the graduated plate of a theodolite is that the arc registered by one vernier will be different to that given by the other.

Thus, if the figure represents the graduated plate, the centre being C, and if the centre of rotation of the vernier plate occupies some other point as C^1, then for any angle α the A vernier will indicate the arc AA', and the B vernier will indicate a larger arc BB'.

Through C, the centre of the plate, draw aCb parallel to AC^1B, and a^1Cb^1 parallel to $A^1C^1B^1$. Then the angles aCa^1 and bCb^1 will be equal to the angles AC^1A^1 and BC^1B^1. Hence, if the theodolite had been in correct adjustment and traversed through the same angle as in the first assumption, the correct arcs given by the verniers would be aa^1 and bb^1. It can also be seen that the small portions of the arc Aa, Bb and A^1a^1, B^1b^1 are respectively



equal. That is to say, the arc AA^1 is just as much too small as the arc BB^1 is too large. Thus, the correct angle is the mean of the angles indicated by the two verniers.

In practice it is usual to read the degrees on one vernier and the minutes and seconds on both verniers. The mean of the readings of the minutes and seconds is then added to the reading of the degrees, thus giving the correct angle. (J. S., *Teddington.*)

323. Weight of Cement.—Taking the specific gravity of Portland cement as 3·1, then the weight of 1 cub. ft. of cement should be $3{\cdot}1 \times 62{\cdot}5 = 193{\cdot}75$ lb. As a matter of fact 1 cub. ft. of cement only weighs from 82 lb. to 104 lb. How is this difference accounted for? (J. R. H., *Rochdale.*)

The difference between the weight of 1 cub. ft. of cement and the weight of 1 cub. ft. of water multiplied by the specific gravity of cement—namely, 3·1—is that cement is produced in a very fine powder, and if you take a measure of 1 cub. ft. and fill it with this powder it will only weigh about 82 lb., but if you vibrate this measure so that the cement settles you would easily be able to get it to weigh 110 lb. This shows that the interstices between the small particles of cement are filled with air, and if you could eliminate these spaces altogether and get nothing but cement it would weigh 193·75 lb. per cubic foot. The finer cement is ground the lighter it becomes. If you take a piece of clinker from the kiln and find its specific gravity it will be, approximately, 3·15. (W.)

Building By-laws.—Mr. W. H. Eley, engineer and surveyor to the Newmarket Urban District Council, intimates that he would be glad if any surveyor who has recently had building by-laws approved by the Local Government Board would kindly forward him a copy.

Durham Sewage Disposal Works.—The sewage disposal works for the City of Durham were completed and officially opened last year by Lord Londonderry, and the effluent attained ever since has been exceedingly good. The one and only drawback was the lack of efficient screening and dredging of the sewage before it reached the pumps, which occasionally caused trouble in clogging the machinery. The town council, recognising this difficulty, at a recent meeting formally approved of a scheme prepared by the engineers, Messrs. Taylor & Wallin (Mr. Harry W. Taylor, Assoc.M.Inst.C.E.), of Newcastle-on-Tyne, for new apparatus of the latest and most up-to-date kind. Application is to be made to the Local Government Board for the necessary loan for installing this apparatus.

LOCAL GOVERNMENT BOARD INQUIRIES.

The Editor invites the co-operation of Surveyor *readers with a view to making the information given under this head as complete and accurate as possible.*

INQUIRIES HELD.

Cheshire C.C. (April 17th. Mr. H. R. Hooper).—£43,288 for extensions and improvements at the county asylum at Upton, Chester.—This is one of the two county asylums in Cheshire, the other being at Parkside, Macclesfield. The present proposal is an instalment of a scheme sanctioned in 1909, when £25,000 was granted for the enlargement and modernising of the institution. After the completion of the proposed new works, the city of Chester, which now has to send its patients to Middlesbrough, will have an arrangement for the reception of a minimum of 40 and a maximum of 80 patients. The total accommodation will be increased from 1,134 to 1,574. Accommodation will be provided for private patients. The inquiry was adjourned for further detailed information.

Chesterfield T.C. (April 16th. Mr. Edgar Dudley).—£2,062 to purchase property in South-street for improvement purposes.—It was stated that South-street is the inlet to the town from Derby, Bolsover, and Mansfield, and on account of its narrowness the motor 'buses have had to change their station from Low-pavement to Lordsmill-street. The proposed purchase would enable the street to be widened from 22 ft. 9 in. to 34 ft. 7 in. The purchase price was at the rate of £10 per square yard.

East Cowes U.D.C. (April 16th. Mr. P. M. Crosthwaite).—£986 for an experimental boring in the parish of South Arreton on a site situated some 5½ miles from the town.—The trial boring, for which the specification had been prepared by the surveyor to the council, Mr. Albert E. Barton, M.I.MUN.E., is the first stage in the execution of a scheme recommended by Mr. Percy Griffith, M.INST.C.E., F.G.S., in a report prepared by him some eighteen months ago. Mr. Barton, in his evidence, explained that the trial boring was to be 16 in. in diameter, and carried to a depth of 400 ft. below the surface, and that the estimate included 14 days' continuous test pumping. Asked by the inspector whether any provision had been made for driving headings, the clerk to the council explained that they had not dealt with this matter as yet, and the surveyor, in reply to the inspector, stated that the reason for making the trial boring of such large diameter was that if a sufficient quantity of water were obtained from it, it would serve as a portion of the permanent works, and the extra outlay on a well and headings would be avoided. Tenders had been invited for the work, and one had been accepted provisionally upon the consent of the Local Government Board being obtained. Mr. Percy Griffith stated that he should not have recommended so large an outlay on experimental works, as he was doubtful whether sufficient water could be obtained from a boring in the chalk; that he would have advised a small boring to ascertain the saturation level, and also to enable a sample of the water to be analysed. He also said it would be unlikely that any increase in the supply would be obtained by having the boring more than 200 ft. below the surface. The inspector afterwards visited the site of the proposed works, accompanied by the surveyor and Mr. Griffith. The estimated cost of the whole scheme is £17,000, although Mr. Griffith had suggested the possibility of restricting the initial outlay to a sum of £13,500.

Leicester T.C. (April 17th. Mr. Edgar Dudley).—This was an application for sanction to purchase land in Coleman-road, and the appropriation of the sum of £2,791 out of the proceeds of sales of corporate estate in defraying the cost of the purchase, also for approval of the purchase of land in London-road for the purposes of street improvement.—The town clerk explained that the first purchase was in respect of about 28 acres of land, at a cost of £2,700, which would be let for allotments. The second purchase was to enable the corporation to continue the widening of London-road.—There was no opposition.

Lincoln T.C. (April 17th. Mr. T. C. Ekin).—£12,500 for the extension of the electricity works, and £7,673 for a refuse destructor.—With respect to the proposed extension of the electricity works, evidence was offered by Mr. S. Clegg, electricity works engineer, and evidence as to the necessity of a refuse destructor was given by Mr. R. A. MacBrair, the city surveyor, and by Dr. Coleman, medical officer of health. It was stated that a suitable site had been obtained in the parish of Canwick.

Meltham (Yorks) U.D.C. (April 21st. Mr. C. H. Eyles).—£6,000 for a housing scheme.—It is proposed to erect twenty-two cottages on the elevated site (5½ acres) behind the Baptist Chapel, known as Broadlands. The council have agreed to its provisional purchase for £440. It is estimated that the expenditure will work out at £259 a year, and the rents at 4s. a week will produce £228 16s. Mr. J. D. Eaton Smith, who appeared for the council, said it was almost impossible, when a couple wished to marry, to find a house of any description. Dr. Gellatly, the medical officer of health, stated that there were in the district 160 back-to-back houses, 512 houses with two bedrooms, and 139 houses with one bedroom. The surveyor, Mr. F. W. Littlewood, said there were eight cellar dwellings in the district with bedrooms on the ground floor, and all were inhabited. As to overcrowding, he knew of one case where there was one bedroom and one living-room occupied by a man, his wife, three children, and two lodgers. It was a common practice for bedrooms to be divided by curtains only.

Melton Mowbray U.D.C. (April 22nd. Mr. R. H. Bicknell).—£1,063 for contemplated improvements at Beck Mill-street.—Mr. R. Barker, clerk, stated that two lots of property had been provisionally acquired for the purpose of widening Beck Mill-street, which connected Timber-hill with King's-road.

Towyn U.D.C. (April 19th. Mr. Courtenay Clifton).—This was an inquiry into an application for sanction to a loan for the construction of an outfall sewer, public lavatories, and new stables, the plans for which were prepared by the surveyor, Mr. R. Price Morgan.—Evidence was given by the surveyor, and the inspector expressed satisfaction with the site and plans. The outfall sewer is to be reconstructed, new piles driven, and the iron pipes lowered and relaid.

Tynemouth T.C. (April 7th. Mr. R. H. Bicknell).—£1,200 for the erection of additional stores near the fish market at North Shields.—It was explained that for some years the trade of the port had been increasing, and the council had from time to time extended the accommodation at the fish quay to meet the growing demand. The council are at present the owners of about twenty-four stores in the neighbourhood of the quay, but all the available buildings of this class were now let, and applications which had been received for further stores have had to be refused owing to the lack of accommodation. The present proposal is for the erection of seven stores, which it was expected would let for an annual rent of about £16 each, or £112 for the whole, in addition to which the tenants will pay rates amounting probably to about £35. Mr. J. F. Smillie, borough engineer, outlined the nature of the scheme in detail, and afterwards the inspector visited the sites of the proposed stores.

APPLICATIONS FOR LOANS.

Birmingham District Drainage Board. — £5,257 excess expenditure on the bacteria beds at Minworth Greaves, £14,473 for the extension of the rectangular sewage filters at Cole Hall works, and the cost of construction of railway sidings at Saltley for the Birmingham Electric Supply Department.

Bridlington T.C.—£1,250 for the purchase of land for a depot.

Brighton T.C.—£3,650, for a period of forty years, and £474 for thirty years, in respect of the St. James's-street improvement.

Buckingham R.D.C.—£170 for the purchase of a site for an isolation hospital.

Burton-on-Trent T.C. — £4,000 for the duplication of the sewage rising main.

Chertsey R.D.C.—£1,873 for private street works.

Cockermouth R.D.C.—£620 for works of sewerage.

Coventry T.C.—£38,149 for works of sewerage and sewage disposal.

Croydon T.C. — £96,000 for the construction of a reservoir and other works.

Finchley U.D.C.—£2,700 for road widening and improvement.

Forres T.C.—£450 for works of street improvement.

Goole R.D.C. — £1,360 for the Swinefleet water scheme.

Hitchin R.D.C.—£1,050 for the purchase of a site for an isolation hospital.

Llanelly U.D.C.—£5,670 for the erection of twenty-six workmen's dwellings.

Moffat T.C.—£600 for the sewage disposal works.

Okehampton R.D.C.—£1,350 for the erection of six workmen's cottages.

Ramsgate T.C.—£6,500 for the construction of new gas purifiers at the gasworks.

Stoke Newington B.C.—£2,050 for street widening.

Taunton T.C.—£3,800 for works in connection with the French weir penstock.

Walsall T.C.—£3,000 for extensions of electricity mains.

LOANS SANCTIONED.

Aberavon T.C.—£6,400 for the erection of water supply works.

Brighton T.C.—£1,000 for the furnishing of the grammar school.

Bromsgrove R.D.C.—£2,300 for sewerage works.

Cheadle R.D.C.—£471 for a water supply scheme.

Croydon T.C.—£8,000 for a fire station at Thornton Heath.

Doncaster R.D.C. — £3,665 for the Askern sewage scheme.

Hayes U.D.C.—£1,650 for sewage disposal works.

Lichfield R.D.C.—£530 for street improvement and repairs.

Mansfield T.C.—£230 for an electric light installation at Mansfield Woodhouse.

Mirfield U.D.C. — £3,850 for works of sewage disposal.

Ossett T.C.—£500 for water main extensions.

Salford T.C.—£14,000 for the extension of the town hall buildings.

Swansea T.C.—£4,000 for paving works.

Westbourne (Sussex) R.D.C.—£425 for enlarging the Emsworth main drainage sewer.

FORTHCOMING INQUIRIES.

APRIL.	£
28.—**Ashford.** For the purposes of sewage and refuse disposal (Mr. Edgar Dudley)	2,540
28.—**Nuneaton.** For the purchase of a motor car and road works (Mr. R. H. Bicknell)	500
29.—**Bingley.** For the purchase of a motor fire engine and street works (Mr. A. A. G. Malet)	20,930
29.—**Bognor.** For works of storm-water drainage (Mr. M. K. North)	150
29.—**Croydon.** For the provision of a hospital (Mr. F. St. George Mivart)	3,100
29.—**Hendon.** For private street improvements (Major J. Stewart)	3,693
29.—**Keighley.** For the electricity undertaking (Mr. T. C. Ekin)...	7,000
29.—**Loughborough.** For the purchase of a motor fire engine (Mr. R. H. Bicknell)	1,200
29.—**Ramsgate.** For municipal office extension (Mr. Edgar Dudley)	750
29.—**Stratford-on-Avon.** For sewage disposal purposes (Mr. A. G. Drury)	1,000
30.—**Barton-upon-Irwell.** For works of sewage disposal (Mr. A. A. G. Malet)	1,600
30.—**Chatham.** For street widening works (Mr. Edgar Dudley)	2,040
30.—**Isle of Wight.** For works of water supply (Mr. M. K. North)...	559
30.—**Ledbury.** For sewage disposal purposes (Mr. A. G. Drury)	2,450
30.—**Oundle.** For hospital purposes (Mr. W. W. E. Fletcher)	1,500
30.—**Shipley.** For the electricity undertaking (Mr. T. C. Ekin)	5,700
30.—**Shepley.** For works of sewerage (Major C. E. Norton)	—
30.—**Wood Green.** For baths and fire station purposes (Major J. Stewart)	6,490
MAY.	
1.—**Bath.** For works of sewerage (Mr. A. G. Drury)	17,000
1.—**Carshalton.** For street improvement purposes (Mr. Edgar Dudley)	500
1.—**Lewes.** For the purchase of property for municipal offices (Mr. M. K. North)	3,000
1.—**Northwich.** For the erection of public baths (Mr. A. A. G. Malet)	11,732
1.—**Salford.** For electricity purposes (Mr. T. C. Ekin)	35,900
1.—**Southampton.** For isolation hospital purposes (Mr. W. W. E. Fletcher) ...	2,250
1.—**Torquay.** For furnishing the new town hall (Mr. W. H. Collin)	5,000
1.—**Walthamstow.** For street improvement purposes (Major J. Stewart)	1,023
2.—**Coventry.** For sewage disposal purposes (Mr. A. A. G. Malet)	38,149
2.—**Derby.** For electricity and street purposes (Mr. T. C. Ekin)	14,297

WATERPROOFING OF CONCRETE.

Mr. H. Kerner-Greenwood writes: "In your notice of the lecture given by Mr. Percy J. Waldram before the Surveyors' Institution I notice it is stated that reinforced concrete is 'almost waterproof.' We find that the exhibit which we have arranged at Olympia to prove that cement concrete can be made absolutely waterproof has attracted the notice of engineers to a most remarkable extent. From the opening of the exhibition to the close three of my assistants have been engaged without cessation during the whole fortnight in answering the interesting questions which have been put to them with regard to our powder, which certainly waterproofs cement without adversely affecting the tensile or compression strains.

"In his paper, too, Mr. Waldram, in discussing the question of rural housing by means of reinforced concrete, says that the walls should not only be weather-proof, but damp-proof, and he suggests an ingenious system of thin slabs screwed on to timber framework, and then rough cast or merely pointed. Of the many thousands of letters sent to us the great majority are with regard to the porosity of existing rough-cast work, for no plastering holds the water so much. If it is sand dashed, the water is held in the little cups which are formed, and driven into the work by the next gust of wind; and if it is pebble dashed the pebbles pierce the work to a great extent. For the latter work we only suggest that 'Pudlo' should be used in the first coat, and it is then a most economical method of waterproofing the side of a house. I notice that in the cheap cottage which was built for Messrs. Rowntree at York, and about which there has been much comment in the papers lately, the architect used 'Pudlo.' It may seem like self-advertisement for me to write like this, and I should certainly not have the temerity to do so unless I were absolutely convinced that I have in 'Pudlo' a material which will certainly prevent porosity and be of considerable gain to architects."

Liverpool Corporation Tramways.—During the year 1912, according to the annual report of the general manager, Mr. C. W. Mallins, Assoc.M.Inst.E.E., the Liverpool Corporation tramways carried 134,249,967 passengers, the mileage covered being 12,590,408, and the receipts £631,071.

Bradford Waterworks Proposals.—During the consideration on Wednesday by a Select Committee of the House of Lords of the water clauses of the Bradford Corporation Bill, counsel announced that the local authorities of Birstall, Cleckheaton, Farsley, Gomersal and Shelf had decided to accept the offer of the corporation to be under the obligation of supplying water in bulk or in detail, at a price to be agreed on by arbitration, the corporation to purchase the pipes and distribution works of the distributors.

Main Road Maintenance in Herefordshire.—Owing to the great increase in the cost of road maintenance the Hereford County Council, with the consent of such district councils as agree, have determined to take over the maintenance of the main roads in the county which have hitherto been maintained by those district councils, and the district councils are requested to co-operate with the county council by employing, on behalf of the county council, the necessary labour, and, on terms to be mutually arranged, using their plant in the maintenance of the main roads, the district surveyors also being employed to supervise the work of maintaining the main roads under the direction and supervision of the county surveyor.

Municipal Work in Progress and Projected.

The Editor invites the co-operation of Surveyor *readers with a view to making information given under this head as complete and accurate as possible.*

The following are among the more important projected works of which particulars appear below: Buildings — Bath, Nottingham £11,000, Wallasey £100,000; housing and town planning—Tilbury; roads and materials—Brentford, St. Pancras, Southwark; sewerage and sewage disposal—Coventry £38,149, Stowmarket £5,314, Tenby £14,000, Turton £8,364; water, gas and electricity—Bedwellty, Sheffield. Particulars of other works projected will be found in our "Local Government Board Inquiries" pages.

BUILDINGS.

Bath T.C.—Plans are to be prepared for the enlargement of the public baths.

Blackburn T.C.—The Watch Committee have recommended the erection of a fire station on the Wrangling.

Cuckfield U.D.C.—A scheme for the provision of a depot is to be carried out at a cost of £330.

Kingsbridge U.D.C.—The surveyor, Mr. J. Hole, has received instructions to mark out a site of three-quarters of an acre for the purposes of a cattle market.

Llandudno U.D.C.—Sketch, plan, and estimate are to be prepared for open-air baths and dressing-sheds on the foreshore.

Marylebone B.C.—Tenders are to be invited for the erection of a new town hall in the Marylebone-road close to the Royal Academy of Music. The site was purchased from Lord Portman for £50,000, and it is expected that the total cost will be about £120,000.

Northampton T.C.—A scheme has been adopted for the erection of washhouses and slipper baths in Bath-street, at an estimated cost of £4,000.

Norwich T.C.—A diver has been employed to examine the foundations of various city bridges, and urgent repairs have been found necessary, and are now being executed at a cost estimated at from £150 to £200.

Nottingham T.C.—The proposal has been adopted to erect public baths on the old tram stables site, at an estimated cost of £11,000.

Stirling T.C.—It has been agreed to inform Mr. Runciman that the council are prepared to spend £800 upon the erection of a pavilion in the King's Park.

Stoke-on-Trent T.C.—The new central power house for electricity purposes at Hanley has been formally inaugurated. The building has been erected under the direction of the borough surveyor, Mr. A. Burton, at a cost of £60,000.

Wallasey T.C.—It is sated that the Local Government Board have approved of the North Mead site, Brighton-street, Seacombe, on which to erect the proposed new town hall. The scheme will involve an estimated expenditure of £100,000.

HOUSING AND TOWN PLANNING.

Clitheroe T.C.—It has been decided to purchase a plot of land, at a cost of over £1,200, at the Salford end of the town, for the purpose of erecting houses for the working classes. It is proposed that each house shall be of the value of £10 per year at least, and shall contain three bedrooms and a bath. Another portion of land is to be used as a public recreation ground.

East Preston (Sussex) R.D.C.—A scheme for the laying-out of a model garden seaside village at East Preston was before the council recently, the plan being submitted by Mr. Wm. Hollis, of Finchley. The building surveyor (Mr. R. R. W. Hyde) said the proposal was to erect 286 houses—mostly bungalows—built of slabs of patent concrete with rough cast exterior and asbestos interior, and the plan also provided for golf links and a pier. The promoters would lay out the estate if the council would amend the existing by-laws in certain directions, and relax the restrictions with reference to the thickness of walls for dwelling-houses. Several members expressed the opinion that the by-laws were too restrictive for a rural district, but it was pointed out that no direct application had been made to the council for a modification of the by-laws in connection with this particular scheme, and the chairman said the consideration of the plan was quite informal, and was not really before them. After further discussion as to the by-laws, it was decided to pass on to the next business. In the course of the debate Mr. Drewitt threw out the hint that the Local Government Board if appealed to might allow the local by-laws existing in the district to be varied so far as the method of construction of the houses was concerned.

Llanelly U.D.C.—A scheme has been approved for the erection of twenty-six workmen's dwellings on the Morfa estate.

Northampton T.C.—A housing scheme has been sanctioned for the provision of thirty-one dwellings, at a rental of 4s. 6d. weekly.

Pembroke (Co. Dublin) U.D.C.—All the housing schemes promoted by the council have practically received the sanction of the Local Government Board. Loans have been approved for the housing schemes for Ballsbridge and Irishtown, and orders have been made by the inspector (Mr. P. C. Cowan) giving the council power to purchase compulsorily all the land required for the other housing schemes, with the exception of a small portion of the Clonskeagh site.

Tilbury U.D.C.—Messrs. Pepler & Allen, architects of the housing scheme, have received instructions to prepare alternative schemes for laying out houses in blocks of four and in pairs.

ROADS AND MATERIALS.

Aberdeenshire C.C.—A report is to be prepared on the condition of the Inverurie-road, with a view, if thought desirable, of submitting a scheme for its improvement to the Road Board.

Aylesbury R.D.C.—A site for sewage outfall works is to be purchased for £300.

Bradford T.C.—The Street, Drainage and Works Committee propose to pave the carriageway in Wapping-road with granite setts, at an estimated cost of £3,208; and to pave Godwin-street, from Westgate to Darley-street, with wood blocks, at an estimated cost of £1,153.

Brentford U.D.C.—The surveyor, Mr. J. W. Croxford, has submitted an estimate, amounting to £130,000, for the widening of High-street, and the council have forwarded it to the county council with an intimation that they would be prepared to make a contribution, not exceeding £15,000, towards the cost.

Donegal C.C.—A grant of £10,000 is to be made by the Road Board on condition that a halfpenny rate be struck for the improvement of existing maintenance contracts, the grant being applied to the resurfacing of leading roads to be approved by the board. The board have also agreed to lend a sum of £5,000, free of interest, repayable in five years, to facilitate the improvement of leading thoroughfares.

Downpatrick R.D.C.—Road improvements are to be carried out at a cost of £500.

Fulham B.C.—The widening of North End-road on the west side, between Hammersmith-road and No. 10 North End-road, is to be undertaken at an estimated cost of £7,300, the London County Council having agreed to contribute one-third of this sum.

Harrogate T.C.—The corporation, who have now used Akonia for several years for dust prevention, have again decided to use this preparation during the coming season.

Hove T.C.—The sea front, as has been the practice during the past few years, is again to be treated with Akonia this season.

Inverness-shire C.C.—The Badenoch District Committee have accepted the following tenders for road improvements in connection with which the Road Board have sanctioned a grant: For improvements on the Perth-Inverness and the Newtonmore-Fort William roads, Messrs. Kings & Co., Glasgow (£4,287); for the steelwork of Laggan Bridge, Motherwell Bridge Company, £1,350; for the masonry work of Laggan Bridge, Mr. James Macdonald, Kingussie, £332.

Kingston (Surrey) T.C.—It has been decided to make up with Plascom a portion of Maple-road.—The borough surveyor, Mr. R. H. Clucas, has been autho-

rised to appoint an assistant storekeeper at 25s. a week.

Lewisham B.C.—Bellingham-road is to be paved as a "new street" for about 963 ft. eastwards from Bromley-road.

Lichfield T.C.—The War Office, the Staffordshire County Council, and the Road Board are to be appealed to for contributions in aid of the widening of Tamworth-road.

Newry U.D.C.—It has been decided to lay down square setts on the quays, at an estimated cost of £3,471.

St. Pancras B.C.—The Road Board have informed the council that they are prepared to contribute £6,000 towards the total expenditure of £30,749 for the repaving of certain thoroughfares in the borough, their contribution to take the form of a grant towards the £9,385 which will be spent upon the bituminous macadam part of the work. The Road Board's consent to make a grant of £6,000 having been received, application will be made to the London County Council for sanction to the borrowing of £21,364 for the granite paving works.

Saltcoats T.C.—The council have adopted a report by the burgh surveyor on the general condition of the roads within the town, and have resolved to expend £600 on their upkeep. Of this amount £110 will be utilised for tar work.

Somerset C.C.—It has been agreed to make a grant of £260 towards the cost of widening Walliscote-road, Weston-super-Mare. The Road Board have promised to contribute £270.—Application is to be made to the Road Board for a grant of £500 towards the cost of the new road in continuation of Lower Milton-road to the Bristol and Weston-super-Mare main road, near the village of Worle.

Southwark B.C.—The Road Board have agreed to contribute £4,500 for the improvement of certain roads in the borough, providing the council increases their estimates for the work which they propose to undertake by a similar amount.

Swansea T.C.—With reference to litigation arising out of the alteration in the road at Worcester-place, the Estates Committee recommend the adoption of the general rule that in future whenever any work is to be carried out which is likely to affect the legal relations of persons other than the corporation it be an instruction to the various officials superintending the work to communicate with the town clerk and ascertain that the corporation is in a proper position to proceed; and that it also be an instruction to the town clerk, where any works are carried out of which he has knowledge, that he shall not, as far as he is able, allow or instruct the officials to proceed with the work until the corporation is legally entitled to do so.

Stafford T.C.—Particulars with respect to a projected new road from the Lammascotes to the Lichfield-road have been forwarded to the Local Government Board.

Tiverton T.C.—The council have adopted a series of recommendations made by a special committee appointed to inquire into the expenditure on the streets and roads, including the following: (1) That to reduce the cost of scavenging, hand labour instead of horse labour be employed for the continuous collection; (2) that the experiment be tried of giving to each man employed on the highways a definite mileage to look after, instead of working men together, as at present; (3) that arrangements be made to relieve the road foreman of his duties in the town as early in the day as possible, thus leaving him free to give more time to the supervision of work on the highways; (4) that the Highways Committee be asked to consider the desirability of buying flints in larger quantities for storage on the landings, and the provision of measuring posts.

SEWERAGE AND SEWAGE DISPOSAL.

Aberystwyth R.D.C.—With respect to the council's application for sanction to borrow £665 for sewage outfall works for the village of Borth, a letter has been received from the Local Government Board stating: "While the present proposal for the improvement of the conditions at the outfall is in itself a desirable one, it does not appear that it can be regarded as a remedy for the insanitary state generally of the village. The board are advised that a considerable improvement would be effected if the council undertook the systematic cleansing of privies, and took steps also to secure the conversion of pit or vault privies into pail privies. On receiving satisfactory assurances that these measures will be adopted by the council without delay, the board will be prepared to sanction the borrowing of the amount required for the works now contemplated subject to certain conditions.

Coventry T.C.—A scheme, estimated to cost £38,149, has been adopted for works of sewerage and sewage disposal in connection with a large scheme which is being carried out for re-sewering the city, and providing a separate surface-water drainage system to relieve the irrigation difficulties on the sewage farm.

East Grinstead R.D.C.—The surveyor, Mr. C. Turton, has prepared a report on the proposed drainage scheme for the parish of Worth, from which it appears that he proposes to have two outfall sites, one taking the sewage from Three Bridges, Copthorne, and part of Crawley Down, and the other the sewage from Turners Hill, the remainder of Crawley Down, Hophurst-lane and Snow-hill. Mr. Buckley said the surveyor deserved great credit for the care with which he had dealt with this matter, and the proposals he had made. Negotiations are to be opened up with the owners of the land to ascertain whether they are willing to sell the necessary plots to the council.

Honiton T.C.—A proposal is being considered for the purchase of 17 acres of land for irrigation purposes, at a cost of £7,200.

Orsett R.D.C.—The surveyor, Mr. S. A. Hill Willis, has been instructed to prepare specifications for the proposed extension of the Little Thurlock sewer, the estimated cost of which is £2,130.

Stowmarket U.D.C.—A sewerage scheme, estimated to cost £5,314, is under consideration.

Swansea T.C.—A special committee has been appointed to inquire into the whole system of drainage, and the work of the sanitary department generally.

Tenby T.C.—The council have decided on proceeding with the works for the improvement of the sewerage, and on the 14th inst. the scheme submitted by the corporation's consulting engineer, Mr. T. J. Moss-Flower, Westminster and Bristol, was approved, and instructions were given for the necessary plans to be forwarded to the Local Government Board with an application for sanction to borrow the money to carry out the work. The proposed works consist of new 4-ft. diameter outfall sewer 500 yds. long, 6-ft. diameter tank sewer about 400 yds. long, new low-level main intercepting sewer and subsidiary sewers, screening chamber, penstock chambers, penstock house, and other works incidental thereto. The estimated cost is about £14,000, and the works are to be proceeded with as soon as possible.

Turton (Lancs) U.D.C.—Plans have been approved for the extension and improvement of the Eagley sewage disposal works, at an estimated cost of £8,364, inclusive of the cost of the land.

WATER, GAS, AND ELECTRICITY.

Barkisland U.D.C.—Approval has been given to a water supply scheme estimated to cost £3,400.

Bedwellty U.D.C.—Acting upon a report by Mr. J. F. Jupp, it has been decided to provide a reservoir at Coedymoth Common, at a height to supply the higher levels, and in such a central position as to command the water of both the Tredegar and the Rhymney and Aber supplies. The cost is estimated at £4,000.

Blackburn T.C.—The Electricity Committee are considering a report by the electrical engineer, Mr. Wheelwright, urging the desirability of erecting a new generating station at Greenbank, to cost £75,000, to meet the rapidly increasing demand for current throughout the borough. Grants of £5,000 and £2,000 have been made in aid of the rates from the profits of the corporation gas and tramways undertakings.

Bolton T.C.—The Waterworks Committee have accepted the tender of Messrs. W. Pollitt & Co., Limited, for the construction of filters, open service water tank, pumping station, and pipe laying, required in connection with the supply of water to the Darwen Corporation.

Bourne U.D.C.—The committee appointed to enter into negotiations with the directors of the gasworks for the purchase of the undertaking have arrived at an agreement as to the price to be paid for the property.

Bulkington U.D.C.—Land has been acquired on the Weston-in-Arden estate for the purposes of a water supply, and it is proposed to erect a tower, sink a well and construct a reservoir.

Christchurch T.C.—The council have accepted the tender of the Bournemouth and Poole Electricity Supply Company, Limited, at £292 per annum for lighting the public lamps -127 in number—for a period of five years from August 1, 1913, the lighting to commence half an hour after sunset, and the lamps to be extinguished at 11.15 p.m.

Derby T.C.—The borough surveyor, Mr. I. Ward, has notified builders and plumbers that in future all lead pipes connected with the town water supply must be thoroughly tinned inside with a good coating of tin, and that only pipes treated in such a manner will be allowed to be fixed.

Dingwall T.C.—A letter having been received from the Local Government Board inquiring what steps the council were taking with respect to the augmentation of the water supply, the burgh surveyor has been instructed to prepare the necessary plans of a scheme for presentation at the next meeting.

Edinburgh T.C.—It is proposed to extend the electric mains to Cramond.

Heywood T.C.—The loss on the corporation electricity and tramways undertakings for the past year was £4,928, which is equal to a rate of 10d. in the £. The loss on the undertaking in the previous year was £3,175.

Kilwinning T.C.—Plans have been passed for an extension of the gasworks. It is proposed to lay down a purifier house and a meter house about 100 ft. long by 30 ft. broad. The estimated cost is £900.

Kirkintilloch T.C.—The proposed extensions of the gas undertaking include the erection of a holder of 150,000 cub. ft. capacity. The scheme is estimated to cost £4,000.

Sheffield T.C.—New waterworks are to be constructed in the Ewden Valley, where the impounding of the waters will bring into use the last available supply within easy reach of the town.

Widnes T.C. — Owing to the increase in the consumption of gas at Widnes, where the price to ordinary consumers is 1s. 1d. per 1,000 cub. ft., and for power purposes 9d. per 1,000 cub. ft., the council have decided to extend the gasworks, and accepted the tender of Messrs. Drakes, of Halifax, for £28,000 for the entire reconstruction of the gas-making plant and the installation of labour-saving apparatus. The total cost of the work will be £36,000.

MISCELLANEOUS.

Maldens and Coombe U.D.C.—The tender of Messrs. Dennis Brothers, Limited, at £690, has been accepted for the supply of a first-aid motor fire appliance.

FOR OTHER ADVERTISEMENTS

See End of Paper.

WANTED.—Civil Engineer in the North of England requires experienced assistant; state experience, age, and salary required.—"Engineer," *Cumberland News*, Carlisle. (399)

BOROUGH OF HAMMERSMITH.
TO PAVING CONTRACTORS AND OTHERS.

The Borough Council invites Tenders for (*a*) paving the macadam carriageways of Wood-lane [part of] and Scrubs-lane with creosoted deal blocks, and (*b*) the making up of Ducane-road, between Wood-lane and H.M. Prison, in accordance with the specifications which, with Forms of Tender, may be obtained on application to Mr. H. Mair, M.INST.C.E., Borough Surveyor, after the 28th instant. The approximate area of the carriageway of Wood-lane and Scrubs-lane to be paved is 13,500 super. yds., and of the carriageway of Duncane-road 7,500 super. yds., and footway 4,050 super. yds.

Sealed Tenders, endorsed "Wood-lane and Scrubs-lane Paving Works" or "Ducane-road Paving Works," as the case may be, must be delivered to me not later than 4 p.m. on Wednesday, the 7th May, 1913.

The Council does not bind itself to accept the lowest or any Tender.

LESLIE GORDON,
Town Clerk.

Town Hall, Hammersmith, W.
April 23, 1913. (400)

PERSONAL.

Mr. J. Johnston, of Dulverton, has been appointed surveyor to the Keynsham Rural District Council.

Mr. Albert Croucher, surveyor to the Cuckfield Urban District Council, has had his salary increased.

Mr. C. Munckton, surveyor to the Wimborne Urban District Council, has been voted £40 for extra services.

Mr. David Maxwell, Arbroath, has been appointed burgh surveyor of Carnoustie at a salary of £140 per annum.

Mr. Ernest E. Morgan, of Swansea, has been appointed architect to the Swansea Town Council at a salary of £500 a year.

Mr. H. A. Mobbs, draughtsman in the Great Yarmouth borough surveyor's department, has obtained an appointment at Cambridge.

Mr. Arthur S. West, water engineer and manager to the Harrogate Corporation, has been elected a Fellow of the Surveyors' Institution.

Mr. H. Marklaw, of Beckenham, late of the public works department, Birmingham, has been appointed chief clerk in the Hammersmith borough surveyor's department.

Mr. H. M. Sykes, borough engineer of Stockton-on-Tees, has been voted £50 for his services in connection with the inquiry for the extension of the boundaries of the town.

Mr. Arthur H. Blanchard, M.AM.SOC.C.E., professor of Highway Engineering, Columbia University, on April 10th delivered an illustrated address entitled "Modern Bituminous Pavements for Municipalities" before the Board of Trade of Elizabeth, New Jersey.

Mr. Howard Martin has been nominated to represent the council of the Surveyors' Institution on the committee which is being formed for the purpose of arranging details of the programme for the Summer School of Town Planning at the Hampstead Garden Suburb.

Mr. Arthur T. Eginton, chief sanitary inspector at Chester, has been appointed sanitary inspector and housing surveyor to the Lancashire County Council. There were about 200 applicants for the position, and the salary is £250. Mr. Eginton will be stationed at Preston.

Mr. T. H. Mawson, of Windermere, has suggested for the city of Calgary preliminary plans which will probably be completed about September this year. The complete plans will be shown at the Royal Academy Exhibition in London next year. Calgary is one of the first western cities to undertake this work.

Mr. C. J. Yorath, deputy engineer and surveyor to the Acton Urban District Council, who, as previously announced in THE SURVEYOR, has obtained an appointment as city commissioner of Saskatoon, Canada, has been presented by the members of the Acton Municipal Officers' Association with a number of works on technical subjects and a travelling trunk. Mr. Yorath left on Wednesday last for Canada.

Sir Charles Rose, M.P., whose death from heart failure, following an aeroplane flight, occurred on Sunday evening last, was a member of the Road Board, on which body he was regarded as the principal representative of the private motorist. He was known as a great supporter of motoring and aviation, and was held in high esteem by those connected with both industries. He was born in Montreal in 1847.

Mr. William Tilcock, who was on Friday appointed as sanitary inspector to the East Molesey Urban District Council, has been for nine years in the service of the Chiswick Urban District Council—four as chief clerk in the Public Health Department and five as assistant sanitary inspector. For the new post he has obtained there were twenty applicants, of whom the three selected for recommendation by a special committee included also Mr. Baxter, of Brighton, and Mr. Fowler, of Wimbledon.

Mr. G. A. D. Mackay, who recently retired from the position of inspector of cleaning and lighting under the Edinburgh Corporation, was last week presented by a number of friends with a cheque for £75 and his portrait in oils. Mr. Mackay, in reply, said, speaking as a native of the West, that to bring up the footpaths, pavements and roadways of Glasgow to the standard they were in Edinbugh would cost

£2,000,000. So far as cleanliness and general appearance was concerned, he had seen nothing in Liverpool, Manchester, London, or even Paris comparable to Edinburgh.

Mr. Ewart G. Culpin, the secretary of the Garden Cities and Town Planning Association, will, in recognition of the highly successful tour which he has just completed in Canada and America, be entertained to dinner at the Holborn Restaurant on Wednesday next by the council of the association. During a three months' tour Mr. Culpin travelled 30,000 miles and addressed over sixty gatherings in the principal cities in the endeavour to awaken interest in the movement his association represents. The visit was made at the invitation of several bodies in America interested in civic and social improvement. Tickets for the dinner may be obtained from the association at 3 Gray's Inn-place, W.C.

Mr. Ralph W. Butler, whose appointment as a junior engineering assistant under the Road Board was recorded in our last issue, was born in Swindon in 1884, being the son of Alderman T. Butler, an ex-mayor of that town. He was articled to Mr. H. J. Hamp, Assoc.M.Inst.C.E., borough surveyor and water engineer of Swindon, and on completion of his articles was appointed engineering assistant under Mr. Hamp. He left Swindon in 1904 on receiving an appointment

Mr. Ralph W. Butler.

From Photo by J. Willcox (Newport), Ltd.

as engineering assistant to Mr. J. F. Burns, the borough surveyor of Devonport. After holding this appointment for five years Mr. Butler was appointed at Newport as second assistant to the late Mr. R. H. Haynes, M.Inst.C.E., and on the death of Mr. Haynes and the reorganisation of the staff was appointed first assistant to the new borough and water engineer, Mr. H. Tremelling, Assoc.M.Inst.C.E. He passed the associate-membership examination of the Institution of Civil Engineers at the early age of twenty-two, and was elected an associate-member in April, 1910.

Messrs. W. A. Valon, Westminster, and J. W. Mackison, executive engineer, Bombay, have been transferred from the class of associate-member to that of member of the Institution of Civil Engineers. The following have been elected associate-members—viz., Messrs. R. C. Aldous, city engineer's office, Nottingham; F. E. G. Badger, Municipal Buildings, Liverpool; C. J. Barker, sewerage engineer's office, Leeds; H. Criswell, county surveyor's office, Horsham; J. R. Fothergill, borough engineer's office, Bexhill; E. J. Goodacre, Municipal Offices, Nuneaton; and W. Ridler, surveyor's office, Tewkesbury; and Mr. A. S. Glover, city engineer's office, Norwich, has been admitted as a student of the institution.

Mr. M. J. Buckley, deputy surveyor of Dublin, who, as stated in our issue of the 11th inst., has been promoted to the more important post of borough surveyor, entered the service of the corporation early in life, after a brilliant course in the Catholic University School, Lower Leeson-street, University College and the Royal College of Science. Working with the Drumcondra Commissioners until 1900, he was then appointed engineer to the Improvements Committee of the corporation. His being given full control of the main drainage scheme showed the confidence placed in him by the late borough surveyor, Mr. Spencer Harty. He was also responsible for the effective carrying out of the Clontarf main drainage scheme. The salary is £800, rising to £1,000 a year.

BUILDING BY-LAWS IN GODSTONE RURAL DISTRICT.

In his twentieth annual report, which covers the year ended December 31st last, Mr. T. C. Barralet, surveyor to the Godstone (Surrey) Rural District Council, mentions that the Plans and Buildings Committee of that authority have submitted to the Local Government Board the draft of amended by-laws, which will, in the case of cottages and moderate-sized houses, allow of the external walls being built of any weather-proof materials when such buildings are detached 24 ft. from other houses. Mr. Barralet thinks that this concession should remove any cause for the suggestion that the provision of cheaper cottages is in any way interfered with by unreasonable building restrictions.

The amended by-laws for new streets are based on the reasonable assumption that short streets do not need to be made of the same width as main roads, and that all the advantages of a wide street from a health point of view can be equally well secured in a narrower street if the houses are set back to a corresponding extent. Hence the new by-laws provide that in new streets not exceeding 500 ft. in length the width may vary under different circumstances from 18 ft. to 30 ft. in width; but the distance between the houses in such streets shall in no case be less than 42 ft. Provision is also made to permit of buildings abutting on footways of not less than 10 ft. in width on the lines carried out in the Hampstead Garden Suburb.

It is hoped that the nett result of these amended by-laws will tend to a pleasing variety in the planning of building estates, and allow of a more generous allocation of land for gardens that under the present regulations is wasted on unnecessary width of roadway.

It should be noted that there is nothing in these amendments affecting long roads which are likely to carry more traffic. These will remain of a minimum width of 36 ft., and where the circumstances would appear to demand a still greater width, the council would, under the new regulations, have a better chance of securing it by being in a position to make concessions in subsidiary streets.

Railways and Road Transit.—The London and South-Western Railway Company have withdrawn from their Bill their application for power to provide and run motor road vehicles in connection with their system. Some sixty petitions against the proposal were presented by local authorities, transit companies and others.

A Dover Improvement.—Dover Town Council have accepted tenders for the construction of a new viaduct road to cost £28,592, while the property to be acquired for the site is estimated to cost £22,000, making the total over £50,000. The object of the road is to abolish the present level crossings and provide a direct approach to the new Marine station.

Municipal Motor Omnibuses.—In reply to a question at a recent meeting of the London County Council it was stated that motor omnibuses are operated by the municipalities of Liverpool, Newcastle, Sheffield, Eastbourne, Keighley and Widnes. The operation, however, had not extended for a sufficiently long period to provide reliable data as to the financial results.

Skegness Roads and Footpaths.—In a recently submitted report to his authority Mr. R. H. Jenkins, surveyor and inspector of nuisances to the Skegness Urban District Council, states that the repairing of the roads and footpaths was last year much handicapped owing to financial difficulties. The surface tarring was greatly hindered by the excess of wet days. In consequence, the highways have severely suffered, and will cost much more in the end. Mr. Jenkins suggests that the surface tarring should be greatly extended, and that the tar paths have a share of this treatment.

The Country Roads Act of Victoria, Australia.

THE COUNTRY ROADS BOARD: ITS DUTIES AND POWERS: OTHER IMPORTANT PROVISIONS OF THE ACT.

The Country Roads Act of Victoria, which came into force on the first day of this year, is a very important piece of legislation. It provides for the creation of a Country Roads Board, the members of which have since been appointed, invests this board with large powers, and entrusts it with important duties. It practically creates a sub-department of State for the control of the more important roads of the country, and no definite limit is set to the mileage of road which may so be controlled by the board; for it has, in the first place, and subject to confirmation by the Governor-in-Council, the power of declaring roads to be main roads and of dismaining any main road, while it has the power, in addition, to construct new roads and deviations.

Further, the board may make all necessary surveys and investigations, not only with respect to specific works, but also as regards road materials, the science of road making, and methods to be followed. It will also act as a central department with regard to maps, records, the publication of the results of investigation, and so forth, and has powers to purchase machinery and plant.

In the following summary of the main provisions of the Act the order of the clauses in the text of the Act itself is followed, and it will be found that the full import of a given clause cannot always be judged only by its immediate context, but must also be considered in the light of some of the clauses which will be found under other of the main heads.

DEFINITIONS.

It is important to note that the expression "main road" does not refer to any roads already in existence, but only to such as shall be declared to be main roads under the provisions of the Act.

The word "municipality" in this Act means the corporation of any city, town, borough or shire.

Since the term "maintenance" is to apply to works of every description calculated to keep the carriageway of the road and "any drain" draining such carriageway in the same state of utility as it was when the road was declared a main road, or in the same state of utility as it was in as the result of permanent improvements carried out under the Act, it is clear that "maintenance" has a meaning which is at once sufficiently wide and sufficiently precise for the purposes of such an Act as this.

Another very important definition is that of "permanent improvement," which is to include all kinds of work, exclusive of maintenance, "calculated to increase the utility of the carriageway of a main road." It seems unfortunate that the word "carriageway" should have been used here unaccompanied by any reference to footways. This, very possibly, is significant of the relative unimportance of footways in the State of Victoria at the present day, but it certainly seems desirable that the Act should be amended by substituting for the phrase "the utility of the carriageway of a main road" the wider expression "the utility of the main road as a highway," and that the present policy of making the local authority responsible for the footways (see below) should be reconsidered.

CONSTITUTION OF THE BOARD.

Reference has already been made (issue of April 4th) to the personnel of the board, which consists of three members appointed by the Governor-in-Council, for a term which is not to exceed five years, and eligible for reappointment for a further term not to exceed five years. Any member of the board may be removed from office at any time by the same authority.

The legal position of the board will be that of a body corporate.

The salary of the chairman is not to exceed £800 a year, and those of the other members are not to exceed £600 a year each. Considering that the chairman of the board will be its chief executive officer, and that it is intended that, as is actually the case, he shall be a man with high professional and technical qualifications, these salaries seem to be very low.

The relation in which the board will stand to the Public Works Department is indicated by a clause providing that the board may, with the approval of the Minister of Public Works, make use of the services of any of the officers and employees of the Public Service, while the appointment of persons as officers and employees of the board rests with the Governor-in-Council.

POWERS OF THE BOARD.

Subsec. 1 of sec. 15 is so important that it must be given in full, as follows:

The board, so far as any moneys legally available for the purpose permit, shall--

(1) Carry out all such surveys and investigations as may be necessary or expedient to ascertain

(*a*) What roads shall be main roads.

(*b*) The nature and extent of the resources of Victoria in metals, minerals and materials suitable for the purposes of road making and maintenance, and the most effective and economical methods for dealing with the same, and for supplying or utilising the same for the said purposes in the whole or any part of Victoria.

(*c*) The most effective methods of road construction and maintenance in the whole or any part of Victoria.

(*d*) What deviations (if any) in existing roads, or what new roads should in its opinion be made so as to facilitate communication and improve the conditions of traffic.

(*e*) Record, publish and make available for general information the results of all such surveys and investigations.

The board may require a local authority to furnish information, which must be supplied within one month from the receipt of the request.

One of the first duties of the board will be the preparation of an official map of Victoria showing the roads "and such other matters as the board shall think fit," and provision is made for maintaining copies of this map in the offices of local authorities, and for keeping these copies up to date.

As regards the procedure by which roads are to be declared main roads, or to be dismained, this will be done by resolutions of the board subject to confirmation by the Governor-in-Council, local authorities which feel aggrieved by any such resolution having the right to appeal to the Minister of Public Works, who may vary it or disallow it. Considering that the Minister of Pubilc Works will, in one of his capacities, be practically the head of the new highway department, it is clear that vexatious or unreasonable obstruction of the work of the board is rendered impossible.

Sec. 19 provides for the preparation of plans and estimates, and sec. 20 for the publication of an order based on these, and for full compensation of persons whose lands are acquired or injuriously affected. The manner in which the amount of such compensation is to be determined is set forth in detail in another part of the Act, but does not demand further attention in the present connection.

As regards the nature of the roads declared to be main roads, the land on which the road is "shall thereupon and thenceforth from the date of such publication become and be absolutely dedicated to the public as a public highway within the meaning of any law now or hereafter enforced."

As regards the carrying out of permanent work the council of each local authority shall carry out all such works within its district unless the Governor-in-Council direct that any specified works shall be carried out by the board itself. Any permanent works carried out by a local authority shall be carried out to the satisfaction of the board.

The provision as to maintenance is that each local authority shall maintain the main roads within its district, unless the Governor-in-Council direct the board to maintain any specified main road. The next subsection is a very important one.

(2) The board shall each year notify to the council of each municipality (see definition) in whose municipal district a main road is the amount such council may expend on the maintenance of each of the main roads within its district.

(3) All maintenance carried out by any council

shall be carried out to the satisfaction of the board.

This provision puts the board in a very strong position indeed, and constitutes it one of the most effective of existing highway departments.

FINANCIAL.

The total cost of making permanent works and of the maintenance of main roads will, in the first instance, be paid by the Treasurer upon warrant of the board, the apportionment of the cost between the various local authorities benefited thereby being afterwards determined. In allocating to each local authority the amount which it has to pay regard will be had to "the benefits it has obtained." A further provision is that the contributions from the local authorities need not be at a uniform rate, but each may depend upon "its ability to pay." In any case, the total amount of the contributions from the local authorities shall equal half the amount expended on permanent works and maintenance during the preceding year. It is further provided that a local authority "may be benefited by expenditure on permanent work and maintenance within the meaning of this section, although such permanent work and the main roads maintained are not situated within its municipal district, if substantial traffic to or from the municipal district of such municipality passes over or, in the case of new main roads, will, in the opinion of the board, pass over a main road on which such expenditure has been made." Local authorities may thus be made to contribute to the costs of roads not within their boundaries, and this by direct procedure, not by roundabout methods based upon rating arrangements, grants, and so forth.

It is in connection with this matter of allocating costs that the chief difficulty in the administration of the measure may be expected, particularly, it may be suggested, as regards the proportions of the cost to be borne by the different shire councils through whose territory the principal main roads will pass. Since the board has also to take into consideration the ability of the different local authorities to pay for the roads, it is to be expected that local authorities will very often object to the amounts of their assessments, especially when they are charged for work done outside their boundaries. From the administrative point of view, and as a matter of balance, it may be desirable that some such check as this upon the otherwise very autocratic authority of the board should come into play, but balance may be effected in more ways than one, and the balance which is maintained by weights distributed over the two halves of a structure throws less strain upon that structure than does a balance which is maintained by a heavy load at each end of it.

With the details of the arrangements as regards the issue of stock, and procedure relating to debentures, we need not concern ourselves, but there is one section which must not be overlooked. This gives the board the power to itself levy a rate in the area of a local authority in case such authority default in its payments on account of road construction and maintenance.

OWNERSHIP OF THE LAND.

Sec. 43 provides that (1) the absolute property in the land over which a main road is declared and confirmed shall be vested in the Crown. (2) [*a*] The materials of all main roads and all matters and things appurtenant thereto, [*b*] all buildings, fences, gates, posts, boards, stones and erections placed upon a main road, [*c*] the scrapings of all main roads and the sand on main roads, shall belong to the board. It is further provided that no main road shall be dug up or used for any purpose which may "injure, obstruct or injuriously affect such road" without the written permit of the board.

TRAFFIC DURING CONSTRUCTION.

The board will have power to close main roads to traffic, or to close them to certain classes of traffic, for the purpose of carrying out works, as well as for the period necessary after the completion of such works, to prevent injury to the road.

To make this provision effective it is further provided that the board may make a temporary road to be used as a public highway while the old road is being reconstructed or repaired. Compensation will be paid when necessary, and no such diversion may be made through "the site or curtilage of any house or a garden, lawn, yard, court, park, plantation, planted walk, avenue or nursery for trees." Lastly, the board has power to stop the traffic on a road where it is unsafe.

EXTRAORDINARY TRAFFIC.

Sec. 48 provides for the recovery by the board of the cost of damages caused by "any excessive weight" passing along the road, with a further provision for the settlement by agreement of such cases. The term "excessive weight" seems wholly inadequate, and the framers of the Act can hardly have followed what has recently been written on this subject, and discussed at meetings and in the technical press. It would, surely, have been desirable to base a definition of extraordinary traffic upon a broader foundation, making it possible to recover damages when the traffic is carried on in any unreasonable manner, or when the damage is caused by some factor other than that of weight itself. It may be suggested that a section of this kind will be most practically useful if it provide for the recovery of damages for "extraordinary traffic," defining extraordinary traffic in some such terms as those used in a famous judgment by Lord Justice Bowen, or, if preferred, one of the longer definitions which have been employed.

Under this head it may be noted that the board will have power to place a notice at any bridge or culvert that it is not capable of carrying a greater weight than that fixed by the board. Should such a notice be disregarded the offender will be liable for a penalty not exceeding £20, while the board may also recover from him, before a Justice or in any court of competent jurisdiction, damage for any injury caused by such excessive weight having passed over the bridge or culvert.

OBSTRUCTIONS ON ROADS.

The Act provides for penalties in the case of obstructions on main roads, or of the removal or displacement of materials, and when damage of this kind is done, or obstructions have to be removed, the board may do this and charge the cost upon the offender.

The duty of keeping a road clear from the outgrowth from hedges is thrown upon the owner or occupier of the land, who may be served with a notice in case the board find it necessary to do so, while, should he fail to remove the obstruction within eight days from the date of such an order, the board may do the work themselves and recover the cost from the owner or occupier. If the owner can be found both he and the occupier are to be served with the order. It is possibly a detail of some importance that the occupier "shall be entitled to deduct such expenses or any cost necessarily incurred by him under this section from any rent then due or thereafter becoming due by him to the owner." As regards trees, any tree obstructing or prejudicing a road may be removed by order of any two Justices, on the application of the board.

DRAINAGE OF MAIN ROADS.

As regards the drainage of main roads, it is enough to say that under the provisions of the Act the board seems to have ample powers for the carrying out of all works necessary for the control or disposal of all surface and subsoil waters; while, at the same time, proper provision is made for the protection of the owners and occupiers of the lands affected. The procedure to be followed is so carefully set forth that it is clear that utmost importance is attached to this matter in sharp contrast with the lack of its recognition in the administrative procedure under which roads have been made and maintained in the United Kingdom.

SOME OTHER MATTERS.

The board has power to enter into contracts for the execution of any work directed by this Act, and may, when this is thought desirable, specify the person to whose satisfaction the work is to be completed, and "the mode of determining any dispute which may arise concerning or in consequence of such contract.

The board has power to make by-laws regulating or prohibiting the locking of the wheel of any vehicle when descending a hill unless such wheel be provided with a skid-pan. Similarly, the board may make by-laws regarding projections on wheels, and the drawing or trailing of sledges or timber upon the main road.

As regards actions against the board for negligence in respect of main roads, a person demanding compensation for injury must make application in a specified form, and under conditions laid down by the Act, the further procedure being also specified. It may be noted that the amount so recovered is referred to as being "in respect of any loss or injury

sustained by any person by reason of any accident upon or while using any main road other than loss or injury caused by any work in course of construction by the board or by the defective construction of any work by the board, or the amount agreed to be paid by the board as compensation to any person in respect of any such loss or injury," and this sum shall be deemed to be a part of the cost of maintenance.

The board have power, with the approval of the Governor-in-Council, to declare that any part of a main road, duly described, shall be a footway, "and thereupon any Act relating to local government shall have the same operation in regard to such footway as if this Act had not been passed." Similarly, footways already fixed by earlier Acts are outside the scope of the Country Roads Act.

The hours to be worked by any unskilled adult workman employed by the board shall not exceed forty-eight hours in any one week, and the wages are to be not less than 8s. per day of eight hours. Overtime shall be paid for at a rate not less than time and a-quarter for the first two hours, and time and a-half for each subsequent hour. The rate of wages and hours to be worked in the case of skilled workmen employed by the board "shall be the recognised standard rate for the recognised hours."

Last, but not least, mention should be made of a very significant section—70—which runs as follows:—

"The Governor-in-Council may from time to time make regulations, to be published in the Government Gazette, for the purpose of carrying this Act into execution or conferring upon the board with respect to main roads any right, power, protection, privilege or obligation relating to the construction, improvement or maintenance of highway conferred upon the council of a municipality by any Act relating to local government."

SOME RECENT PUBLICATIONS.*

Elements of Heat Power Engineering. By C. F. Hirshfeld and W. N. Barnard. Price 21s. nett. London: Chapman & Hall, Limited.

In this book the authors have included in a single volume not only the elementary thermodynamic theory of gases and vapours and of their cycles, but also a consideration of the sources of heat, the methods of making it available for useful purposes, its utilisation in the various types of heat-driven prime movers and their auxiliary apparatus, together with a discussion of the fundamental theory, the ideal and actual performance, and the practical considerations connected with such apparatus. It will thus be seen that the work is comprehensive in scope, and in the course of its forty-two chapters the authors give a full and lucid account of the theory and practice of heat power engineering. The work is conveniently divided into numbered paragraphs, and is well illustrated throughout, and its value to the student is enhanced by the inclusion of a number of problems for solution.

As It Should Be.—Engineers' salaries in Chicago show, according to a report prepared by the Municipal Civil Service Commission, a higher average than that of salaries in any of the other city departments. The average annual salary in the engineering department is about £369. There are seven engineers with salaries ranging from £804 upwards, forty who receive £600 or more, ninety with from £384 to £480, 103 with from £300 to £348, and 111 with from £216 to £264.

Goldsmiths' College Engineering Department.—Summer courses of special character are being held in the engineering department of Goldsmiths' College (University of London), New Cross, S.E., during May and June, as shown in another column, and the lectures on reinforced concrete, engineering costs and works management, and wireless telegraphy should prove very attractive. All these will be treated practically, and the college installation will be used for "wireless" practice. In addition, there are to be special demonstrations in the mechanical and hydraulic laboratories, classes in drawing office and workshop practice, and land surveying for both elementary and advanced surveyors, with plenty of actual work.

* Any of the publications reviewed, or referred to as received, will be forwarded by the St. Bride's Press, Ltd., on receipt of published price.

INTERNATIONAL ROAD CONGRESS.

"OPEN TO ALL INTERESTED."

A correspondent writes: "I shall be glad if you can inform me if attendance at the International Road Congress, to be held in London in June, is in any way restricted—that is to say, if it is open to the public generally, or only to those who have been invited—and if so I shall be pleased to know if it is intended to issue invitations to town councils, county councils, &c., to send delegates."

We have submitted the above to the congress authorities, and have been favoured with the following statement by Mr. W. Rees Jeffreys, the hon. secretary:—

"The congress is open to all those who are interested in the administration and improvement of roads. In addition to surveyors, we are expecting a large attendance of chairmen of county councils and town councils, and chairmen of highways committees, and county and borough treasurers; for, in addition to the papers dealing with the technical side of road maintenance, one very important section of the congress will be concerned with questions of administration and finance. Invitations have been addressed to all the highway authorities in England, Scotland, Ireland and Wales. If that invitation has not for any reason been formally brought before the appropriate committee of any local authority, I should be glad to be informed by any of the members or officials interested."

SPECIAL RAILWAY FACILITIES.

By the courtesy of the Associated Railway Companies, members of the Road Congress travelling to London to attend the congress may obtain return tickets at a single fare and a third at any station in Great Britain upon the surrender to the booking clerk of a voucher to be obtained from the secretary. Tickets will be issued from June 21st to June 28th, and will be available for return up to July 14th. In addition to this general arrangement the London and South-Western Railway Company intimate that they will issue daily tickets at the same rate from stations within a radius of 20 miles from London to delegates attending the congress on production of their tickets of membership, these tickets being available on the day of issue or the following day. A detailed illustrated programme of the congress, extending over sixty-four pages, is now in course of preparation, and will be issued to those who have registered themselves as members of the congress within the course of the next few days.

THE ASSUAN DAM.

RECENT PROTECTIVE AND OTHER WORKS.

Following the laying down of a complete apron across the river for the protection of the Assuan Dam from the effects of erosion, the question of heightening the dam to enable further storage to be made in the reservoir was, said Mr. Murdoch Macdonald at a meeting of the Institution of Civil Engineers on Tuesday evening, taken in hand in 1906. In order to permit of the heightening, Sir Benjamin Baker decided that the dam should at the same time be thickened by adding a 5-metre strip of masonry downstream of and within 6 in. of the original building, the intervening space to be filled in with liquid cement on the completion of the thickening, up to the original roadway level. When the thickening and grouting operations were completed, a solid mass of masonry was to be built on both walls 5 metres high.

The paper described some of the reasons that led to the special method of thickening by leaving an intervening space between the walls, to be grouted up after a time, this problem being connected with temperature-stresses as exhibited in cracks which occurred at various intervals in the original dam.

City of London Improvement.—Leadenhall-street, in the City of London, is so congested at its eastern end that there is scarcely room for two vehicles to pass. The widening scheme is about to be further proceeded with by the City Corporation by the setting back of buildings, at an estimated expenditure of £90,000, subject to the London County Council agreeing to contribute one half the net cost of the work.

Purification of Water by Slow and Rapid Sand Filtration.*

By T. AIRD MURRAY, M.CAN.SOC.C.E.

(Conclusion.)

It has long been recognised that any system of water filtration is not totally efficient by itself in absolutely removing disease infection from water. The measure of overcoming disease infection is the facility of a filter to reduce the number of bacteria originally in a raw water, and the facility to eliminate those forms of bacteria which are peculiar to sewage discharges such as B. coli, &c. While the sand layer in either a slow sand filter or in a rapid filter may be useful as a means of straining dirt or suspended matter from a water, it is recognised that the sand by itself has only a slight effect in keeping back bacteria. The fine character of the sand used in slow sand filters has, however, a much higher bacteria removal efficiency than the coarse sand of rapid filters, and for this reason in many instances the slow sand type has been preferred.

The bacteria removal efficiency for either type of filter does not solely depend upon the sand, but on a layer or film of other matter which accumulates on the surface of the sand. With a slow sand filter this matter is obtained from the raw water direct, and is intercepted and held on the sand surface. It is composed of colloidal matter of a gelatonised zooglea character, and has a definite entraining effect upon bacteria. The removal of bacteria is practically localised to the top ¾in. of the sand surface. With the rapid sand filter the surface cover is artificially produced by adding sulphate of alumina or some other coagulant to the water. In this connection it is of interest to quote from a report of the "Joint Special Committee to examine and report relative to the pollution of Water Supply, and the best method of filtration," City Document No. 15, of the City of Providence, R.I., as follows:—

"If the diameter of matter floating about in water is much less than that of the interstices between the grains of sand composing the filter-bed, such matter, except as much as is caught upon the sharp edges of the quartz, will go right through the filter with the water.

Now, if a substance could be introduced, drop by drop, into the water before it comes to the filter-bed, which would have the effect of curdling the matter together, so that every 100 or so of the smaller particles were made to join together and become one large particle, much as vapour or steam is condensed into drops, it would follow that they would be caught and held from going through the filter. This is accomplished by adding alumina (alum) to the water as it flows to the filter.

"The amount required is from almost none at all to about three-quarters of a grain to the gallon, according to the state of the water, say, an average of from one-quarter to one-half grain per gallon in the ordinary condition of the Pawtucket River water.

"The action is the same as when coffee is cleared by means of the white of egg. No white of the egg goes to the drinker of the coffee—it is all drained off with the grounds; and as no alum goes to the drinker of the water, it unites with the impurities in the water and settles in feathery flakes of insoluble hydrate on the top of the filter, and is washed out with its accumulation of impurities when the filter is cleaned.

"The analysis of the purified water shows no trace of the alumina used, while the analysis of the wash water shows that the alumina is all washed out with other impurities. This feathery bed of precipitate flakes produced by the alum forms a filtering media of insoluble mineral matter which is well-nigh perfect in its character. Bacteria are like the very fine particles of clay of some water, so small as to pass the sand or quartz, but they are caught by the feathery precipitate of alumina hydrate much as the bacteria contained in air are prevented from entering a phial closed with sterilised wool."

"So we see that, first, as in the case of the slow sand filter, so with the mechanical, bacterial removal efficiency does not so much depend upon the filtering material itself as upon an artificial surface or blanket being formed."

Obviously there must be periods with both slow and rapid filters when the blanket or film is in the course of formation, and when the filter is not operating at its maximum efficiency. This means that in all cases of filtration the bacteria removal is not a total efficiency, but a matter of percentage; therefore, the higher the total count of bacteria in the raw water the higher will be the count in the filtered water. If the standard as laid down by the rules of the German Government in regard to the filtration of surface waters used for public water supplies be accepted, that "a satisfactory filtration will never yield an effluent with more than about 100 bacteria per cubic centimetre," then it must be admitted there will be occasions when either system, "slow sand" or "rapid," must fail to meet this standard.

Dr. Nasmith (director of the City Laboratories, Toronto), in a report dated October 5, 1911, states that analyses of Lake Ontario water off Toronto show at times counts of over 400,000 bacteria per c.c. With such a high count in the raw water a 98 per cent removal efficiency would yet leave 8,000 bacteria per c.c. in the filtered water.

The failure of filtration to totally ensure the removal of disease infection from raw waters has pointed to the necessity of some additional method of treatment. Disinfection of filter effluents has been in the past few years put in practice in many European and American cities. Methods of introducing ozone gas to the water has found favour in a few European centres, but has proved costly, and not absolutely efficient owing to ozone being only partially soluble in water. Experiments have also been made with various rays, such as the ultra-violet rays, &c. The most generally adopted method of disinfecting water is by use of hypochlorite of lime. This method has recently come into vogue, not only as a temporary measure in emergency cases, but as a permanent adjunct to filtration plants. The following Canadian and American cities are using this form of disinfectant—viz., Montreal, Toronto, Ottawa, Strathcona, Trenton, Jersey City, Little Falls, New York, Albany, Poughkeepsie, Philadelphia, Pittsburg, Harrisburg, Cincinnati, Columbus, Erie, Hartford, Nashville, St. Louis, Indianapolis, Omaha, Whiting, Minneapolis, Brainard, Des Moines, McKeesport, Grand Forks, Milwaukee, Evanston, Battle Creek, New Brunswick, and many smaller towns. Hypochlorite of lime or chloride of lime is sold in sheet iron drums, and contains on the average about 33 per cent of available chlorine. The lime is mixed usually in a 1 per cent solution, and the solution added to the water by calibrated appliances. An average of about ·5 parts of available chlorine per 1,000,000 parts of water is usually sufficient to sterilise a water from which the suspended matter has been previously removed by filtration.

Local objections have been made to the use of chlorine as applied to domestic water supply because of occasional taste and odour imparted to the water. These, in every case, have been due to carelessness or crude methods of application allowing overdoses at times. With the improved methods of application this chance overdosing can be effectually guarded against. The reaction which takes place when chlorine is added to water liberates nascent oxygen which is the sterilising agent; the by-products are carbonate of lime, hypochlorus acid and hydrochloric acid hardly chemically traceable with the minute quantities of chlorine required. Chloride of lime costs about 1½ cents a pound, and adds little to the cost of water purification.

If it is granted that disinfection of water is advisable, then the rapid method of water filtration should prove as efficient as the slow methods for the preliminary process of removal of suspended matter, together with the added benefit of removal of colour, and will further, in Canada, provide a considerable

* Extracts from paper read before the annual meeting of the Canadian Public Health Association at Toronto.

saving in first cost and, in most cases, in maintenance.

Quoting again from the report of Dr. Nasmith above referred to: "The slow sand filter was, as the name indicates, intended to filter out the suspended matter and bacteria from water. Its efficiency depends absolutely on the care that is exercised in construction and operation. Carelessness in operation will allow bacteria to get through, and it is expensive to maintain. Consequently some municipalities are now using hypochlorite of soda or calcium in conjunction with filtration, and obviously, under these circumstances, such great care in filtration is not so essential. Therefore, a mechanical filter, which is much cheaper in construction and will remove all of the suspended matter and 90 per cent of the bacteria, is just as good a preliminary to any method of sterilisation as the more expensive slow sand filters."

Dr. Nasmith, probably for the purposes of conservative argument, has assumed an efficiency of only 90 per cent bacterial removal for mechanical filters, whereas the majority of manufacturers of such filters are able to guarantee at least 97 per cent efficiency.

The ease and certainty by which any water supplied for domestic purposes can, with modern methods of disinfection, be rendered perfectly safe as far as disease infection is concerned, must form an entirely new factor in determining the type of preliminary filtration. This factor did not exist at the time when, say, the present choice of slow sand filtration was made for Toronto. With the more modern and practically tested methods of disinfection it is very improbable that slow sand filtration would ever have been advised under Canadian conditions.

Further, if the application of a disinfectant such as chlorine is advisable, there is yet another and very important reason for adopting mechanical filtration rather than the slow sand methods. With slow sand filtration, owing to the claim, previously alluded to, that the filters assume a stage of maturity when biological action sets in, it would be unwise to add any sterilising agent to the water before it enters the filters, as such would naturally tend to check any such action.

With slow sand filtration the disinfectant must be added to the effluent from the filters, with the result that the by-products of the disinfectant will be handed on to the water consumer. In the case of mechanical filters the above objection does not apply. No claim is set up by adherents of rapid filtration that the action is other than mechanical; it is not claimed that any organic or biological purification takes place in the filter media; and, therefore, there is no reason against applying the disinfectant to the water before it reaches the filter, and so intercept the by-products by the filtering process. This is done at Harrisburg and other rapid filter plants.

SUMMARY.

(*a*) Filtration of water should be considered chiefly from the point of view of removing dirt or suspended matter from water.

(*b*) Slow sand filters or rapid sand filters well designed and skilfully managed will, from an efficiency point of view, equally remove dirt and suspended matter from water.

(*c*) The choice of either slow sand or rapid filtration to meet the requirements (*a*) and (*b*) is a matter of local conditions, character of water to be treated, climatic and general environment, factors which can only be balanced and determined upon by an expert.

(*d*) Slow sand filtration has the natural advantage over rapid or mechanical methods in that it requires no chemicals in the form of a coagulant, and more closely follows Nature's method of purifying surface water to spring water conditions.

(*e*) The area of land required for rapid filtration is comparatively much smaller than that required for slow sand methods.

(*f*) Where it is advantageous to have the plant and operation entirely under cover the choice must be with rapid filtration.

(*g*) The first cost of installation of rapid filtration is about one-half that of slow.

(*h*) The maintenance cost is determined by the amount of coagulant required for rapid filtration as against the costly process of removing and cleaning the sand surface of slow sand filters. When the amount of coagulant (sulphate of alumina) does not exceed 1 grain to the gallon the maintenance of rapid filtration is below that of slow sand.

(*i*) When it is a question of removing disease infection and rendering a water entirely safe, neither system can be absolutely depended upon.

(*j*) Disinfection is the only method by which an infected water can be guaranteed safe.

(*k*) Disinfection by the economic and generally acknowledged methods can be better applied to rapid rather than to slow methods of filtration. As with rapid filtration the disinfectant can be applied before filtration, and not after, as must be the case with slow sand methods.

(*l*) The assumption that slow sand filtration is more suited to clear water conditions and rapid filtration to turbid conditions has no clear evidence to support it. The opposite is probably the case—viz., that clear water is not capable of forming the film or carpet surface necessary for efficient bacterial removal with the slow sand process, and that a coagulant is necessary in order to artificially form this bacterial straining film.

(*m*) Slow sand filtration is entirely unsuited to highly turbid water, where constant removal of the sand surface would be required to prevent clogging.

(*n*) Rapid sand filtration is suited to either fairly clear water or very turbid water, as the method of cleaning the sand is easily controlled, of short duration, and effective without removing or handling the sand.

(*o*) Cleaning the surface of slow sand filters requires the personal contact of workmen. With the rapid methods compressed air and reverse flow of the water under pressure meets the requirements.

It may be concluded, generally, with the introduction of disinfectants to water, that rapid or mechanical filtration will in the future assume even a more prominent position as a method of water purification than it has in the past. Care, however, will have to be exercised by municipalities in their choice of design of plant. No doubt town and city engineers, aldermen, controllers, and works commissioners will, when the occasion arises, be bombarded by agents and others representing all kinds and sorts of rapid filter contrivances, from the pressure filter to the mechanical gravity types, all guaranteed to provide the very highest efficiencies independent of suitability to local conditions. The lay-out of a plant to meet the local requirements, and the choice of the various manufactured parts in order to provide an efficient unit, can only be trusted to the professional expert who is absolutely independent in his choice, and who is cognisant of the various types on the market and their efficiency to meet particular requirements.

Society of Engineers.—A Bohemian concert will take place in the Council Chamber of the Holborn Restaurant on Saturday, May 3rd, at 8 p.m.

Repair of Flood Damage in Norfolk.—The county surveyor, Mr. T. H. B. Heslop, reports that the work of restoring the damage to roads in Norfolk caused by the flood of August last is practically completed. The cost, he estimates, will amount to about £2,200. The work of reinstating the bridges and culverts damaged by the flood is proceeding steadily. The whole of the culverts have been rebuilt, four bridges have been rebuilt, while two others are in progress.

A New Dust Preventer for Floors.—A great deal of interest has been evinced by hygienists and other visitors generally in the demonstration of dust prevention on floors carried out at the Building Exhibition, Olympia, with Konis, the new compound recently brought out by the Konis Supply Company, of 329 High Holborn, London, W.C., for rendering floors, wood or concrete dustless. A section of the gallery near The Surveyor offices had been dressed with the preparation, and notwithstanding the enormous traffic over it during the period of the exhibition, the treatment proved most effective. Upon inquiry, we are informed that among the many advantages claimed for Konis may be mentioned, in particular, that it is absolutely free from oil or grease and odourless. It is a disinfectant and germicide, and it has the property of drying the ambient air. It also tends to render the floor fireproof, and its application is extremely simple, the only appliance required being a water-can or pail with a mop to wash the floor with the solution. As to the cost, it appears to be very low. It would therefore seem that Konis is particularly suitable for adoption in hospitals, schools, factories, exhibitions, public halls, and all buildings where the presence of dust causes discomfort and is a danger to health.

INSTITUTION OF MUNICIPAL AND COUNTY ENGINEERS.

President—Mr. R. J. Thomas, M.Inst.C.E., County Surveyor, Buckinghamshire.

CERRARD'S CROSS MEETING.

A meeting of the institution will be held in the Eastern District at the Assembly Rooms, Oak End Way, Gerrard's Cross, to-morrow (Saturday).

Programme.

11.15 a.m.—Reception by Dr. J. H. Waters, chairman of the Sanitary Committee of the Eton Rural District Council.

11.30 a.m.—District business.

11.40 a.m.—Discussion on paper to be read by Mr. A. Gladwell, engineer and surveyor to the Eton Rural District Council, descriptive of the new sewerage and sewage disposal works at Gerrard's Cross.

12.15 p.m.—Proceed by motor omnibus (tickets 2s. 6d. each) to the Gerrard's Cross sewage outfall and purification works, which will be formally opened by Colonel the Hon. W. Le Poer Trench, C.V.O., R.E.

1.15 p.m.—Return to Gerrard's Cross for lunch (tickets 2s. 6d. each) at the schoolroom, Gerrard's Cross Common.

2.30 p.m. — Drive to Beaconsfield and Burnham Beeches.

is c[illegible]—Tea at Burnham Beeches, by invitation of
zooglea charac[illegible]A. Gladwell.
effect upon bacteria[illegible]rrard's Cross or Slough, as may
practically localised to [illegible]nt (a party will be made
surface. With the rapid sand [illegible]ering).
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alumina or some other coagulant to the wate[illegible]
this connection it is of interest to quote from a report of the "Joint Special Committee to examine and report relative to the pollution of Water Supply, and the best method of filtration," City Document No. 15, of the City of Providence, R.I., as follows:—

"If the diameter of matter floating about in water is much less than that of the interstices between the grains of sand composing the filter-bed, such matter, except as much as is caught upon the sharp edges of the quartz, will go right through the filter with the water.

Now, if a substance could be introduced, drop by drop, into the water before it comes to the filter-bed, which would have the effect of curdling the matter together, so that every 100 or so of the smaller particles were made to join together and become one large particle, much as vapour or steam is condensed into drops, it would follow that they would be caught and held from going through the filter. This is accomplished by adding alumina (alum) to the water as it flows to the filter.

"The amount required is from almost none at all to about three-quarters of a grain to the gallon, according to the state of the water, say, an average of from one-quarter to one-half grain per gallon in the ordinary condition of the Pawtucket River water.

"The action is the same as when coffee is cleared by means of the white of egg. No white of the egg goes to the drinker of the coffee—it is all drained off with the grounds; and as no alum goes to the drinker of the water, it unites with the impurities in the water and settles in feathery flakes of insoluble hydrate on the top of the filter, and is washed out with its accumulation of impurities when the filter is cleaned.

"The analysis of the purified water shows no trace of the alumina used, while the analysis of the wash water shows that the alumina is all washed out with other impurities. This feathery bed of precipitate flakes produced by the alum forms a filtering media of insoluble mineral matter which is well-nigh perfect in its character. Bacteria are like the very fine particles of clay of some water, so small as to pass the sand or quartz, but they are caught by the feathery precipitate of alumina hydrate much as the bacteria contained in air are prevented from entering a phial closed with sterilised wool."

"So we see that, first, as in the case of the slow sand filter, so with the mechanical, bacterial removal

2 p.m.—Leave town hall and visit—
Quayside.
Ouseburn Valley Works,
Benton Bank Bridge widening and tramway,
Jesmond Dene.

4.45 p.m.—Banqueting hall, Jesmond Dene, kindly lent by the Town Moor and Parks Committee of the City Council, where tea will be provided.

J. P. Wakeford, Assoc.M.Inst.C.E., *Hon. District Secretary.*

Town Hall, Wakefield.

VISIT TO AMSTERDAM AND THE HAGUE, WHITSUNTIDE.

Arrangements have now been completed for the visit of the institution to Amsterdam and The Hague next month.

Ladies are especially invited to attend this meeting.

Programme.

Thursday, May 8th.

Leave London (Liverpool-street Station) at 8.30 p.m., via Harwich and the Hook of Holland.

Friday, May 9th.

Arrive at the Hook of Holland and proceed to Amsterdam, arriving 7.30 a.m.

12.45 p.m.—Carriages leave hotels.

1.0 p.m.—Reception at the town hall by the Burgomaster and Aldermen of Amsterdam.

1.25 p.m.—Leave the town hall.

1.30 p.m.—Arrive at the Exchange, where the party will be received by Mr. A. W. Boss, the Director of Public Works, who, with Mr. F. S. Jacob and Mr. P. Lohr, city engineers, will give a description of the drainage and sewerage works of Amsterdam, dealing with the special difficulties presented by the peculiarities of the country, after which the members will proceed to visit works in course of construction (*inter alia*), the sewage pumping stations (electric pumps),

Europ[illegible]
ducing ozone old and new sewage outfall works, tram-
a few European cities.
not absolutely efficient[illegible]tels.
partially soluble in wate[illegible] *May 10th.*
been made with various ra[illegible]tels; visit to the city
violet rays, &c. The most gene[illegible]s are described as an
of disinfecting water is by use [illegible]atus up-to-date in
lime. This method has recently c[illegible]
not only as a temporary measure
cases, but as a permanent adjunct
plants. The following Canadian and
cities are using this form of disinfectant—
real, Toronto, Ottawa, Strathcona, Trento[illegible]he Isle of
City, Little Falls, New York, Albany, Pough
Philadelphia, Pittsburg, Harrisburg, Cinc
Columbus, Erie, Hartford, Nashville, St.
Indianapolis, Omaha, Whiting, Minnea
Brainard, Des Moines, McKeesport, Grand For[illegible]amer
Milwaukee, Evanston, Battle Creek, New Brunswi
and many smaller towns. Hypochlorite of lime am.
chloride of lime is sold in sheet iron drums, an
contains on the average about 33 per cent of avail[illegible]n
able chlorine. The lime is mixed usually in a 1 pe[illegible]e
cent solution, and the solution added to the water by
calibrated appliances. An average of about ·5 parts
of available chlorine per 1,000,000 parts of water is
usually sufficient to sterilise a water from which the
suspended matter has been previously removed by
filtration.

Local objections have been made to the use of chlorine as applied to domestic water supply because of occasional taste and odour imparted to the water. These, in every case, have been due to carelessness or crude methods of application allowing overdoses at times. With the improved methods of application this chance overdosing can be effectually guarded against. The reaction which takes place when chlorine is added to water liberates nascent oxygen which is the sterilising agent; the by-products are carbonate of lime, hypochlorus acid and hydrochloric acid hardly chemically traceable with the minute quantities of chlorine required. Chloride of lime costs about 1½ cents a pound, and adds little to the cost of water purification.

If it is granted that disinfection of water is advisable, then the rapid method of water filtration should prove as efficient as the slow methods for the preliminary process of removal of suspended matter, together with the added benefit of removal of colour, and will further, in Canada, provide a considerable

* Extracts from paper read before the annual meeting of the Canadian Public Health Association at Toronto.

INSTITUTION OF MUNICIPAL ENGINEERS.

President—Mr. Frank Latham, M.Inst.C.E.I., F.S.E., Borough Engineer and Surveyor, Penzance.

SOUTHERN AND SOUTH-EASTERN DISTRICTS.

A visit will be paid to the Portland cement works of Messrs. Martin, Earle & Co., Limited, Wickham, Rochester, to-morrow (Saturday).

Programme.

9.20 a.m.—Train leaves Cannon-street station for Strood.

10.33 a.m.—Arrive Strood station, where chars-à-banc will be in waiting to take members to the works.

10.45 a.m.—Assemble at works.

12 noon.—Leave works and return to Rochester.

12.15 p.m.—Assemble at Rochester Bridge and inspect, by courtesy of Mr. David Anderson, the resident engineer, the works of reconstruction. The existing structure is being used as a staging on which to build the new steel bridge, one longitudinal half being dealt with at a time so as to maintain the traffic. After the two halves of the new work have been completed and united the existing cast-iron arches will be removed in sections by lowering them down into barges beneath.

Arthur Palmer,
J. W. Brook,
Hon. District Secretaries.

NORTHERN DISTRICT.

A meeting of the above will be held in the Town Hall, Newcastle-on-Tyne, to-morrow (Saturday), at 2.30 p.m.

Business.

To consider letter from Mr. Hill, Secretary to the N.A.L.G.O., offering to allow this association to become affiliated with their association for the sum of £1 1s. per annum, or 3d. per member.

To arrange programme for summer visits.

International Roads Congress.—The secretary will raise the question of all members making a uniform charge for expenses incurred when attending the above congress.

John Robinson,
Hon. District Secretary.

Darlington.

The following council meetings have been arranged: April 30th, London; May 31st, Manchester; June 28th, London; July 30th, London.

B. Wyand,
Secretary.

39 Victoria-street, S.W.

Trade Unionism for Professions.—This will form the subject of a paper which Mr. A. Burnaby Howes, barrister-at-law, will read before the members of the Quantity Surveyors' Association at a meeting to be held at Caxton House, Westminster, S.W., on Monday next, the 28th inst., at 8 p.m.

Town Planning Schemes.—The Local Government Board have authorised the preparation of three more town planning schemes—namely, Twickenham, Much Woolton, and Cheadle and Gatley. The Twickenham scheme applies to an area of 1,860 acres situate in the urban districts of Twickenham and Heston and Isleworth.

Talbot Cars in Australia.—Only a few weeks ago the whole motoring world was acclaiming the truly wonderful speed of the 25-horse power Talbot car which created the historic run of over 103 miles in one hour at Brooklands, and praising the extraordinary efficiency of the engine that had made this achievement possible. That the Talbot car excels in other features than speed alone has been proved by the recipt of a cable announcing the result of the annual reliability trial from Sydney to Melbourne, organised by the Australian Automobile Club. In this event the competing cars included two 1913 model Talbots, which were placed first and second at the finish. As an indication of the sweeping victory of the winning Talbot car, we would add that it secured the maximum marks for reliability, also for hill-climbing, as well as for petrol-consumption, the three classes into which the trial was divided testifying unmistakably to the all-round reliability of the new Talbot cars for road service.

INSTITUTION OF ELECTRICAL ENGINEERS.

QUALIFYING EXAMINATIONS FOR ADMISSION AS STUDENT.

The Institution of Electrical Engineers does not hold a qualifying examination for admission as student.

On and after June 1st next all candidates for election to the class of students will be required to have one of the following qualifications:—

(1) The Matriculation Examination of any University in the British Empire; or the Responsions Examination of the University of Oxford; or the Previous Examination of the University of Cambridge.

(2) The Studentship Examination of the Institution of Civil Engineers.

(3) The School-leaving Examination for the Scottish Education Department.

(4) The Naval Cadet Passing-out Examination.

(5) The Entrance Examinations for Woolwich and Sandhurst.

(6) The School Examination (for school-leaving certificate) or the Senior School Examination of the University of London.

(7) The Oxford or Cambridge Local Examination. (A senior certificate, provided it covers English and elementary mathematics.)

(8) The Oxford and Cambridge Higher Certificate (provided it covers English and elementary mathematics).

(9) The Abiturienten examination of any German or Austrian secondary school, or the corresponding examination of similar schools in other countries.

(10) The certificate of any other educational authority which may be recognised by the council of the institution as equivalent for the purpose of admission to the class of students.

APPOINTMENTS VACANT.

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CHIEF ASSISTANT TO BOROUGH SURVEYOR.—April 26th.—Corporation of Darlington. £230—£250.—Mr. H. G. Stevenson, town clerk.

CLERK OF WORKS.—April 26th.—Pembroke, co. Dublin, Urban District Council.—Mr. J. C. Manly, clerk.

INSPECTOR OF NUISANCES.—April 26th.—Corporation of Bradford. £90 per annum.—Mr. F. Stevens, town clerk.

JUNIOR ASSISTANT TO BOROUGH SURVEYOR.—April 26th.—Corporation of Darlington. £90—£110. Mr. H. G. Stevenson, town clerk.

ENGINEERING ASSISTANT.—April 26th.—Corporation of Birkenhead. £100—£110 per annum.—Mr. C. Brownridge, borough engineer and surveyor.

INSPECTOR OF NUISANCES.—April 28th.—Corporation of Wolverhampton. £100 per annum.—Mr. H. Brevitt, town clerk.

WASTE WATER INSPECTOR.—April 28th.—Pontypridd and Rhondda Joint Water Board. 28s.—35s. per week.—Mr. E. W. Terrey, waterworks engineer, 27 Gelliwastad-road, Pontypridd.

TEMPORARY ASSISTANTS (2).—April 28th.—Devon County Council. £3 3s. and £2 2s. per week.—Mr. Edward Stead, county surveyor, No. 1 Division.

INSPECTOR OF NUISANCES.—April 29th.—Ryton Urban District Council. £100—£150.—Mr. H. Dalton, clerk.

CLERK OF WORKS.—April 29th.—Warmley Rural District Council.—Mr. S. Williams, clerk.

INSPECTOR OF NUISANCES.—April 29th.—Heanor Urban District Council. £100 per annum.—Mr. F. Cattle, clerk.

CLERK OF WORKS.—April 30th.—Sedgefield Rural District Council. £2 per week.—Mr. J. W. Lodge, clerk.

ENGINEERING ASSISTANT.—April 30th.—Durham County Council. £150 per annum.—Mr. William Crozier, county surveyor, Shire Hall, Durham.

SURVEYING ASSISTANT.—April 30th.—Durham County Council. £150 per annum.—Mr. William Crozier, county surveyor, Shire Hall, Durham.

DIVISIONAL ROAD SURVEYOR'S CLERK.—April 30th.—Durham County Council. £48 per annum.—Mr. William Crozier, county surveyor, Shire Hall, Durham.

CLERK OF WORKS.—April 30th.—Sedgefield Rural District Council. £2 per week.—Mr. J. W. Lodge, clerk.

TEMPORARY ENGINEERING AND SURVEYING ASSISTANTS.—April 30th.—Durham County Council. £150 per annum.—Mr. William Crozier, county surveyor, Durham.

WORKING FOREMAN.—April 30th.—Tavistock Urban District Council.—Mr. E. Warran, clerk.

ASSISTANT ENGINEERS. — May 1st. — Indian Public Works and State Railway Departments.—Secretary, Public Works Department, India Office, London, S.W.

SURVEYOR, INSPECTOR AND COLLECTOR.—May 2nd.—Buckfastleigh Urban District Council. £150 per annum.—Mr. Edward Windeatt, clerk.

ASSISTANT SANITARY INSPECTOR.—May 3rd.—Perth County Council. £85 per annum and travelling expenses.—Mr. R. McNicoll, county and chief district sanitary inspector, county buildings, Perth.

SURVEYOR'S SHORTHAND CLERK.—May 5th.—Beckenham Urban District Council. £75—£115.—Mr. F. Stevens, clerk.

CLERK OF WORKS.—May 5th.—Wombwell Urban District Council. £3 3s. per week.—Mr. P. M. Walker, clerk.

CLERK OF WORKS.—May 6th.—Axbridge Rural District Council. £2 2s. per week.—Mr. J. Knight Dunster, surveyor.

BOROUGH SURVEYOR'S ASSISTANT.—May 10th.—Paddington Borough Council. £180—£250.—Mr. Arthur W. J. Russel, town clerk.

CLERK OF WORKS.—May 12th.—Corporation of Aberavon. £2 10s. per week.—Mr. M. Tennant, town clerk.

ENGINEER.—May 15th.—Corporation of Sheffield. Mr. R. M. Prescott, town clerk.

ASSISTANT ENGINEER.—May 15th.—Board of Trustees for the Improvement of Calcutta. 500—700 rupees per mensem.—Mr. C. H. Bompas, chairman, 5 Clive-street, Calcutta.

ASSISTANT ENGINEER.—Public Works Department of the Government of the Gold Coast. £300—£350.—Crown Agents for the Colonies, 4 Whitehall-gardens, S.W.

ASSISTANT ENGINEER.—Required for India by an English firm with large works.—"H. R.," office of The Surveyor, 24 Bride-lane, Fleet-street, E.C.

MUNICIPAL COMPETITIONS OPEN.

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BLACKBURN.—June 2nd.—Schemes for the improvement of the streets in the centre of the town.—Mr. J. L. Beard, town clerk.

EXETER.—June 7th.—Designs for a hostel for male students, for the corporation. Assessor, Mr. Edwin Cooper, F.R.I.B.A.—The Town Clerk.

DEVONPORT.—June 14th.—Designs for municipal buildings and a guildhall, for the Corporation of Devonport. Premiums of £350, £150, and £100 are offered. The assessor is Mr. Ernest Newton, A.R.A., F.R.I.B.A.—Mr. R. J. Fittall, town clerk.

NEWCASTLE-ON-TYNE.—June 14th.—Designs for proposed public baths, for the corporation. Mr. H. W. Wills, F.R.I.B.A., has been appointed as assessor.—Mr. A. M. Oliver, town clerk.

NEWCASTLE-ON-TYNE.—June 19th.—Designs for laying out portion of the Walker estate, for the corporation. Premiums £50, £30, and £20.—Mr. A. M. Oliver, town clerk.

CHEPPING WYCOMBE.—September 1st.—Designs for town-planning the borough and an area immediately adjoining. Premiums, £25, £10 and £5.—Mr. T. J. Rushbrooke, borough surveyor, High Wycombe.

MUNICIPAL CONTRACTS OPEN.

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Buildings.

DUNDEE.—April 26th.—For extensions to generating station, for the corporation.—Mr. H. Richardson, electricity department.

MACCLESFIELD.—April 26.—For the erection of a filter house, for the corporation.—Mr. F. R. Oldfield, town clerk.

SPENNYMOOR.—April 26th.—For the erection of public hall and offices, for the urban district council.—Mr. G. T. Wellburn, 115 Albert-road, Middlesbrough.

BEVERLEY.—April 28th.—For the erection of an infants' school, for the corporation.—Mr. J. Willis Mills, town clerk.

WALSALL.—April 29th.—For the erection of a boiler house, for the Electricity Committee.—Borough Electrical Engineer, Wolverhampton-street.

LONDON.—April 29th.—For structural alterations at the Battersea pumping station, for the county council.—Mr. G. W. Humphreys, engineer, County Hall, Spring-gardens, S.W.

FLINT.—April 29th—May 6th.—For the erection of a school and other works, for the county council.—Mr. Sam Evans, county surveyor, Mold.

CHELMSFORD.—April 30th.—For the erection of a wooden pavilion, for the corporation.—Borough Engineer.

WOOD GREEN.—April 30th.—For the erection of a central fire station, for the urban district council.—Mr. W. P. Harding, clerk.

LYNN.—April 30th.—For extensions to the electricity station, for the corporation.—Mr. A. J. Smith, borough surveyor.

CAMBRIDGE.—April 30th.—For the erection of additions to the Guildhall, for the corporation.—Mr. J. E. L. Whitehead, town clerk.

LEICESTER.—May 2nd.—For the erection of a handicraft centre, for the county council.—Mr. W. A. Brockington, director of education, County Education Offices, Leicester.

DUNMOW.—May 5th.—For rebuilding a bridge, for the rural district council.—Mr. A. E. Floyd, clerk.

SHEFFIELD.—May 5th.—For excavating, erecting retaining wall, and extending reservoir, for the corporation.—Mr. S. E. Fedden, electric supply department, Commercial-street, Sheffield.

SELBY.—May 5th.—For the erection of forty-two cottages, for the urban district council.—Mr. Bruce Gray, Council Chambers, Selby.

COVENTRY.—May 8th.—For the erection of tramway car sheds, for the corporation.—Mr. T. R. Whitehead, general manager, Priestley's Bridge Depot, Coventry.

ALSAGER.—May 13th.—For the boring and lining of Borehole No. 2 in connection with the Oak Farm water supply, for the urban district council.—Mr. John J. Nelson, clerk.

LARNE.—May 14th.—For building twelve single and three double labourers' cottages, for the rural district council.—Mr. S. M. Wallace, clerk.

HASLINGDEN.—May 14th.—For the erection of a school, for the corporation.—Mr. J. S. Green, borough surveyor.

Iron and Steel.

EXMOUTH.—April 26th.—For the supply of cast-iron water mains, 9-in., 6-in., 4-in. and 3-in. diameter, supply of valves, valve hydrants and other fittings, and for the necessary labour and materials required in laying 9-in. and 6-in. mains and fixing valves, for the urban district council.—Mr. Samuel Hutton, engineer.

YORK.—April 26th.—For the supply of iron and steel work required during the ensuing year, for the corporation.—Mr. F. W. Spurr, city engineer.

CHIRBURY.—April 29th.—For the supply of cast-iron pipes and specials, laying and jointing water pipes, and construction of tanks and filters, for the rural district council.—Mr. Charles S. Pryce, clerk.

HARTLEPOOL.—May 1st.—For the supply of iron railings and entrance gates, for the corporation.—Mr. A. P. Horsley, borough engineer.

Roads.

PETWORTH.—April 26th.—For the supply and carting of materials, for the rural district council.—The Surveyor, Fox-hill, Petworth.

SOMERSET.—April 26th.—For the deviation of a road, for the county council.—County Surveyor, Wells.

WOLSTANTON.—April 26th.—For the delivery of 2-in. and 2½-in. machine-broken Clee Hill basalt, Leicester granite or Welsh granite, for the urban district council.—Mr. W. F. Slater, engineer and surveyor.

HORSFORTH.—April 26th.—For making up a street, for the urban district council.—Mr. H. Raven, surveyor.

GRANTOWN-ON-SPEY.—April 26th.—For forming kerbs and footpaths, for the corporation.—Mr. W. Forsyth, town clerk.

WANDSWORTH.—April 28th.—For making up and paving part of Cavendish-road, Clapham South, for the borough council.—Mr. D. A. Nicholl, town clerk.

DURHAM.—April 28th.—For making up certain streets, for the corporation.—Mr. John T. Pegge, city surveyor.

BACUP.—April 28th.—For work of paving, for the corporation.—Mr. W. H. Elce, borough surveyor.

TIVERTON.—April 28th.—For tar-spraying 40,000 super. yards during the coming season, for the corporation.—Mr. J. Siddals, borough surveyor.

STOKE-ON-TRENT.—April 28th.—For making-up certain streets, for the corporation.—Borough Surveyor.

DERBY.—April 28th.—For making up certain streets, for the corporation.—Mr. J. Ward, borough surveyor.

LARNE.—April 29th.—For the construction of a new road, for the rural district council.—The Clerk, The Workhouse.

LEWISHAM.—April 29th.—For street works, for the borough council.—Borough Surveyor.

GLANFORD BRIGG.—April 29th.—For the supply of two 10-ton steam rollers, for the rural district council.—Mr. F. C. Hett, clerk.

GATESHEAD.—April 29th.—For carrying out cement path work, for the corporation.—Mr. W. Swinburne, town clerk.

MIDDLETON.—April 29th.—For re-surfacing a street with tar-macadam, Rocmac, Pitchmac, or other bituminous materials, for the corporation.—Mr. W. Welburn, borough surveyor.

SHOREHAM.—April 29th.—For the supply of granite quartzite or Elvan stone, for the urban district council.—Mr. Harold Brown, clerk.

HOOLE.—April 29th.—For the supply of tar-macadam, for the urban district council.—Mr. C. Atkin, surveyor.

BROMLEY.—April 29th.—For making good certain roads, for the corporation.—Mr. Fred. H. Norman, town clerk.

DEAL.—April 30th.—For street improvement works, for the corporation.—Mr. T. C. Golder, borough surveyor.

DOLLAR.—April 30th.—For the construction of footpaths, kerbs and run channels, for the corporation.—Mr. A. M. J. Graham, town clerk.

WANSTEAD.—April 30th.—For relaying kerb, forming new channel gulleys, and resurfacing carriageways, for the urban district council.—Mr. Bruce Blewitt, clerk.

NEW SARUM.—April 30th.—For the execution of street work, for the corporation.—Mr. W. J. Goodwin, city engineer and surveyor.

WIDNES.—April 30th.—For making up certain streets, for the corporation.—Mr. H. S. Oppenheim, town clerk.

STAMFORD.—April 30th.—For the supply of broken granite, for the corporation.—Mr. F. R. Ryman, borough surveyor.

SALISBURY.—April 30th.—For the execution of private street works, for the corporation.—Mr. W. J. Goodwin, city engineer and surveyor.

WHISTON.—April 30th.—For the supply of macadam, copper slag, kerb, channel, and setts, for the rural district council.—Mr. R. J. Knapman, surveyor.

HOVE.—April 30th.—For paving and other works, for the corporation.—Mr. H. H. Scott, borough surveyor.

WITHNELL.—May 1st.—For the supply of granite macadam, for the urban district council.—Mr. T. Moss, surveyor, Brinscall, Lancs.

OLDHAM.—May 1st.—For making-up and macadamising certain roads, for the corporation.—Mr. J. H. Hallsworth, town clerk.

STOCKPORT.—May 1st.—For excavating and sewering, for the corporation.—Mr. J. Atkinson, borough surveyor.

ARNOLD.—May 1st.—For making up certain streets, for the urban district council.—Mr. C. Ford Spencer, clerk.

JARROW.—May 1st.—For the supply of whinstone and whinstone setts, for the corporation.—Mr. J. Scott Weir, borough engineer.

MALDON.—May 2nd.—For the supply and delivery of broken granite and flints, and for steam rolling, for the corporation.—Mr. F. H. Bright, town clerk.

EAST DEREHAM.—May 3rd.—For the supply of broken granite and granite chippings, for the urban district council.—Mr. F. L. Burch, surveyor.

SAFFRON WALDEN.—May 3rd.—For the supply of granite macadam, for the corporation.—Mr. A. H. Forbes, borough surveyor.

SWANSEA.—May 5th.—For the completion of a new road, for the rural district council.—Mr. Edward Harris, clerk.

SELBY.—May 5th.—For the making of streets and sewers, for the urban district council.—Mr. Bruce Gray, Council Chambers, Selby.

SOUTHAMPTON.—May 5th.—For work of road widening and surface-water drainage, for the county council.—Mr. H. Barber, clerk, The Castle, Winchester.

HORNCASTLE.—May 5th.—For the supply of road material, for the urban district council.—Mr. R. W. Clitheroe, clerk.

ALDERSHOT.—May 6th.—For making up a roadway, for the urban district council.—Mr. W. E. Foster, clerk.

LONDON.—May 6th.—For the supply of 447,000 Jarrah wood and 508,000 creosoted deal paving blocks, and 2,450 tons of Guernsey granite paving setts, for the county council.—Sir Laurence Gomme, clerk.

HAZEL GROVE.—May 6th.—For laying rock asphalt, tar-macadam, paving, kerbing, flagging, and surface-water drainage, for the urban district council.—Mr. F. Pidgeon, clerk.

CRAMLINGTON.—May 6th.—For the supply of broken whinstone, whin chippings, slag chippings, and tarred slag, for the urban district council.—Mr. W. I. Coulson, surveyor.

BRECON.—May 8th.—For taking up and relaying kerb, channel and paving, for the corporation.—Mr. H. L. Griffiths, borough surveyor.

CLEETHORPES.—May 10th.—For making up a road, for the urban district council.—Mr. C. H. Waithman, surveyor.

ROCHDALE.—May 14th.—For work of making up and sewering, for the corporation.—Borough Surveyor.

Sanitary.

GATESHEAD.—April 26th.—For the supply of disinfectants, for the corporation.—Mr. W. Swinburne, town clerk.

GATESHEAD.—April 26th—May 13th.—For a scheme of sewerage and sewage disposal, for the corporation.—Messrs. D. Balfour & Son, 3 St. Nicholas-buildings, Newcastle-on-Tyne.

LYE AND WOLLESCOTE.—April 26th.—For laying stoneware pipe sewers, with manholes, for the urban district council.—Mr. W. Stanley Mobberley, clerk.

KENSINGTON.—April 28th.—For the construction of an underground convenience, for the borough council.—Borough Engineer.

HINCKLEY.—April 29th.—For laying outfall sewer and manholes, for the urban district council.—Mr. E. H. Crump, engineer and surveyor.

HASTINGS.—April 29th.—For laying cast-iron pipe sewers, for the corporation.—Mr. P. H. Palmer, borough engineer.

GRIMSBY.—April 30th.—For culverting an open stream, for the corporation.—Mr. H. Gilbert Whyatt, borough engineer and surveyor.

REPTON.—April 30th.—For the construction of 9-in. stoneware and cast-iron sewers, with manholes and accessories, also the erection of engine house, screening chamber, pump well tanks, filters, sludge lagoons, the supply and fixing of engines and pumps, and other works, for the rural district council.—Mr. C. F. Chamberlin, clerk.

WOOD GREEN.—April 30th.—For the extension of public baths and erection of sheds and workshops, for the urban district council.—Mr. W. P. Harding, clerk.

SURBITON.—May 2nd.—For the erection of a pair of cottages and a single cottage, for the urban district council.—Mr. A. J. Hardwick, architect, Eagle Chambers, Eden-street, Kingston-on-Thames.

BURNLEY.—May 3rd.—For laying earthenware pipe sewers, manholes, concrete tanks and percolating filters, for the rural district council.—Mr. H. Pritchard, engineer, 18 Nicholas-street, Burnley.

BULKINGTON.—May 3rd.—For the removal of night soil, for the urban district council.—Mr. H. W. Wilson, surveyor, Attleborough, Nuneaton.

BIRMINGHAM.—May 5th.—For the construction of a sewer, for the corporation.—Mr. Henry E. Stilgoe, city engineer and surveyor.

RUNCORN.—May 5th.—For laying stoneware and cast-iron pipe sewers, and supplying pipes and specials, for the rural district council.—Mr. George F. Ashton, clerk.

STROUD.—May 6th.—For the construction of sewage disposal works, for the urban district council.—Mr. G. P. Milnes, 7 Rowcroft, Stroud.

POOLE.—May 6th.—For emptying cesspools, for the rural district council.—Mr. G. H. Seymour, inspector, Longfleet, Poole.

NORTH BROMSGROVE.—May 6th.—For the construction of about 2,477 lin. yds. of 6-in. diameter stoneware pipe sewers, with manholes, flushing chambers and ventilating columns, for the urban district council.—Mr. Robert Green, engineer, 37 Waterloo-street, Birmingham.

EPSOM.—May 6th.—For the construction of engine house, bacteria beds, storm-water tanks, and other works, for the rural district council.—Mr. Arthur R. Cotton, clerk.

STALYBRIDGE AND DUKINFIELD.—May 7th.—For the supply and erection of No. 5 rotary sewage sprinklers, with all necessary pipes and fittings, for the Joint Sewerage Board.—Messrs. J. P. Wilkinson & Son, 301 Cathedral-street, Manchester.

CAMBORNE.—May 7th.—For works in connection with sewerage and sewage disposal, for the urban district council.—Mr. C. V. Thomas, clerk.

DENTON.—May 14th.—For the construction of brick and stoneware pipe sewers, for the urban district council.—Mr. William Richards, clerk.

Stores.

MIDLOTHIAN.—May 1st.—For the supply of tools, ironmongery, brushes, oils, paints, rubber goods, explosives, bricks, pipes, cement, coals, and fencing materials, for the county council.—Mr. A. G. G. Asher, county clerk, County Buildings, Edinburgh.

SOUTH SHIELDS.—May 1st.—For the supply of materials for the tramway department, for the corporation.—Mr. J. Moore Hayton, town clerk.

RICHMOND (Surrey).—May 12th.—For the supply of coal, lime, sulphate of alumina and green copperas and filter cloth, for the Main Sewerage Board.—Mr. W. Fairlie, engineer, West Hall-road, Kew Gardens.

Miscellaneous.

GRIMSBY.—April 30th.—For culverting 990 lin. yds. of open stream in (1) brickwork, (2) reinforced concrete or (3) concrete tubes, for the corporation.—Mr. H. Gilbert Whyatt, borough engineer and surveyor.

CONWAY.—May 3rd.—For cleaning, scraping and painting the suspension bridge, for the corporation.—Mr. Hugh Parry, town clerk.

RICHMOND.—May 12th.—For the supply of Welsh steam coal, house coal, Buxton lime, grey lime, sulphate of alumina and green copperas, and filter cloth, for the Sewerage Board.—Mr. J. Leslie G. Powell, clerk.

TORONTO.—May 28th.—For the removal of 35,000,000 cub. yds. of material by hydraulic dredging, for the Toronto Harbour Commissioners.—Mr. E. L. Cousins, chief engineer.

TENDERS FOR MUNICIPAL WORKS OR SUPPLIES.

The Editor invites the co-operation of Surveyor readers with a view to making the information given under this head as complete and accurate as possible.

* Accepted. † Recommended for acceptance.

AYR.—For permanent-way construction and road widening, for the corporation:—

A. Spark & Son, Limited, Glasgow.

BRIERFIELD.—For the construction of septic tanks and contact beds, for the urban district council.—Mr. B. Halstead, surveyor:—

J. J. H. Boothman, Brierfield.

DOVER.—For the construction of carriageway and footpaths, for the corporation. Mr. W. C. Hawke, borough engineer:—

Carriageways.

Baldry, Yerburgh & Hutchinson, London	£17,169
S. Pearson & Son, Limited, London	15,379
H. Lovatt, Limited, Wolverhampton	14,806
Perry & Co. (Bow), Limited, London	13,562
G. P. Trentham & Co., Limited, Birmingham	13,017
Dick, Kerr & Co., Limited, London	12,913
Paramors, Limited, Margate*	12,170

Tramways.

S. Pearson & Son, Limited, London	4,236
Baldry, Yerburgh & Hutchinson, London	4,025
Perry & Co. (Bow), Limited, London	3,768
Paramors, Limited, Margate	3,420
G. P. Trentham & Co., Limited, Birmingham	3,289
Dick, Kerr & Co., Limited, London*	2,892

FARNHAM.—For tar-painting main and district roads, for the urban district council.—Mr. R. W. Cass, surveyor:—

H. V. Smith & Co., Westminster.

HAVERHILL.—Accepted for the supply of broken granite or basalt and tar-macadam, for the urban district council.—Mr. J. H. Clarke, surveyor:—

Jee's Hartshill Granite Company, Atherstone.
The Cliffe Hill Granite Company, Limited, Leicester.
Tarmac, Limited, Wolverhampton.

HUNTLY.—For laying pipe sewer, for the corporation.—Mr. J. Allan, borough surveyor:—

R. Mitchell, Huntly, £117.

INVERNESS-SHIRE.—The Badenoch district committee have accepted the following tenders for road improvements, in connection with which the Road Board have sanctioned a grant:—

Improvements on the Perth, Inverness, and Newtonmore-Fort William roads.—Kings & Co., Glasgow, £4,287.
Steel work of Laggan Bridge.—Motherwell Bridge Company, £1,350.
Masonry work of Laggan Bridge.—J. Macdonald, Kingussie, £332.
The Laggan & Strathdearn divisions of road, a distance of 89 miles, have been let on contract for three years as follows:—Laggan (upper division), J. Tolmie, £278; Laggan (lower division), A. Gordon, £275; Strathdearn (No. 1), W. Mackintosh, £333; Strathdearn (No. 2), J. Cameron Mackintosh, £342.

ROMFORD.—The following tenders have been accepted by the urban district council:—

Works of improvement in Balgores-lane.—Parlby & Bescoby, £453.
Team labour.—Parlby & Bescoby.
Disinfectants.—W. S. Steeples.
Granite.—Messrs. W. Griffiths & Co, 13s. 9d. per ton.

SOUTHEND-ON-SEA.—For the erection of a school, for the Education Committee:—

C. Ansell, Lambeth	£17,937
Davey & Armitage (local)	17,386
W. E. Davey (local)	16,980
A. E. Symes, Stratford	16,893
F. J. Coxhead, Leytonstone	16,793
W. T. Burrows, Maidstone	16,696
S. Roberts, Limited, Plymouth	16,566
Bosworth & Lowe, Nottingham	16,371
J. C. Flaxman (local)	16,000
Parren & Son, Earith	15,966
S. E. Moss (local)*	15,750

STAFFORD.—Accepted for the construction of ward block at isolation hospital, for the corporation.—Mr. W. Plant, borough engineer and surveyor:—

H. Dorse, Cradley Heath, £904.

SWADLINCOTE.—The following tenders have been accepted by the urban district council:—

Cement and Slag Dust.

Barton Cement Company.—Cement, 35s. per ton.
Stanton Ironworks Company.—Slag dust (delivered Swadlincote), 4s. per ton, various sizes 4s. 9d. per ton.

Roadstone.

Salisbury & Wood.—Whitwick granite, broken granite (various sizes), 2½ in. 7s. 1d., 2 in. 7s. 3d., 1½ in. 7s. 3d., 1 in. 6s. 9d., ½ in. 4s. 6d., ¼ in. and ⅛ in., without dust 5s. 9d., with dust 5s. 3d., granite dust 2s 6d., unbroken granite 5s. 6d., rubble 2s. 6d. per ton respectively.
Mount St. Bernard granite 2½ in. 6s. 1d., 2 in. 6s. 3d., 1½ in. 6s., 1 in. 5s. 3d., ½ in., ¾ in., and ⅛ in. 3s. 4d., granite dust 2s. 6d. per ton respectively; concrete kerb 5 in. by 10 in. 8½d. per foot, 6 in. by 12 in. 11d. per foot (circular 6d. extra).

TIVERTON.—Accepted for work of steam rolling, for the rural district council.—Mr. A. J. Mildon, surveyor:—

W. Elworthy, Crossland, 34s. per day.

MEETINGS.

Secretaries and others will oblige by sending early notice of dates of forthcoming meetings.

APRIL.

26.—Institution of Municipal and County Engineers: Meeting at Gerrards Cross.
26.—Institution of Municipal Engineers: Northern District Meeting at Darlington.
26.—Institution of Municipal Engineers: Visit to Messrs. Martin, Earle & Co.'s Cement Works, Wickham, Rochester.
28.—Institution of Civil Engineers (Students' Meeting): Mr. T. Frame Thomson, M.Inst.C.E., on "Law in Relation to Engineering." 8 p.m.

The Surveyor

And Municipal and County Engineer.

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Minutes of Proceedings.

Concrete Surfaces.

The surface appearance of concrete, particularly with regard to the application of special facings and the prevention of unsightly or dangerous cracks, is a matter of vital interest to the engineer, in concrete either plain or reinforced. It is not surprising, therefore, that the Reinforced Concrete Practice Standing Committee of the Concrete Institute should have devoted their attention to these subjects, in regard to each of which they have recently issued comprehensive reports. These interesting documents, some extracts from which will be found in another column, were read and discussed at a recent meeting of the Institute. In regard to cracks, the report is based upon the replies received to certain questions which were circulated among all the members of the Institute. It must be borne in mind that the most serious cracks in concrete work are not the hair cracks which not infrequently make their appearance upon the surface but which are fortunately capable of removal by one or other of the well-known processes available for that purpose. Far greater anxiety is caused by those larger cracks which extend through the body of the work, and are at times a positive danger to an entire structure. Faulty design or workmanship are often the direct cause of these occurrences, and particularly, perhaps, the removal of forms before the work is sufficiently set. In regard to this matter the committee have made some very valuable suggestions as to the length of time which should be allowed to elapse before the removal of the forms in various cases. Then again, cracks are often caused by expansion of the cement or concrete (frequently due to the use of coarse materials containing various deleterious substances), or by the corrosion of embedded steel. In other instances cracks have been caused by shrinkage from setting and hardening in air. It is pointed out in the report that concrete will expand slightly in water and contract on drying out, so that cracking is frequently not evidenced from this cause until the concrete is allowed to dry, which may be some months after the work has been completed. Most engineers who are called upon to use concrete to any considerable extent have experienced cracks due to one or another of the causes named, so that the labours of the committee in extracting principles from the practical experiences of a large number of engineers will, no doubt, be very widely appreciated.

The surface treatment of concrete forms the subject of a separate report, which contains a summary of the replies received to a circular letter issued to all the members of the institute, together with some general conclusions drawn by the committee from the information thus obtained. The most usual way of obtaining a smooth surface appears to be by means of a careful preparation of the moulds, and the application of a liquid mixture of concrete of such consistency as will allow of the smaller particles of the aggregate and the cement being brought towards the outer surface. This report also contains much information as to the colouring of concrete.

* * *

Gerrards Cross Sewage Disposal.

There are several points of interest in connection with the new works of sewerage and sewage disposal which were opened on the occasion of the meeting of the Institution of Municipal and County Engineers held at Gerrards Cross last Saturday. From the paper read by Mr. Arthur Gladwell, and from his reply to the discussion which ensued, we gather that he anticipates that the whole of the sewage effluent will soak away and disappear in the drift gravel of which the irrigation area is composed. This being so, the question arises whether it was necessary to carry the process of purification to such an extreme as to necessitate the use of filters and humus tanks, and whether a good tank effluent could not have been satisfactorily purified on the land. Possibly, the removal of 4,000 cub. yds. of gravel for use in the preparation of concrete for the construction of the works reduced the effective area of the land considerably, and Mr. Gladwell's expressed desire to be "on the safe side," may account for the provision of extra precautions. In any event, the works now provided will remove all cause for anxiety in the future.

Another point raised in the discussion was the question as to how Mr. Gladwell "satisfied the Local Government inspector" that the sewage would be of *medium* strength. Mr. Gladwell did not disclose the method he adopted, but simply pointed to the fact that the works were actually completed and in operation, and therefore the inspector must have been "satisfied." This, of course, ought to settle the matter, but we believe that the same problem must have arisen in many other similar cases, and in our opinion

it is chiefly a matter of dilution. It is obvious that the amount of organic matter in all domestic sewage must be practically the same per head of population, and that the sewage in a town, for example, where slop water-closets are in use, or where the consumption of water per head per day is 10 gallons, must be much more concentrated, and thus *stronger* than the sewage in a town where the consumption of water is 30 gallons per head per day. Mr. Gladwell took the wise precaution of estimating his volume of sewage at 25 gallons per head per day, so that he is bound to be right. If the actual volume of sewage reaches this figure it will certainly not exceed the standard for *medium* strength, and if it should only be 15 gallons, it may then possibly be classified as *strong* sewage, but in that case the total volume will be so much less that the cubic capacity of the filters will be more than ample to comply with the requirements of the Local Government Board for *strong* sewage. Whatever means he adopted to "satisfy the Local Government Board inspector," it is evident, both from his words and his works, that Mr. Gladwell satisfied himself that he would be "on the safe side," as he usually is.

* * *

The Olympia Conference and Highway Administration.

As intimated in the closing paragraph of our report of THE SURVEYOR conference at Olympia, the editor has undertaken the duty of sending to the highway authorities copies of the resolutions adopted at the meeting. It may be hoped that this will give to the resolutions a value somewhat greater than that of mere pious opinions, since the meeting was representative of well-informed opinion and long practical experience in highway work. It is, perhaps, unfortunate that the word "important" was allowed to stand in the first resolution, since it is undoubtedly the case that a large amount of skill and the recognition of scientific principles are necessary in the case of all kinds of roads; but local authorities will doubtless realise that the principle applies to the management of roads of all classes, each class being, in its way, important. It is desirable that the occasion shall not be allowed to pass without some consideration of the attitude of surveyors towards possible and probable changes in highway administration in the United Kingdom, more especially with respect to the second proposition and the considerations embodied in the proposed amendment to the fourth.

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The Suggested County Unit.

It is significant of the attitude of surveyors towards proposed changes of a certain kind that the second proposition proved wholly unacceptable to the meeting, and was withdrawn without the discussion of any alternative, though one of the surveyors present was prepared to put one forward. Surveyors will have to make up their minds, however, whether they will passively await developments or whether they will meet them with proposals of their own. Consider a stretch of rural district road, along which there proceed considerable numbers of motor cars, motor delivery vans, and other vehicles not belonging to the district, as well as farm wagons from adjoining districts, passing through to distant railway stations to deliver hay and straw, and to fetch lime and manure: take such a piece of road in a small rural district, and consider not the merits of the case, but the question whether in fact the county at large will allow this road to be under the administrative arrangements made by a few local shopkeepers and landowners, and under the management of a surveyor appointed by them and responsible only to them. It is not in the least likely that such a state of affairs will be allowed to persist, even if the appointment of the surveyor were subject to the approval of the Road Board. The public, or those capable of influencing Parliament, will demand that in one form or another the resources of a department or an organised body of engineers shall be available in such a case, so that if the surveyor, though otherwise competent, is not the right man for the job he can be transferred to some other post. If the work, including improvements, be for a time specially difficult, a young surveyor can be replaced by a senior man of wide experience, and if the surveyor be incapacitated for a time by serious illness his work can be carried on without loss of time and without any lapse from normal efficiency. If a county organisation be unacceptable, would district surveyors prefer that the Road Board should be developed into an inspecting department for all roads, or do they prefer to await sweeping changes, including, perhaps, a network of national roads, and the formation of a corps of national road engineers? If such a body could be regarded as likely eventually to absorb the whole body of surveyors the latter might await such a development without alarm. But there would be strenuous opposition to such a policy, and it is more likely, therefore, that the new organisation would be partial only, and many district surveyors would find themselves in quiet backwaters, the victims of a policy of hard and fast and quite undesirable classification of roads, the "important" roads and the "other roads." Whatever may be in theory and in fact the best way to manage district roads, it cannot be doubted that Parliament is likely to take the view that a road in the charge of a man drawing some £250 a year should be under the superior control of a man drawing £600 a year, say, and to some extent influenced by the decisions of a still more important person. It will be held, and the position is a strong one, that it must be more economical and more effective to have a set of men graded as to qualifications and pay in charge of the roads of the country, than to pay such salaries as will ensure that every road surveyor shall be a highly qualified man of good training and experience. It will be held that for a given mileage of roads one man on £1,000 a year, three on £600 a year, and twelve on £300 will give better results than sixteen men drawing £400 a year apiece.

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The Width of Road Controlled.

As regards the fourth proposition, surveyors are to be congratulated on having directed attention to the fact that with the resources up to the present at their disposal they have been unable to deal effectively with the matter of drainage; with respect, of course, to roads in difficult situations as regards subsoil and surface water. It may further be suggested that Mr. Ryves' amendment might have obtained some measure of support if there had been present surveyors from those parts of the country where roads are, on the average, located in much narrower strips of controlled land than the widths usually allotted to the road in the south-eastern counties and other areas more fully represented at the meeting. It must also be remembered that the meeting was composed mainly of surveyors from that part of the British Isles which has a small rainfall. There have to be considered not only the getting rid of troublesome water, but the protection of the road from crumbling banks, from landslips, from distortion of hedges, and from the formation of runnels of water down the banks of cuttings. In such cases it would seem to be good policy to place a further

strip of land under the control of the surveyor, a proceeding which would have the further advantage of doing away with disputes as to the respective liabilities of the landowner and the local authority with regard to the maintenance of banks, fences, and retaining walls. It is usually to the advantage of any man occupying an official position to have the range of his responsibilities widened, since this usually tends in the long run to better pay and better prospects. As our old friend Æsop would have pointed out, had he been at the Olympia meeting, the high position which that very competent animal the cat holds in our midst is due not so much to the fortitude with which she faces misfortune as to the celerity with which she seizes every opportunity of adding to her prerogatives.

* * *

Some Principles of Road Crust Construction.

Some important principles of road crust construction are very clearly set forth in a paper by Mr. A. T. Agg, of Illinois, the main points of which are briefly summarised on another page, with a few notes from the discussion which followed the reading of the paper. Mr. Agg's remarks on the rolling in of screenings are specially worth attention. It is certainly the fact that the tendency for dry rolled hard binding material to form pockets in a road crust is often overlooked, or submitted to, and even when definite pockets are not formed there is a tendency for the stones to be thrust unduly far apart, and for their interlocking to be to a considerable extent destroyed. This action is minimised if the road metal be of mixed sizes; but, more generally, the chief precautions to be taken are to roll the metal first, and to keep it compact by the use of sufficient water. The water has the further effect of acting as a lubricant, assisting the passage of the chips into the voids. The effective binding of the crust of a road is, of course, recognised as an important matter, but the principles which govern road binding are sometimes not sufficiently considered when attempts are being made to do the best that can be done with a limited expenditure. When a fairly thick course of stone is being rolled it might be an advantage in some cases to add the finer stuff a little at a time instead of attempting to force it all in from the top after the metal has been rolled. When a fairly thick course of stone of uniform size and fairly cubic shape is being rolled, it is often a long time before it will carry the roller, and in the meantime there is a tendency towards the formation of undulations, from one cause or another, or potential undulations which will appear later.

Another matter of considerable importance, and to which Mr. Agg referred, is the choice of a binder, the solid binder or packing material, for bituminous-bound limestone road crusts. Much depends upon the nature of the stone and the range of sizes. For a stone may be of such a nature that it will form but little dust when heavily rolled, but will crush together sufficiently to require very little packing material, especially if the stone be a mixture of several sizes. Some limestones, on the other hand, need a solid binder, for we do not want a road crust consisting of stones jammed together at various angles, with a large percentage of voids or of spaces uselessly and disadvantageously filled with an excess of the bituminous binder. In such cases a silicious packing material may be useful, but it must not be overlooked that the all-limestone crust has, when water bound, such good features that the possible advantages of an all-limestone crust with a minimum of bituminous binder should be carefully considered. As regards the feeder layer described by Mr. Agg, the principle, to which we have lately referred in these pages, is a sound one; but it may be undesirable under some conditions to put down a thick layer such as that described in the paper. On roads with much fast motor traffic the material would be driven to the edges of the road in a few hours, and there are other circumstances making it impossible to apply a feeder layer of considerable thickness. But for roads with small traffic, or seasonal traffic, the principle is a very good one, and is applicable to many kinds of road crusts, and in many parts of the world.

Perhaps the most important matter of principle suggested by the discussion was in connection with the provision of cross drains for the roads of Alleghany County, Pennsylvania. We are bound to say that the circumstances under which such drains, spaced 50 ft. apart, are likely to be useful are seldom or never found in practice. Even if we suppose that the drains are 4 ft. below the surface, there are few loose soils in which such a drain would command a range of 24 ft., and for a compacted road bed covered by a dense road crust such a drain would command a strip only a few feet wide. If great road engineers believed in putting drains across roads at intervals 20 ft. or more apart, their practice was in defiance of principles. As intercepting drains, in the case of a tendency to the formation of water channels along the road bed, cross drains are useful, and individual cross drains at selected spots may be very useful indeed, but they should be put in each where it is wanted and not at regular intervals. Opportunities for drawing attention to detailed descriptions of methods of construction adopted in different climates and under various circumstances occur very frequently; but it is comparatively seldom that matters of principle are explained and discussed, and in the present case the four subjects to which we have referred are all of prime importance and well worth the careful consideration of road engineers.

For Technical Students.

The work which has been accomplished by the Imperial College of Science and Technology at South Kensington, and the well-known excellence of the instruction to be obtained there, will no doubt create an eager demand for the free places in the college which are about to be awarded by the London County Council. In making their announcement, the council point out that the instruction will be of an advanced nature, and therefore only advanced students who are qualified to enter on the fourth year of the course should apply. There is no restriction as to income, but intending candidates must be ordinarily resident within the area of the administrative County of London, and must be students who have been in regular attendance at appropriate courses of instruction for at least two sessions. The free places will be awarded on consideration of the past records of the candidates, the recommendations of their teachers, the course of study which they intend to follow, and generally upon their fitness for advanced study in science as applied to industry. Candidates will not be required to undergo a written examination. It is possible that in special cases the free places may be extended to two or more years. The council are undoubtedly adopting a wise policy in awarding these scholarships on the past records of the candidates and their fitness for advanced technical work, rather than on the result of a competitive examination. It occurs to us that the offer may be of interest to some of our younger readers, to whom we would point out that application forms may be obtained from the Education Officer, London County Council Education Offices, Victoria Embankment, W.C., and must be returned not later than Saturday, the 24th inst.

Institution of Municipal and County Engineers.

MEETING AT GERRARDS CROSS.

From Photo by] MEMBERS AND VISITORS AT GERRARDS CROSS MEETING. *[Drake, Slough.*

The inauguration of a scheme of sewerage and sewage disposal at Gerrards Cross, in the rural district of Eton, took place on Saturday last, and it was a happy idea on the part of Mr. Arthur Gladwell, the surveyor to the council and the engineer for the works—upon which a sum of some £28,000 has been expended—to arrange for the simultaneous holding of a meeting of the Institution of Municipal and County Engineers in the picturesque little Buckinghamshire parish. It will be realised that the reception of the institution involved no small addition to the many and important duties which fell to Mr. Gladwell's lot in connection with the ceremony, and it says much for his capacity for organisation that the day's proceedings passed off with all possible smoothness and undeniable success. It was perhaps regrettable that the weather conditions were not of an entirely favourable character. The inauguration of the new works was performed in a downpour of rain, which ceased, however, as the three revolving distributors which form part of the scheme came into operation, permitting the large company present afterwards to make a thorough inspection of the works without discomfort.

The institution meeting was opened in the morning at the local assembly rooms, Mr. R. J. Thomas, the president, occupying the chair, and others present including Messrs. H. T. Wakelam (Middlesex), vice-president, J. A. Webb (Hendon), P. G. Killick (Finsbury), A. J. Martin (Westminster), C. Chambers-Smith (Westminster), A. Gladwell (Eton), J. H. Roebuck (Eton), E. J. Elford (Southend-on-Sea), honorary district secretary, W. Fairley (Westminster), H. Percy Boulnois (Westminster), E. Willis (Chiswick) and W. R. Locke (Hemel Hempstead).

Dr. J. H. WATERS, chairman of the Sanitary Committee of the Eton Rural District Council, expressed his pleasure in welcoming the members of the institution. Such visits could not but do good all round. The interchange of ideas in connection with the almost interminable and certainly complex questions connected with public health administration were of value to all concerned, whether as members of local authorities, ratepayers, or officials. The science of civil engineering, as applied to the requirements of communities, was an important factor in connection with the comfort and health of individuals, and as a medical man he had always entertained a high opinion of the skill of municipal engineers, who as public officials so well served the various authorities for whom they act, and who were called on from time to time to advise such authorities on matters of importance in the general scheme of local self-government, and to design and carry out more or less important works for the general good; who also by their high-minded devotion to duty were ever rendering signal service to the public at large. Their institution, composed as it was of members of an important and useful profession, had, he understood, for one of its principal objects the laudable one of collecting and distributing among its members such information relating to the practice of civil engineering as applied to municipal work as was at one and the same time both instructive and useful, which could not but be of great benefit to those they served. It was by visits such as these that information could be most surely and usefully gained, although in the present instance it must be admitted they were about to visit works of perhaps relatively small extent compared with works which he had no doubt some of them had designed and carried out; but it might be taken even in that relatively small yet in itself important scheme some details of interest might be found, and some information of a useful character gained. The pleasure he felt in welcoming the institution was enhanced by the fact that their president was the county surveyor of Bucks, in which county the meeting was being held, and the fact that it had been possible to arrange the meeting during Mr. Thomas's presidential year was also a source of considerable gratification to their engineer and surveyor, Mr. Gladwell.

The PRESIDENT, in acknowledgment, said it was most gratifying to receive a welcome from the council. Public officials did appreciate very keenly any direct interest shown by their employers in the work they were carrying out, and it was a source of very great gratification that there were present so many members of the Eton Rural District Council to welcome them. It was a compliment not only to their institution, but to their esteemed colleague Mr. Gladwell, in the inauguration of the work he had carried out. In this sort of reciprocal treatment meted out to surveyors public authorities never missed much. It was always desirable and expedient that councils and officials should meet together as often as possible, and particularly in the inspection of work carried out, because very often work described in a board room or council chamber appeared very different from the seeing of the actual work. They would see work carried out that afternoon which would enlighten them in the latest methods of sewage disposal, because if there was anything Mr. Gladwell was keen about it was in being up to date in any work he carried out. The members of the institution would find much to interest and teach them in methods of sewage disposal where the area of land was limited by £ s. d.

The members then proceeded to the sewage disposal works, which were formally opened by Colonel W. Le Poer Trench, C.V.O., R.E.

On arrival at the works Dr. WATERS expressed his pleasure in welcoming them to take part in an interesting and, from the public health point of view, an important function, fraught with much importance to the present and future welfare of Gerrards Cross. He need not dilate on the importance to a community of the provision of an adequate and satisfactory system of sewage disposal and purification. It was one of the necessities of modern civilisation, and was of the utmost moment, not only to the comfort, but to the health of the individual. It was also unnecessary to refer to the difficulties which the Parochial Sanitary Committee of Gerrards Cross had had to encounter in dealing with the problem of

sewage disposal prior to and during the inception of this scheme, and to a certain extent during its construction. But it was a matter of congratulation that the moment had at last arrived when these difficulties might fairly be said to be at an end, and it only remained for him to express a sincere hope that the scheme to be inaugurated would serve the purpose for which it had been designed, and would for a long time to come prove adequate for the work it was called on to perform.

Following Dr. Waters' observations, Mr. Gladwell described the works in some detail, and expressed the hope that the scheme would fulfil its mission, would prove to be both adequate and suitable for the purpose for which it had been designed, and would perform its part in the scheme of public health administration which was so important to the health of communities. Mr. Gladwell paid a high tribute to Mr. J. H. Roebuck, his assistant, who has been associated with him in the capacity of resident engineer in the construction of the works. Mr. Roebuck had, he mentioned, been engaged with him in the design of four and the construction of three schemes of sewerage and sewage disposal, and during that time had brought to bear upon his duties skill and judgment of the highest order. His services had, he added, been at all times highly appreciated by all with whom he had been brought into contact.

Colonel W. E. Le Poer Trench then inaugurated the work by admitting the sewage to the first bed for treatment, and Dr. Waters and Mr. Hindley afterwards admitted the sewage to the second and third beds respectively.

The party then returned to the schoolroom, Gerrards Cross Common, where luncheon was served, Colonel Trench presiding. Following luncheon, a number of toasts were honoured and congratulatory speeches made.

Councillor S. J. Prevost, in proposing success to the sewage scheme, spoke of the magnificent way in which the work had been carried out by Mr. Gladwell, referring appreciatively at the same time to the services rendered by the latter's assistant, Mr. Roebuck, as consulting engineer.

Mr. H. Percy Boulnois, submitting the toast of "The Eton Rural District Council," congratulated the local authority on the success of the scheme. There appeared to have been no waste of money. The site, in particular, had been well selected, its position being such that the sewage reached the works entirely by gravitation, and the scheme was of a capacity sufficient to provide for the needs of the district for a great number of years.

Responding to the toast of "The Institution of Municipal and County Engineers," Mr. R. J. Thomas, the president, said it was an intense pleasure to the members of that body to attend that gathering and find one of their most honoured and respected members held up to general approbation. The works they had seen that day were in every respect up to date—which was only what could be expected from Mr. Gladwell, who was never standing still—and he congratulated the engineer on the inception, the design and the execution of the scheme.

A vote of thanks to the chairman was proposed by Mr. S. J. Prevost. Mr. H. T. Wakelam (Middlesex) seconded, and the proposition was adopted.

The meeting of the institution was resumed after the luncheon proceedings, under the presidency of Mr. R. J. Thomas, and consideration given to the following paper:—

THE MAIN DRAINAGE OF GERRARDS CROSS.

By Arthur Gladwell,

Engineer and Surveyor to the Eton Rural District Council.

The parish of Gerrards Cross forms one of the nineteen rural parishes over which the Eton Rural District Council exercise jurisdiction, and is an entity of recent creation, having been formed (in 1896) a civil parish by the grouping together of parts of five other parishes. The area of the parish is 2,116 acres, and it is situate about 3½ miles N.W. of Uxbridge, 4 miles S.E. of Beaconsfield, and 18 miles from London, on the London to Oxford main road.

The levels above ordnance datum of the area now provided with sewers vary from 150 ft. to 290 ft., the lower levels obtaining along the valley of the Misbourne river, while on the higher levels is situate the greater portion of the sewered area. The geological formation varies considerably, and consists for the most part of drift gravel with interstratified beds of sand, &c., overlying the Woolwich and Reading beds of the Lower Eocene, which in places outcrop to the surface, and which in their turn overlay the upper cretaceous chalk. In other places the beds of gravel are of considerable thickness, but the surface of the underlying clay being very undulating (as is usually the case in areas contiguous to the edge of the London Basin, as this is), in many places large volumes of water lying in the pockets formed by the surface undulations of the clay were encountered in the construction of the sewers, rendering the work at times difficult, dangerous, and relatively costly.

From Photo by] Percolating Filters, Gerrards Cross Sewage Works. *[Drake, Slough.*

(Stone's Distributors.)

It is not unusual, in writing a descriptive paper such as this, to include a more or less lengthy, interesting, and accurate reference to the place and its surroundings, but in this connection the author does not feel equal to the task of doing justice to such a subject, but contents himself by saying that the place itself is a gem of Nature in a beautiful setting, making for health, and therefore joy, and lies surrounded by a wealth of interesting localities, such as Windsor Castle, Eton College, Burnham Beeches, Stoke Poges (the burial place of the poet Gray), Beaconsfield, The Chalfonts (St. Peter and St. Giles), at the former of which places is to be found Jordan's Meeting House, where William Penn, the founder of Pennsylvania, lies buried, and at the latter Milton's cottage, where "Paradise Lost" was written at the time the poet was residing at Chalfont St. Giles; many other places of deep interest to the student both of Nature and history lie within easy distance of this beautiful and interesting place.

Ten years ago Gerrards Cross was a hamlet of about 250 inhabitants, and the population were for the most part grouped round the beautiful Common, but in April, 1906, the new railway of the Great Western and Great Central Joint Committee was opened for traffic, resulting in the immediate and rapid development of the place as a residential area of the first order. Owing to the phenomenal development of building activity, added to the difficulty of providing a suitable and sufficient area for the disposal of sewage from cesspools, the question of the provision of main drainage became one of great and

increasing urgency, and, acting on instructions, the author, in February, 1910, presented a report to the council on the whole question, which report advocated the provision of a scheme of sewerage and sewage disposal at an estimated cost of £28,000. This report was adopted, and the recommendations therein contained ordered to be carried out. The scheme was prepared and submitted to the Local Government Board. An inquiry was held by one of their engineering inspectors on May 12, 1911. The work was commenced in November, 1911, and is now virtually completed. The scheme is one of gravitation throughout, and comprises the construction of about 10 miles of sewers of 15 in., 9 in., and 6 in. diameter respectively.

The design of the scheme of sewers presented one or two points of difficulty, a recital of which may not be without interest. In the first place, the level of the Amersham main road (along which the 15-in. diameter main outfall sewer has been constructed) at one point recedes in a contrary direction to the fall of the sewer: this necessitated the construction of the outfall sewer (for a distance of 700 ft.) above the surface of the roadway. This was accomplished by obtaining an easement from the Great Western and Great Central Railways Joint Committee, which permitted of the sewer being constructed in cast-iron pipes on concrete piers at the foot of the embankment under the railway viaduct spanning the Amersham main road. In carrying out this work it was also necessary slightly to alter the line of road, which, by the consent of the county surveyor (our esteemed president), was accomplished at a reasonable cost. Had it not been possible to arrange the above details, as shortly described, it would have necessitated the construction of this outfall sewer at a gradient of 1 in 1,000, whereas it is now constructed at a gradient of 1 in 600 for the whole of its length. In this connection it will be appropriate to mention that this outfall sewer is so constructed, both as to its diameter and gradient, as to terminate at a point (on the Amersham main road) at which the parish of Chalfont St. Peter (Amersham rural district) adjoins Gerrards Cross parish, so that if in the future—near or remote—the duty devolves upon the Eton Rural District Council of receiving, conveying, and disposing of the sewage from the above-named adjoining parish of Chalfont St. Peter, preparation for such has already been made. Another difficulty which presented itself was consequent upon the fact that the new railway intersected (by a deep cutting) the area to be sewered. It therefore became necessary to design a distinct gravitation system for the areas lying on either side of the railway, the two systems joining at a point on the Amersham main road contiguous to the southern face of the railway viaduct which spans the road.

The depth of the sewers underground varies considerably, owing to the surface conformation of the sewered area. The deepest cutting was 30 ft., which was, unfortunately, in bad ground, and extended a considerable distance, but the author is pleased to be able to say that, owing to the skill of the contractors and the excellent body of men in their employ, the entire work has been carried through in a most excellent manner without accident to life or limb, for which the author is grateful.

Reference has already been made to the difficulty experienced in disposing of the contents of cesspools connected with the rapidly increasing number of houses within the area, and by the time the work of constructing the sewers was commenced this question became one of some complexity to the Parochial Sanitary Committee of the parish, and engaged the author's serious consideration, with the result that he succeeded in arranging that, so soon as any length of sewer was completed, tested and passed, facilities should be given to owners whose properties abutted on the line or lines of such sewers to cause the drainage from such properties to be connected with the main sewer, preparations for treating the sewage thus admitted into the sewerage system having previously been made by adapting a small portion of the outfall works as an irrigation area. The first of such connections to the system was made on April 22, 1912, and the total number of properties connected with the system now exceeds 350. No difficulty whatever has been experienced in dealing with the volume of sewage upon the small area originally allocated; this provision has, the author hopes and believes, been of considerable convenience to the residents, and has not been without its effect in the direction of economy in local administration.

But, after all, the design and construction of systems of sewers for the conveyance of foul and effete matter is only a means to an end, the end being the satisfactory purification and disposal of the waste and discarded products of communities more or less populous, and it is in the satisfactory design, construction, and maintenance of works intended to effect this consummation that the greatest interest centres, and upon which no thought or study on the part of the public health engineer can be considered either misplaced or redundant. The subject of sewage purification and disposal is both a complex and fascinating one, not only on account of its inherent difficulties, but also on account of its extreme importance to the health and comfort of the community, and it is, therefore, to the question of the design of the outfall works connected with this scheme that the author would more particularly call attention, albeit that by so doing he may be inviting an annihilating criticism from those of his *confrères* who are both more able and who are possessed of larger experience than he can lay claim to in this connection. The site upon which the outfall works have been constructed has an area of about 12¾ acres, and formed part of the estate of the late Mrs. Way, of Denham-place. The subsoil for the most part consists of siliceous gravel drift, and doubtless at one time formed part of the lagoon of the Misbourne river. The site may be said to be an ideal one for the purpose of the disposal of sewage effluent, and would appear capable of absorbing an almost incalculable volume of such effluent. The irrigation area has been levelled and prepared for the cultivation of osiers. The outfall works are designed to effect the purification of the sewage from a population of 4,500 persons, allowing 25 gallons *per capita per diem*, with provision for dealing with a flow of three times this volume, the dry-weather flow provided for being 112,500 gallons per day of twenty-four hours. The system of sewers is what is now known as the "partially separate" system, a certain volume of storm water from back roofs and back yards being provided for. The sewage on first entering the works flows through a screening and recording chamber into a set of six (three coupled pairs) detritus chambers, which are provided with sharply sloping floors designed to encourage the deposition of the grosser suspended solids; these chambers are fitted with deep scum boards, while in each is fixed a valve for the purpose of enabling sludge to be removed therefrom by gravitation to the sludge area. Fixed weirs are also provided at each side of the inlet channel, over which weirs all sewage exceeding in volume three times the dry-weather flow automatically escapes, and is conducted to either or both of two stand-by tanks, which are in their turn connected with special storm-water irrigation areas. Provision is also made for conveying any sludge deposited in these tanks to the sludge lagoons.

From the detritus chambers the sewage flows to a set of three continuous-flow liquefying tanks, the total capacity of which equals the daily dry-weather flow (112,500 gallons) to be treated. The effluent from the tanks will pass into the three measuring or dosing chambers which will be controlled by automatic dosing and recording gear; these dosing chambers have a greater depth than that necessary to contain the measured volume of effluent comprising each discharge to the spreaders; this provision is made with a view of arresting suspended solids which may be carried by the effluent leaving the tanks, such solids, in the form of sludge, being easily valved off to the sludge area. The aërobic bacteria beds, three in number, have each a diameter of 65 ft., with a central annular opening 9 ft. in diameter, and a depth of filtering material of 4½ ft., and are designed to treat the total volume of the dry-weather flow at the rate of 70 gallons per cubic yard per twenty-four hours. From the bacteria beds the effluent flows into a set of humus tanks, the capacity of which equals one-twelfth the dry-weather flow. After passing through the humus tanks the effluent is conveyed by means of stoneware pipe carriers to the various sections of the irrigation area, where, owing to the porous nature of the soil, it will be readily absorbed.

DISCUSSION OF MR. GLADWELL'S PAPER.

Mr. E. Willis (Chiswick) said he was sure he would be voicing the wishes of the whole of the members present, and particularly the many visitors, if before opening the discussion on the paper he proposed the accordance of a hearty vote of thanks to Mr. Gladwell, not only for what he had shown them that day, but for the excellent description of the works which he had provided them with. The part which Mr. Roebuck, assistant to Mr. Gladwell, had taken in the

carrying out of the scheme had been very fully acknowledged by the latter. In regard to that he was sure they all owed a great deal to their assistants, and unless they had their loyal and hearty co-operation they could not do their work so well for the benefit of local authorities. The site of the works appeared to him to have been excellently chosen. The difficulties of drainage were great in many towns, and there had probably been difficulties to contend with even at Gerrards Cross, but Mr. Gladwell had succeeded in carrying out a complete gravitation scheme, thereby saving great expense of pumping plant and its maintenance in the future. If it was possible to have a complete gravitation scheme they accomplished a great deal. They had in the site one especially suitable for sewage disposal. They had a locality where the levels where the sewage was received were considerably above where the sewage was passed into the river, and those levels had been utilised to the utmost in the design of the scheme. Of course, Mr. Gladwell was fortunate in having a variation in level of over 140 ft. over the whole district. In Chiswick there was not a variation of 30 ft. over the whole area, and in some parts they were actually below the levels of the highest spring tides. Another point was that the tanks, filter-beds, and chambers in the Gerrards Cross works were all arranged in triplicate. They all as far as possible arranged these in duplicate, but it was always better where possible to arrange these matters in triplicate. The works generally were practically automatic, and in that respect their cost of maintenance would be very low in the future, and he congratulated Mr. Gladwell and his assistant as well as the local authority on the success of the scheme.

Mr. H. Percy Boulnois (Westminster), seconding the vote of thanks, said it was almost a pity that the works were so good, because they could not have any of that annihilating criticism which Mr. Gladwell spoke of; but there could be no criticism of these works, and he would tell them why—they had passed the Local Government Board. If these works had been open to criticism the officers of the Local Government Board would already have done their duty. He must confess he was struck with the apparent simplicity of the works, and, after all, that was the great thing to achieve. Simplicity was the most difficult thing in science and art, and these works, from their very simplicity, struck him as being as perfect as such works could be. These works were perfectly up to date. They were designed for the treatment of a medium strength sewage. He would like to ask Mr. Gladwell how he got the Local Government Board to approve that strength when the quality of the strength was unknown. Mr. Gladwell estimated that 25 gallons a day would give him a medium-strength sewage, but how was it the Local Government Board allowed that, and did not insist upon the strong-sewage formula? It was a very important point, because in designing sewage disposal works the crux of the whole thing was "what is the strength of the sewage?" Then what was the character of the land? Was it light subsoil or sand, or what was it on which he passed the effluent? He would like to know the name of the stream into which the effluent flowed, and whether it was a tributary of the Thames. With reference to the deep sewers of 30 ft., he wished to know whether these were simply outfall sewers or sewers to which houses had to be connected. If so, a subsidiary sewer of less depth would have to be laid. Then who constructed the sprinklers? They seemed to be very remarkably good in design. He believed they were Stone's sprinklers; they seemed to be very flexible, for he had noticed them turning by the action of the wind, which showed that they were extremely delicate and performing their duty exceedingly well. It was a domestic sewage at the present moment, but if Gerrards Cross went ahead was it not possible that in the future they would have manufactories—say a big brewery—and they knew how difficult it was to treat brewery wastes.

Mr. W. R. Locke (Hemel Hempstead) asked if Mr. Gladwell thought it was necessary to have humus tanks when he was putting the effluent on the land. In his own district they had a fall from 500 ft. to 250 ft., and they had to pump up all the sewage between 200 ft. and 300 ft. through 1 mile of rising main. He would like to congratulate Mr. Gladwell on having been able to get the money to deal with his scheme in the way in which he had done.

Mr. J. A. Webb (Hendon) put a question as to the nature of the bearings in the heads of the sprinklers. If Mr. Gladwell had ball-bearings at the bottom as well as at the top he had an excellent idea, and one that would not be an expense in upkeep. Then he would like to know whether Mr. Gladwell had used any special pipes in his deep sewer work where he had to contend with water. He wished to ask whether iron or double steel pipes were put in the deep work. Another point he would congratulate Mr. Gladwell upon was the additional humus tank. Engineers who had to deal with sewage where they had to discharge into streams which were made up with effluents from farms knew the value of this additional humus tank. He would ask Mr. Gladwell to consider whether it would be advisable with the scum boards to do away with the open ends, and thus prevent any possible wash of the humus. The boards were there to retain the humus at the bottom, and allow the liquid to flow over the top, but with the open ends it would tend to scour.

Mr. A. J. Martin (Westminster) was not at all sure whether he would not be expected to sit there on a penitent form in a white sheet, and carrying a candle, because his last appearance there was for the purpose of opposing the scheme. In justice to himself he must plead that he did not say a word against the scheme. It struck him as an excellent scheme. With regard to the scheme, one of the points which struck him was the excessive depth of some of the sewers. He did not envy Mr. Gladwell having to lay sewers 30 ft. deep in a waterlogged soil, but he seemed to have got through it, and having been there to oppose him he would like to congratulate him on carrying it to a successful issue. It reflected the greatest credit upon everybody. With regard to the disposal works he would like to echo what Mr. Boulnois had said as to their efficiency and simplicity. As far as one could see they were well designed and thoroughly well executed, and he had no doubt whatever they would do all that could be expected of sewage works. Mr. Gladwell was to be congratulated upon the excellent site—excellent in allowing the sewage to be carried there by gravitation, and excellent in the soil, with the result that the effluent would satisfy the Thames Conservancy Board. The cost of £28,000 was not a trifle even for a prosperous and progressive district like Gerrards Cross. He would like to quote a reminiscence of Sir Charles Cameron, who, entering a compartment of a railway train in which there was a young couple, noticed their cheerful looks vanish as he went in. When they emerged from a long tunnel Sir Charles, addressing the young man, said, "Do you know that that tunnel cost to build £260,000?" "All I can say," replied the young man, "is this—that it is worth every penny of the money." He thought he could say that if these works cost £28,000, or even after an eloquent exchange of views £30,000, they were worth every penny of the money. The cost of this scheme was the first cost, and they would be free from the upkeep of a heavy recurring expenditure in working expenses.

Mr. W. E. Eaves (Uxbridge) said that, like Mr. Martin, he was an opponent of the scheme for a neighbouring landowner. He could only say, as far as one could see—apart from the position of the disposal works geographically, which he did not care for as agent of that landowner—that the site was excellent and suitable.

The vote of thanks was passed.

Mr. Gladwell, in reply, said he had to express gratification that Mr. Willis, with his wide knowledge of sewage disposal matters, had let him off so lightly, and contented himself, as he had done, with merely proposing the vote of thanks. He was grateful to Mr. Boulnois for having seconded the vote, for it gave him the opportunity of refreshing his (Mr. Boulnois') memory on one point. Mr. Boulnois had asked on what basis he had arrived at his estimate of the strength of the sewage with which the new works would have to deal. He (the speaker) perfectly well remembered on a certain occasion—one of many—when Mr. Boulnois was at the Local Government Board calling on him at his office and referring to that very subject. Mr. Boulnois unlocked a drawer and produced the information which he had asked for that day—(laughter) and he (Mr. Gladwell) had worked on the basis of that information with the greatest advantage. Of course, he did not remember it; he would not have the time to remember, if he lived to be 100, all the kind actions he had done for members of the municipal engineering profession. Classification of the sewage with which he had to deal into strong, medium or weak seemed, after what he was told, more or less a matter of guesswork, and supplied him with food for considerable thought. Having

regard to the local conditions, and to the fact that the houses in the district were, generally speaking, large ones, containing one or two baths, he decided that the sewage could not be weak. On the other hand, there were no trade effluents to be treated, so it could not be strong; *ergo* it must be medium, and following the line of least resistance, he resolved that it must be medium.

Mr. Boulnois: How did you satisfy the Local Government Board inspector?

Mr. Gladwell said he could only assume that the Local Government Board and their inspector were satisfied, having regard to the fact that the works were now in operation. As regarded the deep sewers, that was one of the points of discussion between the engineering staff and himself, and as a result of the interviews which took place he decided that where any sewer was more than 10 ft. below ground he would either bring up the connections to the different properties from the depth of the sewer or alternatively make a subsidiary sewer. He had adopted both those alternatives. Where it was cheaper to bring up each connection from the main sewer to the curtilage of the property that system had been adopted, so that no owner of property had any occasion to go deeper than 10 ft. into the ground for his connection. As to the spreaders, those certainly worked very well; they were of the Stone type, and were fitted with compensating arms, which provided that when the flow from the measuring chambers commenced the whole of the arms came into operation, but that when the head of effluent went below a certain point the two compensating arms went out of action, leaving the work to be done by the others. That ensured that the spreaders would revolve with a low head of sewage. He trusted that Mr. Boulnois' prognostication in regard to brewery refuse would never come true, for that was one of the most difficult and refractory descriptions of sewages that one could be called upon to deal with. As to Mr. Locke's remarks, the humus tanks might be considered by some engineers to be somewhat redundant; he (the speaker) did not think so. It appeared to be a playful habit of the humus they had to deal with to spread itself as a sort of film over the land and destroy the value of the latter, and he thought it best to be on the safe side and ensure that the effluent should have the best possible chance of being irrigated by the land over which it flowed. Mr. Boulnois had said that he (Mr. Gladwell) did not appear to have called attention to the quality of the land over which they were distributing the effluent, but he would point out that he had done so at considerable length in his paper. The land formed part of the lagoon of the old river Misbourne, which was now being restricted in its capacity for mischief by being confined to a sort of channel. The character of the land was that of alluvian drift, free gravel, and when he told them that in the relatively small excavation which had been undertaken they had obtained probably 4,000 cub. yds. of excellent washed ballast for concrete used in the works, he thought it would be sufficient to convince them that the site was an ideal one for the irrigation of sewage. He could assure Mr. Webb that the weight to be sustained by the sprinklers was distributed on four ball races—two at the head and two at the foot, side rollers governing the oscillation of the sprinklers. That accounted for the exceedingly easy manner in which they commenced to work that day, and no doubt the movement would improve as they settled down to work. He had thought that Mr. Webb was going to refer to the white tiles which they had made use of in the work, and which, as the resultant effluent flowed over them, were useful in enabling one to observe the clearness of the water. Mr. Webb had once criticised the use of white tiles on the ground of their liability to be affected by frost and the glaze coming off, but so far that had not happened. But they could all learn from one another. At Mr. Webb's works one day he saw a new revolving spreader with a weather vane fixed on it, and the vane was revolving with the spreader. (Laughter.) He would rather have his white tiles than Mr. Webb's weather vane. He had heard that the weather vane had since been dismantled, but he had not discarded his white tiles. (Renewed laughter.) Mr. Webb had also referred to the scum boards in the humus tanks. One lived and learned, and to a certain extent these humus tanks—as all humus tanks were—were more or less experimental. They wanted to arrive at a certain result, but if, as Mr. Webb suggested, by the cutting of a few holes in the boards the desired results could be obtained they would be cut, but not until he had satisfied himself that the present arrangements were a failure. The river Misbourne was a tributary of the Thames, passing first into the Colne, but as he did not intend for many years to send any effluent into the Thames he did not think the Thames Conservancy officials would be unduly concerned with the quality of their effluent; but if ever they were he hoped to be able to deliver it as pure as was done at Burnham and Iver. As to the vote which had been proposed, he required no thanks, for, like his brother engineers, he loved his work. He found the subject of sewage disposal a most fascinating one, and was prepared to undertake any amount of research if he could only attain results. One man might get a little bit in front of another, but others could soon follow up, for engineers were all good copyists. If the science of sewage disposal could be in any way advanced, and if, by a meeting of that kind, any information could be afforded either to the institution or members of local authorities the day would not have been wasted.

Mr. Webb said he would be glad to have an answer to his question as to the pipes used in the work, and to know whether, owing to the difficult nature of any part of the ground, he was obliged to leave in any large quantity of timbering.

Mr. Gladwell said the pipes he used, except in shallow places where it was necessary to employ cast-iron ones, were entirely composed of Dorsetshire clay. The joints used in the deeper waterlogged areas were Hassall's double-lined joints. Wherever it was possible to avoid the extra expense of using those, the joints had been made with a ring of gaskin, followed by a fillet of cement. He looked upon that as a very good joint; although in many instances the saturation limit of the subsoil water was 8 ft. or 10 ft. above the invert of their joints, he could not say that the leakage into the sewers was at all appreciable. In connection with some of the deep cuttings approximating 20 ft. or 30 ft. he found it necessary for the safety of the workmen and the roads and adjoining property to leave in a considerable amount of timber, but by a clause which he had added to the contract that was paid for at the rate of 1s. 6d. per cube foot. Timber, of course, cost more than that, and the arrangement was consequently not a profitable one for the contractors. He regretted that, but at the same time he had to safeguard the interests of the local authority in the matter.

SEWAGE APPARATUS AT GERRARDS CROSS.

The three recording or measuring chambers in the new works at Gerrards Cross are arranged to be discharged by special machinery designed and patented by Messrs. J. Stone & Co., Limited, engineers, Deptford, S.E. This apparatus comprises a main automechanical low-draught dosing syphon, an auxiliary syphon, a cut-off valve, and a counter. A fixed volume is delivered per dose owing to the cut-off valve closing the inlet directly the tank discharges. When the sewage falls to the bottom water line the discharge ceases, and the inlet is automatically opened. The counter registers each discharge, thus converting the tank into a meter, so that the volume of sewage treated may be determined at all times. In this manner the sewage is discharged in measured quantities at regular intervals. The action of this apparatus is positive, no hydraulic head being lost in its application, and owing to the comparatively small number of moving parts, it is not liable to derangement.

The three percolating filters are formed of hard burnt vitrified furnace clinker supplied by Mr. Frank Keep, and are automatically operated by J. Stone & Co.'s latest improved patent revolving syphonic distributors, each 65-ft. diameter, as stated in Mr. Gladwell's paper. They uniformly distribute from 90 gallons to 560 gallons per super. yard per twenty-four hours, and are adapted for erection on a concrete base. The makers claim that their design and construction are such that friction has been almost entirely eliminated.

Broadly described, the fixed parts of the distributor consist of a massive central column, surrounded by a stationary cylinder which is connected to the supply pipe. The revolving parts comprise a patent "Overdraw" syphon, the annular ascending leg of which rotates between the stationary cylinder and central column, and is common to four syphon bends to which the distributing arms are attached, and supported from two patent steel ball races at the top of the column, and guided by a Stone's patent bronze bearing, fitted with phosphor-bronze balls at the bottom of the ascending syphon leg. The two driving arms are accurately perforated on the "hit-and-miss" principle,

so as uniformly to distribute 90 gallons per super. yard per twenty-four hours; while two compensating arms (perforated as mentioned above) with overflow bends automatically come into operation with a sewage flow of from 90 gallons to 560 gallons per super. yard per twenty-four hours. By this means considerable latitude is provided for dealing with various flows. The same liquid head is maintained on the distributing arms as in the dosing tank. It is claimed to be impossible for these distributors to flood, as the top of the stationary cylinder, from which they draw their supply, is well above the top water level of the supply tank. A speed of 4½ revolutions per minute is easily maintained, which shows an ample margin of power for wind resistance. The design is very massive, and the details, particularly the patent "Overdraw" syphon, the patent bearings—which may be removed and inspected without dismantling—the distributor, the correct disposition of metal to take all stresses, the automatic adjustment to the ever varying sewage flow, the utilisation of the full liquid head for driving, the absence of friction, the avoidance of complicated mechanism, the accessibility of parts, the effective grouping and combination of mechanism best adapted for this particular class of work, together with easy means of manipulation, should certainly render this distributor immune from breakdown, fracture of parts or excessive wear.

We are asked to mention that copies of the group reproduced on p. 690 can be obtained from Mr. Geo. H. A. Drake, 47 High-street, Slough, price 3s. 6d.

PUBLIC WORK IN ST. AUSTELL.

SURVEYOR'S ANNUAL REPORT.

Mr. E. D. Groves, M.INST.M. AND CO.E., surveyor to the St. Austell (Cornwall) Urban District Council, last year prepared a scheme for the main drainage of the western part of that town, and this was adopted and carried out, with the exception of one short length, during the summer. The remaining length was to be completed early this year. By the carrying out of this scheme the discharge of the drainage of this district into open leats has been discontinued. Mr. Groves mentions that there are sewers in other parts of the town that will require attention.

In his annual report Mr. Groves states that plans for seventeen new buildings were approved by the council.

In regard to public lighting, the report states that lamps are fixed at 120 different positions within the district.

WATER SUPPLY.

Throughout the year a constant supply was maintained, but owing to the exceptional rainfall, comparisons with the dry season of the previous year were difficult. Notwithstanding the wet season and the consequent increase in the yield in the springs during portions of the year, the work of waste detection was vigorously carried out, with the result that the consumption per head of population was reduced by 17 gallons per head per diem.

The employment of a water inspector for the months of July, August and September had very good results. The work of house-to-house inspection of all fittings helped to keep the percentage of wastage at a low figure. This was fully illustrated in the month of October, when the inspections had been stopped, by an increase in the consumption of 10 gallons per head per diem. Mr. Groves remarks: "For a wet season the rate of consumption was too high, and I consider that it may be accounted for to a certain extent owing to the large proportion of old fittings that exist, which continually get out of order and leak. Provision should be made for the continuation of the house-to-house inspection next summer, and should repairs not be done after reasonable notice has been given proceedings should be taken." The total rainfall for 1911 was 42·20 in.

Saskatchewan Roads.—For roads and bridges £400,000 is to be spent by the Highways Commission of the Provincial Government in the province of Saskatchewan during the coming summer. It is expected that between thirty and forty steel-frame bridges, with concrete piers, and between 300 and 400 wooden-trestle bridges will be built.

TRADES UNIONISM FOR PROFESSIONS.

By A. B. Howes,
Barrister-at-Law.

[We make the following extracts from a long and interesting paper which Mr. Howes read on Monday evening last at a meeting of the Quantity Surveyors' Association.]

In the study of the history of commerce, trade and manufacture, we find that at an early period the advantage of dividing labour into special and distinct branches was realised, and as civilisation progressed the adoption of this principle became one of its distinguishing features, and in many ways tended to its advancement. . . . In course of time, as trades became separate and distinct from one another, we find, on the part of the members of each trade, an increasing tendency to unite for the purpose of controlling their particular trade. . . .

Although it is rather a contradictory use of the word, we find that in the past unions among members of a particular profession were, in certain cases, recognised by the Legislature, and were given statutory control over the members of that profession. . . .

With the exception of the medical and legal professions, it is noticeable that all these unions are of comparatively recent origin. Another remarkable circumstance is that in each case where statutory recognition has been obtained, it has been achieved by the efforts of the members of the particular profession, and is not due in the first instance to Parliament.

That registration is the outcome of modern requirements is abundantly shown by the action of the Colonies in requiring the registration of professions which in the Old Country can be carried on by anyone, although in all probability before many years have elapsed this wise rule will be general here as well.

The demand for registration is no doubt occasioned in some degree by increased competition among professional men and the higher standard of efficiency required in those unions which hold examinations prior to the admission of members. It is to be observed that, where registration is compulsory, the serving of proper articles of apprenticeship is obligatory, and has much to recommend it.

To summarise, the advantages of registration appear to be these:—

- The standardisation of the qualification of members, at all events as regards a minimum qualification.
- Powers of discipline over the members in regard to their professional conduct; powers which are especially effective where such conduct is not within the purview of the law.
- Regulation of fees paid to members of the profession.
- A closer union in the profession by reason of these three principal advantages.
- A general uplifting of the tone and character of the profession by reason of its recognised disciplinary organisation.

A detailed analysis of these advantages would take too long, and some points are obviously open to discussion. For example, in a newly organised profession the question of advertising would require to be very carefully dealt with. It is probable that the objection to advertising is a relic of the early Victorian aversion to association with trade, but . . . it is very doubtful whether regulations precluding advertisement are advantageous in a profession, especially when a large amount of advertisement is secured by the services of the press agent and other well-known means, which are quite incapable of control by any professional body. On the other hand, it is easy to understand that, if it be decided to allow advertising, the advertisements must be kept within decent bounds.

Middlesex Guildhall.—The new Middlesex Guildhall at Westminster will be completed and ready for the opening ceremony the first week in October.

A Sanitary Institute for India.—The Corporation of Bombay view very favourably (says the *Times of India*) the proposed establishment in Bombay by the local Sanitary Association of a Sanitary Institute, and at the next meeting of the body a recommendation will be placed before the members of the Municipal Commissioner that the municipality should contribute towards the cost of the establishment.

The Surface Treatment of Concrete.

CONCRETE INSTITUTE COMMITTEE'S REPORTS.

At a recent meeting of the Concrete Institute a report of the Reinforced Concrete Practice Standing Committee, dealing with the subject of the surface treatment of concrete, was submitted by Mr. G. C. Workman, the hon. secretary of the committee.

As a result of investigations the committee have drawn the following conclusions—namely, that the most usual way of obtaining a smooth surface on concrete or reinforced concrete works consists in careful preparation of the moulds and the use of a fairly liquid mixture of concrete of such consistency as will allow of the smaller particles of the aggregate and the cement being brought towards the outer surface. Care must be taken, however, that the moulds be sufficiently watertight to prevent the formation of honeycombs at any of the joints.

A good surface may be obtained by working up and down against the shuttering with a spade perforated with holes, which treatment will bring the smaller materials towards the outer surface of the work. Another method consists in applying to the inside of the moulds a mixture of sand and cement, and then to form the core with concrete of an ordinary mixture.

The usual method of treating the surface of concrete which has hardened consists in hacking the face of the work and plastering it with a mixture of sand and cement in the proportion of 1 to 3. The surface of this plastering must be left sufficiently rough to form a key for a finishing coat of sand and cement in the proportion of 1 to 2. To obtain a perfectly level surface this coat can be finished with a steel trowel or wood float. A similar process with Keene's cement gives a very good outer coating.

It is advisable to avoid the rendering or plastering of any surface of concrete or reinforced concrete which is to be exposed to weather, because in such cases the thin coating or rendering applied to the hard surface of the concrete is likely to peel off or to craze. If a smooth surface is required, it is better to obtain it by means of carefully prepared centering.

A good method of improving the appearance of the surface of concrete which is to be left from the moulds is to wash it over, after making good any deficiency, with grout composed of cement and water. This operation is usually done by means of a brush, and is known as "brush rendering."

Another method of surface treatment is to expose the aggregate by rubbing the surface vigorously with a wire brush. This process may be hastened by the application of diluted hydrochloric acid, which has the effect of removing the cement on the surface. If acid be used, the surface should be washed after treatment.

When dealing with the surface of floors, it is preferable to apply any rendering which may be required immediately after the concreting operation has been terminated, and before the concrete has set hard.

For the colouring of the concrete the following process has been advised by some of the members:—

For colouring concrete or rendering, care is necessary in selecting colours. Venetian red and Indian red should never be used, because they are heavily loaded with calcium sulphate, which often causes the cement to disintegrate. Red hæmatite, some red ochres, and many other of the iron ores, particularly if burnt, are safe and suitable. Red hæmatite has a very powerful effect, very little being needed. Yellow ochres are suitable and safe, and have considerable colouring power. Burnt umber is safe, and gives a nice warm colour. A satisfactory colour has not been found in blue or green. Copper arsenide gives a fair green, but it is not desirable. Ultramarine is unsafe. Black oxide of manganese is probably best, but it is not possible to get a clear black. Ground hard-burnt coke may be used, but it is not so good. Ground coal or lamp black are quite inadmissible, except in the case of some of the anthracite coals. A clean white is not obtainable, except by using a white cement. A near approach to white may be obtained by the use of slaked white lime; the lime carbonates on the surface and forms a permanent and almost white colour. A cream colour which looks very well may be obtained by the use of slaked lime with a little yellow ochre. Chalk and whiting do not give very satisfactory results. In all cases but that in which slaked lime is used the colour in sufficient quantity to give the desired tint should be mixed (preferably ground) with the dry cement. Hand mixing is not satisfactory. Slaked white lime should be freshly made, but perfectly slaked, and should be mixed with the cement and aggregate at the time of using. By blending the colours named, all usual building material shades of red, brown, buff and grey may be obtained, and they are all permanent and safe.

Finally, it is possible, of course, to obtain very pleasing effects by the use of rough casting, and also by the introduction of flints or other stones placed by hand in the moulds and surrounded by cement.

SOME OF THE REPLIES RECEIVED.

(1) Rough casting is the best finishing coat for exterior finish. In applying a cement rough cast, however, a bonding material should be used to insure adhesion to the old concrete. For floors, stairs, walls, and internal finish generally, tiles and granite finish may be employed; there, also, the use of a bonding material is advocated.

(2) Blue stone dust trowelled to a glass face before the cement is set is advocated for facing the concrete, without any rendering. For rendering mortar composed of 1 part of sand to 1 part of pure Portland cement is advocated with trowelled finish.

(3) In surfacing the concrete without rendering it is advised that the surface of the mass concrete should be beaten down level and smoothed with a wooden or metal float just as it is beginning to set according as to whether a dead or bright surface is desired. It should never be faced, as is often done, by the application of a thin skin of a finer material, which, when applied, if the mass has partly or wholly set, nearly always comes off. Micaceous, clayey, silty or ochreous sand or gravel should be avoided, particularly micaceous sand, the mica in which, if the concrete be much worked, rises to the surface and causes constant dusting. If a floor is to be faced with a finer or richer class of concrete, then use that used for the body. If a facing material is not used, the concrete should be mixed plastic and worked up and down and to and fro with a shovel, trowel or rod all along the faces which are to be exposed, and particularly along the arrises. Concrete for such work requires to be properly proportioned so as to be without voids. On removal of the forms any roughness may be removed by rubbing with a piece of sandstone and water, or the face may be rubbed with a mixture of sand and cement by means of a wooden float, but this latter is not recommended if oil or soap has been used on the moulds, as the thin skin frequently fails to adhere and weathers off. If rendering is employed, Portland cement or clean, gritty sand or fine gravel is the best; the cement should be so proportioned as to rather more than fill the voids in the aggregate. It is not desirable to render with neat cement as hair cracks generally ensue.

(4) A facing mixture, usually 2 parts of sand to 1 of cement, put in the mould against the face of the form with the concrete behind it, has been found satisfactory. For colouring such a facing ochres have been found satisfactory, especially if not used in excess; they have apparently little effect on the durability, and with a white cement a little colour goes a long way. Greys of all shades can be obtained by admixture of lampblack. All the colours seem to fade until the work is matured, but afterwards stand perfectly well. The ultimate colour can always be found by experiment.

(5) A good sound skin can be obtained by specially tamping the concrete against the shuttering. All seams or joints between successive lifts require special attention. If the surface be pitted with small airholes, a mixture of fine sharp sand and cement proportioned 2:1 should be applied with a large brush and immediately rubbed into the surface with steel trowels or floats.

(6) If rendering be used, it should be proportioned 2 of sand or very fine aggregate to 1 of cement; in no case should neat cement be used.

(7) The most satisfactory way of facing concrete *in situ* without rendering is to apply a plaster in the form of cement mortar against the shuttering, as the concrete is put in, keeping the plaster a little higher than the concrete and carefully working the latter into the mortar all in one operation.

(11) For residential or street architecture cement finish is best, and can be varied almost to any extent by polished finish, wood float finish, coarse or fine sand, white sand, red sand, yellow sand; further, there is the scagliola finish, but it is, of course, very expensive; the cement can also be tinted a brick red and jointed, and a brick finish obtained. Two to one of sand and Portland cement is best for rendering. The cement should be plastered in the ordinary way, but with greater pressure than for ordinary plaster, indeed, the more pressure the better. The best form of colouring should be coloured sand.

(24) Forms or shuttering may be coated with a lime-wash made of pure lime, slaked with boiling water, and applied when hot. Before application a large cupful of linseed oil or tallow should be added to each pailful of hot lime; this assists in closing the pores of the wood and prevents the adhesion of concrete.

(25) In executing concrete without rendering, if the boards are planed and covered with thick oil paper the surface is good enough for whitewashing. The best rendering is cement and sand outside and putty and plaster inside.

CRACKS IN CONCRETE.

In a report on this subject the committee say:—

The cracking of concrete is unsightly, but is not necessarily dangerous. Cracks in concrete may be divided into two classes: (1) Surface cracking; (2) body cracking. In the first category the cracks are often referred to as "hair" cracks, by reason of their fineness and semblance to hairs, and occur both in plain and reinforced concrete. They are also known as "crazing," and are of very frequent occurrence. They appear to arise from the surface skin of cement mortar being richer in cement than the mortar of the body concrete, thus exposing almost a neat cement skin, which expands at a different rate on exposure to the sun's rays than the body concrete. It is worse upon the uppermost face in a mould, where the lighter and weaker particles of cement work up to the top and form a skin known as "laitance." If work be kept under water, and sometimes if shielded from the sun, this crazing may not occur. To overcome its unsightliness the surface skin should be removed either (1) by brushing the concrete when green with wire brushes; (2) by rubbing by means of a stone or piece of concrete and sand and water; (3) by dressing with hand or pneumatic operated chisels and hammers; (4) by brushing the surface with hydrochloric acid and subsequent washing with clean water. The last two named methods are best with completely hardened concrete.

The cracks extending through the body of concrete may be ascribed to the following:—

(1) Faulty design and construction so far as statical resistance is concerned.
(2) Expansion of cement or concrete.
(3) Corrosion of embedded steel.
(4) Shrinkage from setting and hardening in air.
(5) Difference of temperature in different parts.

(1) Under the first head the following causes have been noted:—

(*a*) Settlement of the foundations.
(*b*) Too high a stress in the reinforcement, resulting in excessive deformation.
(*c*) Too thick a covering of concrete, in particular where the effective depth of beams is very small.
(*d*) Too early removal of forms.
(*e*) Defective design of forms with inadequate allowance for contraction and expansion due to variation of moisture. Dry timber may expand and crack the concrete unless wetted beforehand.
(*f*) Careless removal of forms, which may result in cracking the concrete by shock of falling timber, or by levering and prising on the green concrete.
(*g*) Vibration, resulting in deficient adhesion and excessive deflection. Forms should be very rigid.
(*h*) Insufficient allowance for continuity, fixity, and general monolithic nature of concrete work done *in situ*.
(*i*) Too close spacing of steel, so that there is no room for the concrete to get round and adhere or bond with the bars.

(2) Expansion of cement or concrete.

Under this heading the following causes of cracking are noted:—

(*a*) Overlimed and coarsely ground cements which were frequently met with years ago caused expansion, to overcome which it was necessary to leave room for expansion—*i.e.*, expansion joints. Especially was this precaution adopted round the edges of floor slabs adjoining walls.
(*b*) Coarse materials containing sulphur compounds, unburnt fuel, oxidisable or hydratable iron compounds, unslaked lime, and other deleterious substances.

(3) Corrosion of embedded steel.

Should the steel in reinforced concrete corrode by reason of porosity of the concrete or the presence of deleterious substances in the coarse materials of which it is made, or by electrolytic action, the concrete cover to the bars will crack and burst off.

(4) Shrinkage from setting and hardening in air.

This is probably the most frequent cause of cracking. Concrete will expand slightly in water and contract on drying out, so that cracking is frequently not evidenced from this cause until the concrete is allowed to dry, varying usually up to two months, and in thick mass walls moisture and heat are retained for a long period, and may delay cracking up to six months and even longer. It is usual to keep concrete wet for several days after manufacture in order to ensure it gaining maximum hardness, and it is specially important to prevent rapid drying by sun and wind, so that the surface of concrete should be shielded against such exposure. A dry mixture of concrete shrinks less than a wet mixture, and concretes richer in cement contract more than lean mixtures. For reinforced concrete work medium wet mixtures are desirable, and therefore concrete richer in cement than 1 to 5 is not advisable for curtain walls.

As the rate of shrinkage varies with different proportions of the concrete ingredients—cement, sand, coarse material, and water—variation in such proportions should be avoided as much as possible. Cracks in plastering are often due to such irregular contraction.

(5) Difference of temperature in different parts.

Considerable difference of temperature will cause cracking, and should be avoided as much as possible.

COVENTRY ELECTRICITY PROFITS.

LOCAL GOVERNMENT BOARD INSPECTOR'S SUGGESTION.

In the course of a recent Local Government Board inquiry with respect to an application of Coventry Town Council to borrow a sum of £20,000 for the municipal electricity undertaking, the inspector, Mr. H. R. Hooper, remarked that the corporation last year made £16,000 profit on electricity, and applied £4,000 in relief of borough rates instead of paying back again some of its outstanding capital, which had doubled in the past six years. On the other hand, a good many municipal undertakings had lessened such capital, and that ensured a far better asset to a town. He did not question that Coventry had done very well, but the city was applying money in relief of rates, and was still going on borrowing in order to do so. The result was that the ratepayer had to pay more in the long run, and, of course, this particular application of profits was no relief to the poorer people of Coventry, who paid rates in rent. Again, 2,000 electricity consumers were making profits for 115,000 people, one-fifteenth of the population making a contribution to the rates for the benefit of others who did not use electrical energy. He hoped the council would seriously consider the question, and, without relieving the rates, look to the future and avoid further borrowing of money. The department was in business, and there was no sentiment about it at all. Coventry was a very enterprising city, and could not afford to be generous, and should supply cheap power.

New Technical School for Cardiff.—A new technical school building in Cathays Park, the plans for which have been prepared by Messrs. Ivor Jones and Percy Thomas, will form roughly three sides of a quadrangle, having frontages to King Edward VII. Avenue, College-road, and the North-road. The fourth side is being reserved for future extensions. The building will consist of three floors, and will be constructed generally in brickwork, with front and side elevations faced in Portland stone in the Neo-Greek style.

MUNICIPAL WORK IN THE FAR EAST.

ENGINEERING PROBLEMS AT SHANGHAI.

In his report for 1912 Mr. Charles H. Godfrey, Assoc.M.Inst.C.E., engineer and surveyor to the Shanghai Municipality, makes some interesting observations on matters connected with road construction. In Shanghai, he says, what difficulties there are are accentuated by peculiar circumstances: the absence of certain classes of industrial works leaves practically no choice of material, and importation from Europe or America burdens the work with heavy freight charges. The peculiar nature of local traffic, concentrated as it is into narrow roads, coupled with climatic conditions, nullifies the advantages otherwise to be gathered from the result of extensive work in Europe and America. With regard to local traffic, Mr. Godfrey points out that the weight per lineal inch of wheel tyre is, in the case of fully loaded wheelbarrows and handcarts, greater than the unit weight of the steam rollers under which the roads are consolidated.

"With regard to the bituminous treatment of macadam roads," Mr. Godfrey continues, "too much emphasis cannot be laid on the fact that tar-painted macadam and tar-macadamised roads can in no sense be termed permanent pavements, and cannot therefore be compared with hardwood blocks or natural asphalt laid on cement-concrete foundations. The improvement, however, over ordinary water-bound macadam is very noticeable.

"For the congested roads of the Central District macadam is an unsuitable material, but it is only by comparatively heavy capital expenditure that anything very much better can be substituted. In my report for September the following note on the subject of road foundations appeared:—

"'One of the main causes of the short life of the metalling on many of the heavily trafficked roads is that almost all the roads, particularly in the Central District, now possess no foundation to speak of, and the new metalling in many cases has to be laid practically on the mud. The original foundation consisted of about 8 in. of consolidated broken bricks. These bricks, in the first place, possess very few lasting qualities, particularly when laid on such a wet subsoil as we have in Shanghai. Under the influence of the water in the subsoil and continual steam rolling for many years, the broken bricks have disintegrated, and, as a foundation, are now useless. The extreme importance of a first-class foundation is obvious, and it is highly desirable that new foundations should be constructed as occasion and finances permit. Broken bricks are now no longer being used for road foundations, and all new roads are being constructed with a foundation of about 10 in. of Soochow granite spalls.'"

TAR-MACADAM.

A tabulated statement in the report shows that tar-macadam has been laid in some of the busiest roads in the Central District. Although they have given satisfaction so far, Mr. Godfrey has no intention of recommending the extended use of tar-macadam in roads subjected to such heavy traffic. The object in these cases was to subject the road to a severe test in order to observe the wearing and other qualities of the road in the shortest possible period. Generally speaking, he recommends that road treatment should proceed upon the following lines: Roads subject to very heavy traffic—hardwood paving blocks, or some form of asphalt laid on cement-concrete foundation; roads subject to moderate traffic—tar-macadam; roads subject to light traffic—water-bound macadam surface with refined tar or other inexpensive bituminous material.

Mr. Godfrey proceeds: "Although, of course, the initial cost of a tar-macadam road is higher than the cost of an ordinary macadam road, the life is longer, maintenance charges less, and, at the same time, a much better road surface is obtained. The saving effected in the cost of cleansing would also be considerable if bituminous or similar roads were constructed upon a large scale. The quantity of detritus removed from a tar-macadam road has been found to be 37 per cent less than from a macadam road. As this additional 37 per cent is largely binding material, it will be seen that this is a matter of first importance. The advantages and otherwise of a bituminous road are obvious to a careful observer, and need not be enumerated here. Work on the above lines is limited by the output and price of desiccated tar, but even if difficulties should arise in this connection, there remains the choice of a number of imported preparations which, although rather more expensive, would give compensatingly better results."

Lithofalt blocks laid in September, 1911, continue to be satisfactory, and very little measurable wear was observed after twelve months' use. In November a short length of adjoining road was paved with blocks made in the council's own depots with locally available materials. These blocks have not been laid down a sufficient length of time to pass an opinion on their wearing qualities, but it is pointed out that the basic compound contains no natural asphalt.

MUD ROADS.

The maintenance of unmetalled roads in the Western District in a condition suitable for vehicular traffic continues a source of difficulty and expense. The condition is largely dependent upon the weather, as frequently after 200 or 300 coolies have been employed for several days in raking the roads, a heavy rain shower, coupled with the passage of a small number of equestrians, has reduced the road to an almost impassable condition for wheeled traffic, and the work has to be done over again when sufficiently dry. As opportunity offers the mud roads are being reformed with a cross fall in order to throw off the rain as quickly as possible, and assist in preventing the surface being worked up into a slushy state in wet weather.

The length of roads under the control of the council is nearly 113 miles, and that of footways over 94 miles.

TRAMWAY TRACK.

The maintenance of the macadamised area of the tramway track was attended to last year by the municipal engineer's department, on behalf of the tramway company. The upkeep of the setts adjoining the rails reverted to the tramway company after having been looked after by the council for the previous twelve months. The cleansing of the rail grooves and drain boxes was also attended to by the department, at the company's expense.

Mr. Godfrey remarks that, despite the continual repairs effected by the tramway company, the condition of the track generally is unsatisfactory, the rail joints appearing to be the most fruitful source of trouble. He adds: "The whole question is one that will need the most careful consideration. The track occupies such a large proportion of the available carriageways that the matter is of the utmost public importance. Not only is it exceedingly difficult to maintain the track in a satisfactory condition, but the adjoining macadam is rapidly destroyed by the scouring action of the water splashed with considerable force from the rails by passing cars. The continual excavating at rail joints is a source of great inconvenience to vehicular traffic, and in certain thoroughfares is attended with danger."

In order to avoid the constant interruption of the road repairing gangs by passing tramcars, an attempt was made to carry out the remetalling of the tramway area at night, but night work had to be abandoned in the face of complaints from residents in the neighbourhood of the noise made by the coolies and the rollers.

LABOUR.

Considerable difficulty has been found in obtaining an adequate supply of suitable labour, except for about four months in the winter. Mr. Godfrey observes that the nature of most municipal work does not, as a rule, attract a good class of labourer, and it is therefore doubtful if a moderate increase in the rate of pay would result in any improvement. Good coolie foremen are also difficult to obtain, many of them being unreliable and lazy when not under immediate foreign control. Increased foreign supervision was introduced at the end of August, and resulted in much more efficient work. Endeavours are now being made to concentrate work as much as possible and so reduce the number of small isolated gangs. Artisans give little trouble, and are for the most part fairly diligent workmen.

PUBLIC LIGHTING.

The only feature of interest is the gradual replacement of enclosed arc lamps by lamps consisting of a cluster of four 100-candle power metallic filament lamps. It is expected that during 1913 the whole of the old enclosed arcs will be removed. Apart from

an anticipated improvement in the lighting a very considerable saving will be effected.

NEW BUILDINGS.

Since the early part of last year there has been an appreciable boom in the building trade. The increased activity has been almost entirely confined to the construction of Chinese houses, the Northern District leading with a total of 960. Not only have old houses been pulled down and new ones erected in their stead, but in many cases large blocks of houses (1,500 in all) have been erected on undeveloped land. The class of building now being erected shows that a serious attempt is being made to provide a better house than has been the case in the past, and there is a strong tendency towards providing a "fore gn air" to the structures wherever compatible with the standard design of a typical Chinese house. Many of the better class "hongs" are now being built with a fireplace in at least one room on the ground floor, and in some of the blocks of houses now under construction provision has been made for lighting the living rooms by gas or electricity. Since the laying of solid ground floors has been enforced, a much superior wooden floor has been laid, the Japan planking formerly used being replaced by Oregon pine, in many cases tongued and grooved.

CUMBERLAND ROADS.

COUNTY SURVEYOR'S REPORT.

Mr. Wm. Finch has issued his first annual report as county surveyor and bridgemaster of Cumberland, the statement covering the financial year ended March 31st last.

It appears that the expenditure during the year by the county council on ordinary maintenance and repair of rural main roads—of which there are 460 miles under their direct control—has been £30,413, the estimated cost at the beginning of the year being £28,920. The average cost per mile of £66 2s. 9d. is slightly in excess of the average cost for the previous year.

During the last five years the average cost per mile for maintenance of main roads, excluding improvements, has increased by £14 12s.

ROAD METAL.

Many of the main roads, which have been surfaced with inferior limestone and hand-broken cobbles gathered from the adjoining land, or taken from river beds, are in a very weak state, and Mr. Finch considers it would be false economy to continue further the use of this class of material, except on certain roads where the traffic is not so excessive.

He adds that the extra cost of applying granite or whinstone of approved quality in place of land and river cobbles will increase the initial cost, but he is convinced that the use of this better-class material will eventually be a saving, and give a much improved wearing surface to the roads.

Mr. Finch mentions that the foundations of many of the heavily-trafficked roads are weak, and will require strengthening, and, in some places, reconstructing before a good surface can be maintained, even with the best class of surfacing material.

DRAINAGE.

Considerable subsoil drainage has been carried out in recent years, but the county surveyor contends that a good deal more is necessary in many parts of the county, in order to keep the surfaces sound and good. In many instances the original open watercourses through private property have been piped and filled in by the owners, and these pipes are now silted up, causing a blockage of the road surface water. Much trouble has arisen through such blockages, and Mr. Finch points out how important it is that the original outfalls for road surface water and drainage should not be interfered with. This matter is being attended to throughout the county.

NARROW ROADS.

Many of the main roads in the county are stated to be much too narrow for modern traffic, and much damage is done by the heavy traffic following in one track up the centre of the road. The chief damage is caused by steam motor wagons and traction engines using one track on these narrow roads, in spite of instructions to vary the track, and the wear, even on a newly-made surface, is soon appreciable. In many places damage is done to the surface by soil and dirt being carried on to the main roads by the wheels of carts coming from the adjoining land, which entails expense to the county in cleaning off. Mr. Finch is of opinion that notices should be issued under the Highways Act, 1835, secs. 72 and 73, to restrain persons from causing such damage and expense.

TAR-MACADAM.

During the past three years tar-macadam has been laid down in the villages where the main road required metalling, and altogether 41,248 sq. yds. of surface have been treated in this way, at a total cost of £4,825, an average cost per square yard of 2s. 4d. Mr. Finch observes: "The first cost of laying down tar-macadam is, on the average, about double that of ordinary clay-bound macadam, but with the aid of the Road Board grants towards the additional cost, I am certain that the better-class surface and the extra life of the roads will compensate for the increased initial cost. During wet weather the superiority of tar-macadam is evident, being cleaner and sooner dry. The wearing surface is more even, and during dry weather the dust nuisance is almost obviated."

THE SIDCUP TRIALS.

Referring to the experimental lengths of roads laid down at Sidcup, Kent, by the Road Board, Mr. Finch remarks that the experiments are most interesting, but the traffic over the main roads at Sidcup is so considerably in excess of any traffic in Cumberland that a reasonable comparison could not be formed, and he expresses a desire to see the Road Board carry out some experimental work in the North of England or South of Scotland.

RURAL FOOTPATHS.

The general repair and upkeep of footpaths, the county surveyor proceeds, is more necessary on account of the extra amount of traffic using the roads, and many new lengths of footpaths are now being formed along the grass margins by the sides of the rural main roads, particularly in the vicinity of towns and villages. The formation of the footpaths is chiefly of gravel or other similar material. In some cases tarred chippings have been used, and this class of material makes a clean and most satisfactory footwalk

URBAN MAIN ROADS.

The mileage of county main roads maintained by the various urban authorities under agreement is 73 miles, the total cost being £6,937, or an average cost of £95 2s. 8d. per mile per annum. These roads vary in quality, and, in Mr. Finch's opinion, it would be more satisfactory for the county council to pay the actual cost of thoroughly repairing and remetalling these roads as they require it, and fix an annual payment for ordinary maintenance and upkeep till the roads require remetalling. The payment of an annual sum is not, in his view, a satisfactory method of dealing with these roads, having regard to the rapid changes which are at present taking place in the traffic using the roads.

Village Sewage Disposal in the West Riding.—New sewage disposal works at Smithy Brook, a village lying between Thornhill and Middlestown, were formally opened last week. The scheme was designed by the borough engineer of Dewsbury, Mr. Harry Dearden, and carried out under the supervision of the assistant engineer, Mr. F. D. Tunnicliffe. The original estimated cost was £600, but to meet the requirements of the Local Government Board an additional £200 has been spent in providing an extra percolating filter and a humus tank. By carrying out the works on the present scale the corporation will be able to deal with the sewage of Whitley, for the treatment of which there is no existing provision. There is already a dry-weather flow of about 10,000 gallons a day received at the works, and ultimately it will reach 24,000 gallons. The sewage is mainly sink water, few houses having the water-carriage system, and there is no admixture of trade effluent. After gravitating to the works the sewage is received into a detritus tank, where the grosser solids are collected, and is subjected to further treatment in open settling tanks of 22,000 gallons capacity, percolating filters and secondary filters, the purified effluent being discharged into the brook. Storm water up to three times the dry-weather flow will be treated in the ordinary way, the excess passing into stand-by tanks and thence over a submerged wall into the brook. Liquor from the sludge filter and the supernatant water from the settling storm water and humus tanks will be pumped back to the detritus tank by a centrifugal pump driven by a petrol engine.

INSTITUTION OF CIVIL ENGINEERS.

STUDENTS' ANNUAL DINNER.

Mr. R. Elliott-Cooper, president of the Institution of Civil Engineers, took the chair at the thirty-eighth annual dinner of the students of the institution, which was held on Wednesday night at the Trocadero Restaurant. The members and guests present included Mr. B. Hall Blyth, M.INST.C.E., F.R.S.E. (vice-president), Mr. Basil Mott, M.INST.C.E., Mr. Percy G. Bowie (chairman of the London Students' Committee), Mr. F. France Thomson, Mr. F. Palmer, M.INST.C.E., Mr. W. T. Spear, Mr. A. T. Walmisley, M.INST.C.E., Mr. E. Worthington, M.INST.C.E., Mr. W. G. Sinnett, and Mr. H. V. Hutt (hon. secretary of the Students' Committee).

The loyal toasts having been duly honoured,

Mr. P. G. Bowie proposed "The Institution, the Secretaries of the Institution, and our Guests." It was, he said, difficult, after nearly a hundred years, to realise the great advance that had been made by the Institution of Civil Engineers. It was started mainly for the acquisition of scientific knowledge, and the members not only obtained a certain degree, but entered into an obligation to carry out the objects of the institution, and spread a knowledge of civil engineering. It was largely owing to the members of the society that so much advance had been made in the science of engineering during the last century. As regarded the secretaries, he knew that the work they discharged could not be in better hands. They had had a specially successful season of lectures, and they were particularly indebted to the gentlemen who had permitted visits to their works, because the students were thereby able to see actual work going on, and thus obtain a certain amount of useful information.

The President, in reply, said he had been a member of the institution for more than forty years, and during that period he had witnessed many changes, changes which he might safely say had been for the good. He was sure that one of the changes that had the greatest effect towards placing the institution on a firm and lasting basis was the establishment of the examination. As years went on engineering became a more scientific profession than it was in the early days, and it therefore became more necessary that there should be some examination for those who intended to enter its ranks. Then they had enlarged the number and scope of the council, so that not only were the great centres in this country represented by engineers of skill, but other parts of the world and our great over-sea dominions were mostly represented. This not only had the effect of bringing a larger sphere into contact with the institution, but also made the members who went abroad feel that they were inside the institution, and not out of touch with the profession. The Government now recognised the test examination of the institution for appointments in the Indian Public Works Department. A few years ago the War Office decided to establish a corps of Reserve of Royal Engineers associated with the institution, and selected by the president. The members of it were to serve for a limited period of training with the Regular Forces, and they became for the time being officers of the Regular Army. So important did the Government think the development of the project might become that they offered to a limited number of gentlemen who had been through Chatham appointments in connection with the War Office. The institution had now a membership of over 9,000, and they hoped soon to have a home in London which would be second to none of that of any scientific body.

Mr. Basil Mott, in the course of his response, said there was not the least doubt that the training they received was of vital importance to the young members of the institution. He looked upon the students as one of the most valuable assets of the institution, and they were confident that the students would continue to hand on the traditions they had inherited quite as worthily as those who had gone before them.

Mr. Spear also briefly acknowledged the toast.

Mr. B. Hall Blyth submitted "The Students," and insisted upon the value of experience to young engineers. He advised them to devote themselves whole-heartedly to the work they had undertaken, and reminded them that they enjoyed advantages in which their forefathers had no part. There was, for example, the hydraulic riveting machine, which was not known to the old generation, and in this connection the speaker stated that this machine was first used upon a Clyde bridge, of which he was the designer, and which was built by Sir William Arrol. Then there was also pneumatic pressure and reinforced concrete, while they worked with steel instead of cast-iron. His advice to the students was to work with zeal, and seek to preserve some individuality in what they did.

A reply by Mr. H. V. Hutt completed the toast list.

HILL'S ROAD CLEANSING MACHINE.

DEMONSTRATION AT OLYMPIA.

While the weather on "Surveyors' Day" at the Building Trades Exhibition was what is usually described as "propitious," it was, from one point of view, disappointing, since there was neither mud nor dust in the removal of which the capabilities of Messrs. E. & P. Hill's road cleansing machine could be demonstrated. The weather was so dry, sunny and windy that it would have been difficult to make and to keep ready a film of artificial mud, while the strong breeze prevented dust from lying on the road. The surface of Sinclair-road was therefore strewn with gravel, including pieces of such sizes as fully to demonstrate the effective character of the work done by the machine in this respect. The road was completely cleared of gravel to the full width of its sweeping path, the fragments and small pebbles which at first sight seemed to have been left being found, on closer inspection, to be imbedded in the tarred surface and flush with it, forming, in fact, a part of the road surface itself. These pebbles and fragments had been pressed into the road by heavy wheel loads after the gravel was strewn and before the machine got to work.

Sir George Gibb, chairman of the Road Board, and Mr. H. Percy Boulnois, M.INST.C.E., accepted seats on the vehicle, which was driven up and down Sinclair-road carefully watched by a considerable gathering of surveyors and others interested in the demonstration. It was observed that the brush was actuated independently of the road wheels, so that the vehicle could proceed without the brush being in action—which was to have been expected; and, what is of more importance, the brush could be made to work away at one place when the vehicle was standing still.

A Big Public-Service Staff.—The Public Service Commission of the First District of New York will soon, in order to get out plans for the new subways, increase its present staff of 764 to 1,000. This year's appropriation for the commission is £334,600. The figures indicate the magnitude of the work of regulating the public utilities in the largest city in America.

The Growth of Municipal Engineering in Philadelphia.—In an article in *Scientific American* by Mr. Rudolph Blankenburg, Mayor of Philadelphia, the author says that municipal engineering began there with an official who was known as a "Regulator," to whom were left all questions affecting watercourses and the laying-out of roads, and who worked practically without instruments. Now there are in the city over a hundred technically trained and educated men whose knowledge of their subject has become sufficiently extended to be considered scientific. As to street cleaning, in spite of advances in methods and machinery, the author holds that "everything we are doing to-day is so far from satisfactory that it is bound to disappear and to be supplanted by a system the detailed methods of which we know but little to-day. . . . Street lighting is just beginning to take its place as a subject for scientific inquiry on the part of municipalities. . . . The sewage disposal method which obtains over the greater part of Europe is now absolutely obsolete. Most American cities have not begun the study of sewage disposal problems." On the question of staff, the author has the following pointed remarks: "If the city is going to place itself," he says, "in the position where it can compete technically, it must learn that men with technical skill and training are commanding increasingly high salaries in private or corporate employ, and we must be ready to meet them or lose their services. At the same time it must learn to do the lowest grade of work with men well qualified for it, and paid more than they are paid by private enterprises. A further evidence of the interest that is being taken by technically trained men in municipal work is that a number of the different colleges are now extending courses, not only in municipal administration, but in municipal engineering. The number and scope of these courses are increasing very rapidly."

FEATURES OF MACADAM CONSTRUCTION.

The following notes are from a paper read before the ninth annual convention of the American Road Builders' Association, by Mr. T. R. Agg, a road engineer of the Illinois State Highway Commission, and from the discussion following the reading of the paper and reported in the *Canadian Engineer*:—

Mr. Agg laid stress upon the importance of using stone of the right size to suit the conditions. Stones which are too small will be unduly crushed, while stones which are too large will not be crushed enough to keep the voids filled, notwithstanding the action of weather and traffic. For motor traffic, fairly large stone may be suitable, even to a point causing a rough surface and some inconvenience to traffic. In Illinois the soft limestone in use was found to give the best results when the material ranged from 2½ in. to ¾ in. The surface should be free from pockets of finer material. To ensure this the road is harrowed, which shakes down the finer material and brings the larger pieces to the surface.

In rolling a good crust it is important that the stones should be interlocked by working in the chips and dust with the roller, the allowance per square yard of finished limestone crust being about 2½ minutes. Most of the rolling should be done before the screenings are spread, as if these are spread too soon they only serve to separate the larger stones, and pockets of the smaller material are formed. The screenings should be washed into the voids and allowed to set before much rolling is done on them. A bonding surface tends, in Mr. Agg's opinion, to promote durability, and it should be about ¾ in. thick, consisting of 75 per cent gravel, ¾ in. downwards, and 25 per cent sandy loam.

In making bituminous-bound road crusts the good features of water-bound macadam should be retained and supplemented. The Illinois Highway Commission finds no reason for a change in the sizes of stone used or in the general method, provided the desired results can be obtained without making such changes. The usual thickness is 8 in., of which 5 in. is the lower course, which is bonded, and 3 in. the upper course. It is considered that for a bituminous-bound upper course the stone should not be much less than from 1½ in. to 1 in. When making bituminous-bound limestone crusts the limestone screenings should not be used, as they have very small wearing value, and the dust formed prevents the binder from sticking to the stone. Gravel should be used instead, preferably in two sizes, ¾ in. to ⅜ in., and ⅜ in. to ¼ in., the former as the main binder and the latter for surfacing.

In the discussion which followed the reading of the paper, Mr. R. A. Meeker, State Highway Engineer of Maryland, said that if macadam roads were properly maintained they were no more dusty than many other classes of pavement. A number of tests of pieces of crust taken from roads showed that a macadam crust in perfect condition should not contain more than 21 per cent of voids. As regards harrowing, he considered that while it might be effective with soft limestone, it would not do for trap rock and dollomite. In New Jersey the contractors were required to supply "specification stone" in regularly graded sizes. The Maryland engineers could heartily endorse what Mr. Agg had said about rolling: a good macadam road could not be built without plenty of water. The Maryland specifications provide that no screenings shall be rolled dry, this being a very wasteful process. A macadam road must be treated as concrete, and to get good results with concrete it must be thoroughly puddled. In New Jersey the great variety of soils had provided the State engineers with much experience. It was found that trap rock was not in all cases the best stone. For medium or light traffic a dollomite, or one of the harder limestones, gave far more satisfactory results, was less costly to prepare, and provided a harder and smoother surface.

Mr. J. S. Gillespie pointed out that, good as they were, the methods followed in Alleghany County, Pennsylvania, had proved unsuccessful in the face of motor traffic. Macadam roads were a good substitute, but if one had the money one did not want to fall back upon macadam. Macadam roads with 8 in. of Telford foundation, and 4 in. upper course, had proved unsuccessful. He did not condemn them everywhere, but they were no good in Alleghany County nor in the western part of Pennsylvania. Trap rock was not available, and most of the stone used was limestone from Ohio. If roads could be closed during the spring thaw the situation would be greatly improved, but this could not be done, and the roads were rutted. On this point Mr. P. Blair remarked that on many roads in Alleghany County the water was not drained from underneath the bed of the road to the side ditches. Cross drains at right angles were required to keep the road bed dry. Mr. Gillespie explained that French drains were put in at every 50 ft. The foundations did not give way, and the Telford pavement remained in place; it was the top coat which was shifted.

MUNICIPAL WORK IN AUSTRALIA.

PRAHRAN ENGINEER'S REPORT.

Mr. Wm. Calder, whose appointment as chairman of the newly formed Country Roads Board of Victoria, was announced lately, states in his last issued report as city surveyor of Prahran that during the financial year ending September 30, 1912, the steady progress which has marked the history of the municipality for the past decade has been fully maintained, and that of the general prosperity enjoyed by the State, Prahran has received its fair share. The number and value of the new buildings erected has exceeded any previous record in the history of the city, the value of these being close upon £200,000. The new buildings have been mostly erected in recently subdivided estates, but it appears that several of the recent sub-divisions have been cut up without regard to the continuity of new with existing streets, and with allotments of anything but a generous area. In mentioning this, Mr. Calder expresses regret that the municipal councils do not possess greater powers in controlling the laying out of new streets and building allotments

The report mentions that the mileage of streets in the city now exceeds 64, and there are over 18 miles of lanes.

The tar-painting of macadam roads was actively proceeded with last summer, the area of streets so treated being 226,740 sq. yds.—the total length of streets represented by this area being 14¼ miles, or just double the area tar-painted during 1910-11. Mr. Calder observes: "There is no doubt that very considerable benefit has been derived from this work, not only in the lessening of the dust nuisance, but in the general greater cleanliness of the streets thus treated."

ELECTRICITY FROM REFUSE.

The whole of the house refuse, amounting to 7,801 tons, and trade and market refuse, amounting to 1,073¼ tons, making a total of 8,874¼ tons, was consumed at the destructor, the quantities burned per month and the revenue received for electricity being set out in tabular form.

The number of electrical units generated and sold was 396,090 units, and the quantity used for the council's own lighting and other works, 45,204 units. The quantity of electricity generated per ton of refuse burned for the whole year was 47·09 units, and the water evaporation per lb. of refuse was 1·08 lb. The revenue received from electricity sold was £678, as against £808 for the previous year. This shortage is owing to the reduced price received for the electrical current, this being ·411d. instead of ·486d. as formerly, and to a temporary breakdown in the generator through the burning out of several of the coils, causing the generating plant to be out of action for nearly a month. On the other hand, an increased amount of current has been used on the council's own works—namely, 45,204 units, as against 32,527 units in the previous year, due to the increased use of the tar-macadam mixing plant.

London Main Roads.—In the House of Commons last week the Prime Minister was asked whether he was aware that the general scheme for the improvement of the main roads in and out of London was in the hands of the Board of Trade; that such money as might be available for this purpose was at the disposal of the Road Board; that the limited control over the town-planning schemes as regarded the adoption of the general road scheme lay with the Local Government Board; and whether he would, before it was too late, take steps to empower some central authority to assume undivided responsibility in this matter. Mr. Asquith said he thought it important that the departments named should keep in touch with each other and co-operate, so far as possible, in dealing with these questions, but he did not at present see his way to propose legislation setting up a central body such as was suggested.

Assistants' and Students' Section.

Conducted by SYDNEY G. TURNER, Assoc.M.Inst.C.E.

All communications in regard to this page must be addressed to The Editor, St. Bride's House, 24 Bride-lane, Fleet-street, E.C. *Envelopes must be marked "Assistants' Section" in the top left-hand corner. Correspondents are invited to submit questions for consideration and answers to the questions which appear. For the contributions considered to be the most meritorious, one or more premiums in books will be awarded monthly. Diagrams must be drawn to scale on separate sheets, ready for reproduction.*

THE MONTHLY PREMIUM.

The premium for April is awarded to

Mr. J. Skillman,
5 Cromwell-road,
Teddington,

whose contributions have, in the opinion of the adjudicators, been the best received during the month.

QUESTIONS.

This week answers are invited to the following questions:—

314. Concrete Roof.—It is desired to construct a semi-circular barrel roof in concrete of 50-ft. span, reinforced with expanded metal. Show the dimensions of the supporting walls, which are to be 15 ft. high from the top of the footings. The roof is to be ribbed with an extra thickness of concrete over the piers. (H. V. A., *Clapton.*)

317. Strength of Beam.—A rolled steel I beam of British Standard Section, 12 in. by 6 in., and weighing 54 lb. per foot, is capable of sustaining a load of 15 tons uniformly distributed over a span of 20 ft. What would be the safe load uniformly distributed which could be placed on either half of the lower flange? ("Pupil.")

321. Paving.—What is the correct method of setting out a paved road? Show how to work out the heights and cross-fall for a road 54 ft. wide, to be paved with a camber of 1 in 48 (channels each side are level). (P. G., *Chichester.*)

324. Oil Engines.—Assuming two engines of equal horse-power (4-h.p.), one an oil engine and the other a petrol, what would be the approximate cost for running each engine for fuel and repairs? How would the costs compare with each other, including first outlay and oil, repairs, &c.? In regard to efficiency, which engine would be the more efficient from an economic standpoint? ("Griffo.")

325. Air Compressors.—How is the size of an air receiver calculated in connection with an air compressor? Of what thickness of metal would it be made if (1) of cast iron, (2) wrought iron, assuming it had to withstand a pressure of from 15 lb. to 40 lb.? Give any further particulars regarding same. ("Griffo.")

[The Editor is at all times glad to hear from readers who desire to submit questions regarding matters of general interest, points of daily practice, &c., for insertion in the "Assistants' and Students' Section." Questions which are published are taken into consideration, as well as other matter, in awarding the Monthly Premium.]

REPLIES TO QUESTIONS.

320. Water Tower Design.—Design a small water tower to hold 8,000 gallons, top water level being 30 ft. above ground level, tank of cast-iron, framework of tower of steel. Show full calculations, including wind pressure allowances. (W. H. B., *Bocking.*)

Suitable dimensions for a cast-iron tank to contain 8,000 gallons of water are 12′ × 12 × 6, the water level being within 6″ of the top.

The tank could be constructed with Messrs. Mather & Platt's standard plates 2′ square, the weight of which would be 5 tons.

Weight of water in tank = 22·32 tons
" " " and " = 27·32 (say 28 tons).

The tank will be carried by seven steel joists as shown in Fig. 3.

Each joist, except the two external ones, will be required to carry a distributed load of $\frac{28}{6} = 4\frac{2}{3}$ tons.

B.M. at centre $= \frac{Wl}{8} = \frac{4\frac{2}{3} \times 11 \times 12}{8}$

Moment of resistance $= f \times Z$ where f = working stress taken at 6 tons per sq. in., and Z = modulus of section.

$$\therefore f \times Z = \frac{\frac{7}{14} \times 11 \times \frac{4}{12}}{\frac{8 \times 8}{2}}$$

$$\therefore Z = \frac{77}{f}$$

$$= \frac{77}{6} = 12\frac{5}{6} \text{ inch}^3 \text{ units.}$$

The nearest modulus of section to this amount in the tables of British Standard Sections is 13·9 in.^{3} units, which is for an 8″ × 4″ section at 18 lb per ft. run.

These seven joists are borne by two main joists resting directly on corner piers as shown in Fig. 3, each carrying a

dist. load of $\frac{28}{2}$ tons + weight of joists

= 14 + ·34
= 14·34 tons.

$$\text{B.M.} = \frac{Wl}{8} = \frac{14{\cdot}34 \times 11 \times 12}{8}$$

$$\text{M.R.} = f \times Z$$

$$\therefore Z = \frac{14{\cdot}34 \times 11 \times \frac{2}{12}}{\frac{8 \times 6}{4}} = \frac{157{\cdot}74}{4} = 39{\cdot}43 \text{ in}^3 \text{ units.}$$

The nearest modulus of section in tables is 42·32, which is for a 10″ × 6″ section at 42lb. per ft. run.

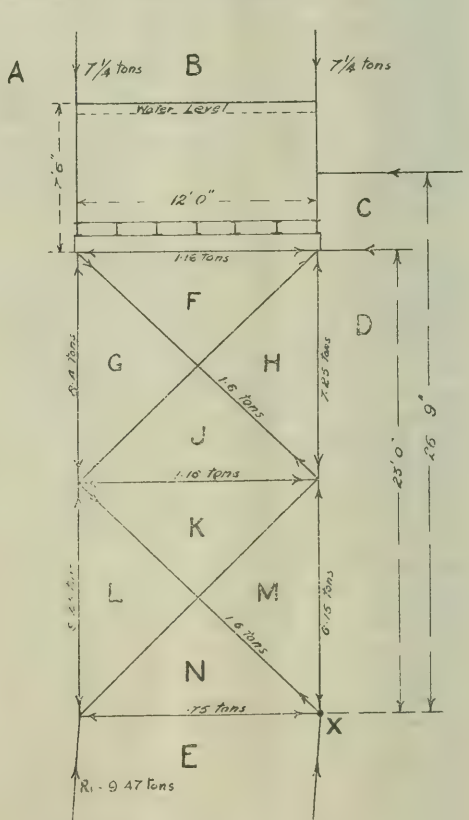

Fig. 1.

(Scale ½″ = 1′.)

To enable us to find suitable sections for the various members of the tower we must draw frame and stress diagrams as shown in Figs 1 and 2.

The bulk of the wind pressure will be concentrated on the side of the tank. The distance from the pier cap to the top of the tank is 7′ 6″

∴ Area exposed to wind = 12′ × 7′ 6″

and taking maximum wind pressure at 50lb. per sq. ft., the total pressure = 12′ × 7′ 6″ × 50

= 4500lb.

The Surveyor

And Municipal and County Engineer.

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Half of this amount only will be needed in the diagrams, as we are only considering one half of the tower

$$= \frac{4500}{2} = 2250 \text{ lb., say 1 ton.}$$

This amount will be acting at a point 3′ 9″ above top of pier, but to enable us to draw a stress diagram we require to know an amount acting at the top of the pier which will have the same effect on the structure.

$1 \times 26' 9'' =$ equivalent pressure $\times 22$

$\therefore$ equivalent pressure $= \frac{26{\cdot}75}{23} = 1{\cdot}16$ tons.

Total weight on piers—

Tank and water,	28 tons
8×4 joists,	·34
10×6 joists,	·45
	28·79 (say 29) tons

$\therefore$ weight on each pier $= 7\frac{1}{4}$ tons.

To obtain the amount of the reaction R_1 take moments about point x

$$7\tfrac{1}{4} \times 12 + 1{\cdot}16 \times 23 = R_1 \times 12$$

$$\therefore R_1 = \frac{87 + 26{\cdot}68}{12}$$

$$= 9{\cdot}47 \text{ tons.}$$

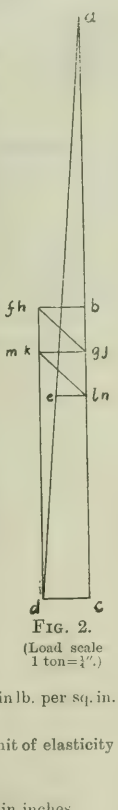


Fig. 2.
(Load scale 1 ton = ¼″.)

Design of Piers.—The greatest stress in the piers will be found to be 9·45 tons. For the purpose of calculating size of piers we can take them as being fixed at both ends, and as the bracing and struts divides the piers into two portions we can take them as being 12 ft. long.

The formula used in this case is Rankine's Revised Formula as explained in Mitchell's "Advanced Building Construction."

$$p = \frac{f}{1 + a\frac{l^2}{r^2}}$$ in which p = ultimate stress in lb. per sq. in.

a = reciprocal of limit of elasticity

$$= \frac{1}{40000}$$

l = length of pier in inches.

r = least radius of gyration.

f = ultimate resistance of steel in compression = 60,000 lb.

Consider the case of a 5″ × 4½″ steel joist in which least radius of gyration = 1·034 inch [3] units.

$$p = \frac{60000}{1 + \frac{1}{40000} \times \frac{144^2}{1{\cdot}034^2}}$$

$$= \frac{60000}{1 + \frac{19376{\cdot}64}{40000}}$$

$$= \frac{60000 \times 10000}{14844{\cdot}16} = 40419 \text{ lb. per sq. in.}$$

The factor of safety to be used is dependent on the ratio $\frac{\text{length of column}}{\text{least width of section}}$ and is found from the table to be 6·2.

Thus the safe stress that can be used with this section of joist is $\frac{40419}{6{\cdot}2} = 6519$ lb. per sq. in.

A 5″ × 4½″ joist used as a pier will therefore safely carry

$$\frac{6519 \times \text{area of joist}}{2240} = \frac{6519 \times 5{\cdot}29}{2240} = 15 \text{ tons}$$

We only require the pier to carry 9·47 tons, but the next smaller size of joist (5″ × 3″) will be found to be too small.

Cross Bracing.—It will be noticed that part of the cross bracing is redundant whilst the wind pressure is acting on the side shown; they would, however, be required if the wind pressure was reversed.

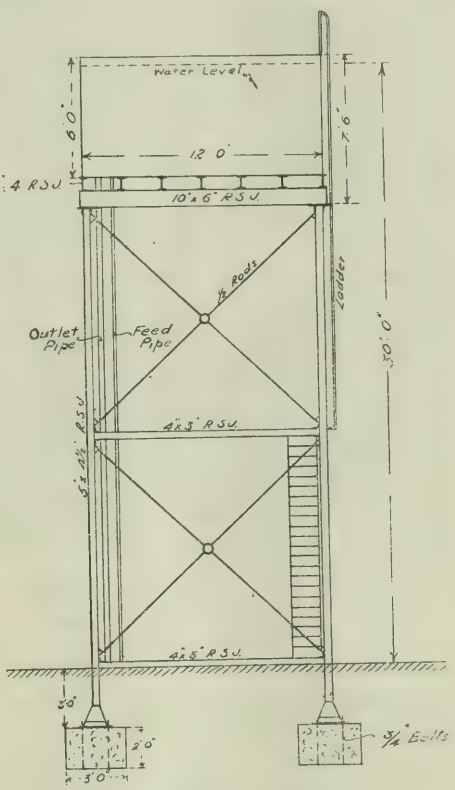


Fig. 3.
(Scale ⅛″ = 1′.)

The stress in the braces or ties is 1·6 tons; ½″ diam. rods will serve for this purpose.

Struts.—The stress in the horizontal struts is 1·16 tons. A 4″ × 3″ steel joist can be used in this instance, although somewhat stronger than is required for this stress. The additional strength, however, will allow for the fixing of pipes and ladders.

Fig. 3 shows an elevation of the finished tower.

The concrete under each pier should be 3 ft. square and 2 ft. thick in ordinarily good ground.

One point that must not be lost sight of is whether the tower will be able to resist wind pressure when the tank is empty.

Forces resisting wind pressure = (weight of metal in tower + weight of concrete bases) × 6

$$= (7 \times 4)\ 6 = 66 \text{ ft. tons.}$$

Total wind pressure $= 2{\cdot}01 \times 26{\cdot}75$

$$= 54 \text{ ft. tons.}$$

The structure will therefore be safe under these conditions.

(A. V. C., *Nelson.*)

SOME RECENT PUBLICATIONS.*

Records of the Survey of India, Vol. II., 1910-1911. Prepared under the direction of Colonel S. G. Burrard, C.S.I., R.E., F.R.S., Surveyor-General of India. Price 6s.

The topographical survey, during the period covered by the report, was continued in Kashmir, the Punjab, the United Provinces, the Central Provinces, Berar, Madras, Burma, the Shan States and Assam. The area surveyed in the United Provinces was intersected by the Jumna, the Ganges and the Chambal rivers, and near the Jumna and Chambal the country was cut up by deep ravines, the beds of the main rivers being, in some places, as much as 150 ft. below the surrounding plains. In the Central Provinces the country surveyed included densely wooded hill slopes, scored by steep chasms 200 ft. to 300 ft. deep. In South Kanara the country under survey consisted of a succession of highly cultivated valleys, with belts of jungle fringing the cultivated areas, and there were no villages, the population being concentrated in the towns along the main roads and scattered in innumerable isolated huts. The work in Southern India included a survey of the Periar catchment on the 2-in. scale, this area forming a part of the unexplored portions of the Pandalam Hills. It is for the most part covered with evergreen forest and dense undergrowth; there are little or no means of communication, and transport and labour are extremely difficult to obtain. After leaving Bangalore the party was delayed nine days by the Theni River being in flood and impassable. In Burma, a part of the country surveyed, in the valleys of the Irrawaddy and Taping rivers, was marshy and covered with thick jungle. Among the many difficulties encountered in Karenni and the Shan States one of the most serious was the haze in the valley of the Salween River, morning mists in December and January and smoke haze in March. No rain fell from the beginning of December to the middle of April, and the heat was intense in the river valleys. In the trans-Salween area of the Southern Shan States the villages numbered about one to 20 square miles, and there was one piece of country 180 miles square with but two villages in it.

In the geodetic survey important observations of astronomical latitudes were made, and a considerable number of pendulum observations. The report contains much interesting matter relating to triangulation, especially as regards the problem of making junctions with the Russian triangulation. The Indian triangulation up to latitude 36 deg. is of the highest degree of accuracy, all stations, with the exception of the forward rays at one, having been observed with a 12-in. micrometer theodolite.

Modern Pumping and Hydraulic Machinery. By Edward Butler, M.I.MECH.E. Price 18s. nett. London: Charles Griffin & Co., Limited.

In this work the author deals exhaustively and systematically with the whole range of pumping appliances, as well as the various machinery used in hydraulic transmission and generation of power. A moment's reflection as to the wide variety of uses to which pumps of different kinds are put in modern practice is sufficient to show the wide field which must be covered by such a work. Thus there are excellent chapters on waterworks pumping engines, mine pumps, artesian well pumps, boiler feed pumps, hydraulic power pumps, fire pumps, centrifugal pumps and many others. In regard to each class of pump the author has given, where necessary, an explanation of the theoretical principles involved, together with a full consideration of the construction, advantages and working. In view of the recent opening of the Chingford reservoir, peculiar interest attaches to the Humphry gas pump, which is described at some length. An excellent feature of the book are the illustrations, which are numerous, and very well drawn and reproduced. As a comprehensive treatise on the subject, Mr. Butler's book should be in the library of every engineer concerned with pumping and hydraulic machinery.

The Problem of the Gasworks Pitch Industries and Cancer is dealt with in a sixpenny booklet published by Mr. John Murray. The authors are Messrs. H. C. Ross and J. W. Cropper, and some observations by Mr. W. J. Atkinson Butterfield, who is engaged in experiments in connection with the question, are included in the publication.

* Any of the publications reviewed, or referred to as received, will be forwarded by the St. Bride's Press, Ltd., on receipt of published price.

ASSOCIATION OF SOMERSET SURVEYORS.

MEETING AT WELLS.

A well-attended meeting of the Association of Somerset Surveyors was held at Wells on Saturday last under the presidency of Mr. Francis Parr, Assoc.M.Inst.C.E., borough surveyor of Bridgwater.

In the course of the proceedings an illuminated address, expressing the gratification of members at his success and their regret at his departure, was presented to Mr. E. J. Stead, Assoc.M.Inst.C.E., by the president. Mr. Stead, who has recently been appointed as county surveyor to the Northern Division of Devonshire, was warmly greeted on rising to respond.

Mr. T. Orchard, surveyor, Clutton, brought forward a motion affirming that surveyors are entitled to the same relief as that given to medical men in the matters of the rebate on petrol and taxation of motor cars. After considerable discussion it was agreed that a resolution embodying this opinion should be sent to the secretary of the Institution of Municipal and County Engineers in order that he might bring the matter before that body, copies also being directed to be sent to the County Councils' Association, the Road Board, and the Chancellor of the Exchequer.

A discussion then took place on a paper on the taking off of quantities for sewerage works, read by the president at a previous meeting in Bridgwater.

The following gentlemen were proposed and declared duly elected as members and associates of the association: As members, Messrs. G. W. Groves, surveyor, rural district council, Dulverton, and C. Pursey, city surveyor, Wells; as associates, Messrs. C. B. Barnes and C. B. Borthwick, Wincanton.

A vote of thanks to his Worship the Mayor of Wells for granting the association the use of the council chamber for the meeting terminated the proceedings.

A Proposed New Durham Road.—Plans for a proposed new road from West Hartlepool to Easington, 8 miles in length, are being prepared by Mr. J. G. Heslop, surveyor to the Easington Rural District Council. The scheme includes the construction of bridges—one 1,000 ft. in length—and the plans for these are being prepared by Mr. Nelson F. Dennis, M.Inst.C.E., borough engineer of West Hartlepool.

Sewerage in Nuneaton Rural District.—At a meeting of Nuneaton Rural District Council last week plans were presented by Mr. F. C. Cook, borough surveyor of Nuneaton, for a sewerage scheme for Arley. The scheme would provide for about 2,000 people, the present population of the area dealt with being estimated at 650. The total cost was estimated at £3,250. The scheme was adopted, and it was decided to make application to the Local Government Board for sanction to a loan for £2,500 to carry out the scheme.

Structural Economy.*—We have received an admirable little book by Mr. E. A Slater, which every borough engineer should make a point of possessing. It represents the "bovril" of engineering practice from foundations to bridges and cuttings, dealing on the way with walls, ground floor construction, roofing materials, upper floor, girders, roofs, ventilation and heating, drainage and sanitary fittings, corrugated iron buildings, fencing, planning, paving, roads, tramways, quays, and service and storage reservoirs. There is a chapter on the law relating to structures, and a number of calculations of real practical value. Mr. Slater's main object is to emphasise the importance of contemplating ultimate economy in carrying out works of the kind enumerated. Original cost is not everything; subsequent maintenance has also to be added. Particular attention is given to the laying out of industrial suburbs, and this feature of the book should appeal to officials who have to give practical effect to the provisions of Mr. Burns's Act of 1909. The methods described in the book are explained in such a way as to induce builders, and those who employ them, to think twice before the old text-book rules, or rule-of-thumb traditions, are continued. The building trade is too much confined to a theoretical rut, and Mr. Slater shows by one practical illustration after another how and why the formulæ of the past should give way to the theorems of the present.—*Municipal Journal.*

* By E. A. Slater, Assoc.M.Inst.C.E., F.S.I., M.Inst.Mech.E., Lecturer on Structural Engineering. 6s. nett. St. Bride's Press, Limited, 24 Bride-lane, E.C.

LOCAL GOVERNMENT BOARD INQUIRIES.

The Editor invites the co-operation of SURVEYOR *readers with a view to making the information given under this head as complete and accurate as possible.*

INQUIRIES HELD.

Alfreton U.D.C. (April 23rd. Mr. R. H. Bicknell).—£1,500 for laying a new main between the Butterley and the Lindway No. 2 reservoirs.—The surveyor, Mr. R. F. Ward, explained that the original pipe was 4 in. in diameter, and it was proposed to lay a 7-in. main. At the present time water was running to waste at Butterley reservoir when the Lindway No. 2 reservoir was not full. The existing reservoir capacity was 27,000,000 gallons, and the daily consumption in the district 280,000 gallons per day. It was proposed also to enlarge the Butterley reservoir, 14 acres having been acquired for £625.

Belfast T.C. (April 25th. Mr. P. C. Cowan).—£21,571 for the completion of the new public abattoir.—The city surveyor, Mr. H. A. Cutler, explained that the provisional sums provided for the equipment of the abattoir were based on the simplest and cheapest apparatus procurable; but when tenders were received, and an inspection made of installations upon which the tenders were based, the committee were of opinion that the best and most up-to-date would be the most satisfactory and cheapest in the long run, so that the figures in these items had been very considerably increased. The total expenditure would be £51,571, and the contractors were Messrs. H. & J. Martin, Limited. He expected that the abattoir would be ready for opening in about two months, and he was satisfied it would be convenient, suitable and sufficient.

Bournemouth T.C. (April 22nd. Mr. Edgar Dudley).—£18,000 for the purchase of Strouden Farm for corporation purposes, and £4,500 for the purchase of land for pleasure grounds near Strouden Farm; also for laying out existing grounds on the sea front at Southbourne. There was no opposition to either proposal.

Dundalk U.D.C. (April 28th. Mr. P. C. Cowan).—£5,000 for the purpose of carrying out electric lighting extensions in the town.—Mr. M. Comerford, town clerk, explained that the council had carried out a scheme of electric lighting with a loan of £20,000. Owing to the demand, however, they found it necessary to extend the mains, and required an additional £5,000 for this work.

Neath T.C. (April 15th. Mr. M. K. North).—£75 for the widening of Gasworks-road, and £700 for paving the corporation enclosure on the quay.—The town clerk, Mr. Ed. Curtis, and the surveyor, Mr. D. M. Jenkins, explained the details of the work, and there was no opposition.

Newcastle (Ireland) U.D.C. (April 24th. Mr. P. C. Cowan).—£6,500 for a scheme of sewerage.—Mr. Croasdaile, engineer, stated that it was proposed to have an outfall piped through the Shimnah River at the Castle Bridge, and discharging below low-water mark at a point between 590 yds. and 600 yds. from the nearest high-water mark. The single outfall would be sufficient for the needs of Newcastle.

Rothwell U.D.C. (April 15th. Mr. A. A. G. Malet).—£9,000 for the construction of sewage disposal works at Lemonroyd.—The clerk, Mr. W. Dodgson, stated that the proposed works were outside the district. There was no doubt as to the necessity of the scheme, as the present works were entirely inadequate. The principal difficulty had been that the site was taken on a lease which would run out in 1930. The works and sewers were liable to subsidence. Quite recently a colliery had been sunk in close proximity to the works, and there were two seams of coal which could be obtained from under the works. When the coal had been got it was expected that there would be subsidences.

West Ham T.C. (April 11th. Mr. Edgar Dudley).—£4,748 for the purchase of property for the widening of High-street, Stratford; Greengate-street, and New Barn-street, Plaistow; and for the extension of the Plaistow recreation ground.—With respect to High-street, it was explained that the council proposed to increase the width to 85 ft. The proposal as to Greengate-street was to complete the widening previously undertaken, and to add a footpath where at present none existed on that side. The present width of New Barn-street was 28 ft. to 39 ft., and it was proposed to increase it to 43 ft. and 56 ft. It was stated that the Road Board had been approached with a view to securing a grant towards the widening scheme.

APPLICATIONS FOR LOANS.

Brighouse T.C.—£1,000 for the provision of automatic gas lamp controllers.

Cleethorpes U.D.C.—£4,000 for the erection of a refuse destructor.

Freebridge Lynn R.D.C.—£750 for the erection of four cottages.

Harrow U.D.C.—£400 for works of sewerage.

Huddersfield T.C.—£4,000 for the provision of dwellings at Mold-green.

Mansfield T.C.—£3,580 for works of street improvement.

Middlesbrough T.C.—£5,000 for fire brigade purposes.

Newbury T.C.—£330 for the purchase of a site for an infants' school.

Norden U.D.C.—£1,155 for sewerage purposes.

Paignton U.D.C.—£1,340 for a road widening scheme, and £220 for a public convenience.

Portsmouth T.C.—£750 for main sewer extension.

Wallasey T.C.—£16,203 for a new school.

Watford U.D.C.—£4,300 for a housing scheme.

Ystradgynlais U.D.C.—£1,000 for new municipal offices.

LOANS SANCTIONED.

Atherstone R.D.C.—£1,745 for the provision of working-class dwellings.

Barrow-in-Furness T.C.—£8,037 for a new school and street work.

Bungay U.D.C.—£3,500 for workmen's dwellings.

Carlisle T.C. £7,100 for water supply extensions.

Erith U.D.C.—£1,200 for the purchase of a school site.

Sedgley U.D.C.—£5,600 for new gasworks.

Skegness U.D.C.—£1,600 for sewage disposal purposes.

Trowbridge U.D.C.—£16,500 for the extension of the sewage disposal works.

FORTHCOMING INQUIRIES.

MAY.	£
6.—**Colne.** For works of road improvement (Mr. F. H. Tulloch)	1,349
6.—**Hartley Wintney.** For works of sewage disposal (Mr. H. Shelford Bidwell) ...	4,550
6.—**Hexham.** For works of sewage disposal (Mr. R. G. Hetherington)	1,850
6.—**Kendal.** For works of sewage disposal (Mr. F. O. Stanford)	9,800
6.—**Petersfield.** For the purchase of a recreation ground (Mr. Edgar Dudley) ...	1,100
6.—**Seaton.** For works of sewerage (Mr. P. M. Crosthwaite)...	1,300
7.—**Beckenham.** For works of park extension (Mr. R. H. Bicknell)	800
7.—**Blackburn.** For street widening purposes (Mr. F. H. Tulloch)	2,330
7.—**Easington.** For works of sewerage (Mr. R. G. Hetherington)	17,300
7.—**Haltwhistle.** For sewage and water supply purposes (Mr. F. O. Stanford) ...	7,000
7.—**Rhondda.** For electricity and destructor purposes (Mr. H. R. Hooper)	61,900
7.—**Sevenoaks.** For a housing scheme (Mr. C. H. Eyles)	1,200
8.—**Cardiff.** For the provision of a mansion house and judges' chambers (Mr. H. R. Hooper)	8,000
8.—**Easingwold.** For works of water supply (Mr. F. O. Stanford)	8,657
8.—**Knutsford.** For works of street improvement (Mr. F. H. Tulloch)	5,000
8.—**Liskeard.** For works of sewage disposal (Mr. P. M. Crosthwaite)	700
8.—**Sandown.** For laying out a public garden (Mr. H. Shelford Bidwell) ...	1,100
9.—**Horsham.** For works of street improvement (Mr. Edgar Dudley)	1,600
9.—**St. Ives.** For fire station and foreshore purposes (Mr. P. M. Crosthwaite) ...	873
9.—**Swansea.** For the extension of the police and fire station, and street works (Mr. A. G. Drury)	48,850
10.—**Newport (Salop).** For sewage disposal works (Mr. F. H. Tulloch) ...	495

Municipal Work in Progress and Projected.

The Editor invites the co-operation of Surveyor *readers with a view to making information given under this head as complete and accurate as possible.*

The following are among the more important projected works of which particulars appear below: Buildings—Birmingham, Dunfermline £10,000, Sale £10,000, Stirling £18,310; housing and town planning —Huddersfield; refuse collection and disposal—Cleethorpes; roads and materials—Cumberland £16,000, Huddersfield £55,944, Notts £13,500; sewerage and sewage disposal—Cannock £4,925, Whitby £4,828; water, gas and electricity—Scarborough £8,500.—Particulars of other works projected will be found on our "Local Government Board Inquiries" page.

ADMINISTRATION.

Lancaster T.C.—A committee that had been discussing the question of the municipal staffs have reported that there has been no waste in the surveyor's department, nor is there at the present time. They suggested that another assistant be engaged at £120 a year, and that the salary of the assistant surveyor be increased £20 a year. The council have approved these recommendations.

BUILDINGS.

Birmingham T.C.—The scheme for the extension of the Salterley Grange and West Heath sanatoria has been approved by the Local Government Board. It is proposed to increase the accommodation from 158 to 184 beds. The amount to be contributed towards the cost by the Local Government Board is £16,560, leaving about £15,000 to be found from the rates.

Dublin C.C.—An estimate of £800 has been passed for the erection of a court-house and concert hall at Rathcoole.

Dunfermline T.C.—Consideration is being given to a scheme for the extension of the Carnegie public library, at an estimated cost of £10,000.

Frodingham U.D.C.—The question of providing public baths is to be considered by the council.

Glasgow T.C.—Attention is being given to the need of providing, either by bridge or tunnel, a route across the lower reaches of the Clyde, which shall accommodate considerable road traffic and relieve the congestion of the more central city streets. The probability is that a pretentious scheme will be decided upon, and that it will take the form of a bridge. This will need to be of the replacement type, owing to the river traffic, which includes vessels of the largest class and in very considerable volume. The bridge will also need to provide for cross-river running of the electric trams, and generally to accommodate the heaviest class of road vehicle; marine boilers, engines and large tools are quite common loads in the neighbourhood.

Sale U.D.C.—New municipal offices and a parish hall are to be constructed at a cost of £10,000.

Stirling T.C.—A scheme has been prepared by Mr. J. G. Gillespie, of Glasgow, for new municipal buildings, at an estimated cost of £18,310.

HOUSING AND TOWN PLANNING.

Athy (Co. Kildare) U.D.C.—The council are about to take over from the builders twenty-two artisans' dwellings, which they have had erected in the town under a scheme for the housing of the working classes. The expenditure involved is £6,600, repayable in sixty years. Three bedrooms are provided in each class of house. Negotiations for a second scheme of forty houses are at present proceeding. These will be mainly for the labouring class, to let at rents of 1s. 6d. or 2s. weekly.

Glasgow T.C.—It has been referred to the Executive Committee on Housing to report as to the advisability of applying for powers to enable the corporation to purchase a number of tenement properties in each of the congested areas of the city, with a view to having these tenements put into a good sanitary condition, the rents subsidised, and the houses let to such people as are at present compelled by poverty to inhabit unhealthy dwellings.

Huddersfield T.C.—A scheme has been approved for the erection of fifty workmen's dwellings on the Royds Wood estate.

Oldham T.C. The Housing and Town-planning Committee have considered some designs of houses prepared by Mr. F. Thorpe, the architect who was awarded the first prize for his town-planning designs. Mr. Thorpe stated that in Oldham there were about 36,000 dwellings, of which 150 were empty, and only eighty let at a less rental than 4s. a week. One of the sketches produced was of a block of four dwellings, which, he said, could be built at £400 a block, or £100 a dwelling, and let at a rental of 3s. a week, including rates. The local building by-laws were an obstacle to house building at reasonable prices, and he suggested that they should be revised and altered in several directions. It was decided to propose to the surveyors and Buildings Committee a relaxation of the building by-laws.

Portsmouth T.C.—Plans for the erection of sixty-three working-class dwellings have been submitted to the Local Government Board. The cost per house is about £200.

Queenstown U.D.C.—The tender of Messrs. Meagher & Hayes, of Cork, at £14,130, has been accepted for the erection of fifty workmen's dwellings.

Tiverton T.C.—Five architects competed for the premium offered by the council for the best set of plans of a housing scheme, and the committee appointed to award the prize have selected the set of Mr. S. Thompson-Clothier, of Street, Somerset. The borough surveyor, Mr. J. Siddalls, gives the estimates accompanying the winning set as follows: For 114 houses—Land, £1,280; buildings, £15,146; sewerage and water, £385; street work, £750; fencing, £164. The houses will be of three classes. Class A, £180 per house, with three bedrooms, parlour, small base, and kitchen; Class B, to cost £135, no parlour; Class C, to cost £107, two bedrooms and living room. The houses will be in blocks, red brick up to a string course, stucco above, casement windows, red tile roofs, and Classes A and B would have a bath. Mr. W. H. Martin expressed his opinion that too many of the wrong class of house were proposed to be built. A committee has been appointed to take such steps as may be necessary to bring the matter up to the point of obtaining tenders provisionally to be approved by the Local Government Board.

REFUSE COLLECTION AND DISPOSAL.

Bermondsey B.C.—The question of the disposal of house refuse came up on a report of the General Purposes Committee. The Electricity Committee had complained of the additional cost of consuming refuse owing to its damp condition, and had suggested that the pails supplied to householders should be covered. The General Purposes Committee stated that they had viewed samples of covered pails, but as the hinged covers were liable to get out of order, and as the loose covers were liable to get lost, apart from the additional cost, they were unanimously of opinion that the provision of covered pails was inadvisable. The committee have been requested by the council to give the matter further consideration.

Cleethorpes U.D.C.—The tender of Messrs. Manlove, Allicott & Co., of Nottingham, at £3,722, has been accepted for the erection of a refuse destructor, consisting of three cells, combustion chamber, water-tube boiler, and accessories, designed for the destruction of 30 tons of refuse per working day of sixteen hours.

Middlesbrough T.C.—It has been decided by the Sanitary Committee to continue the present system of barging out to sea a portion of the town's refuse, and to erect an enclosed staith dock on the site adjoining the transporter bridge, at a cost of £4,200, where the barge is loaded.

Newhaven R.D.C.—The question of Sunday street scavenging was raised at a recent meeting, when Mr. Moubray inquired whether work was being done at Rottingdean on Sunday mornings, and on eliciting the response that loose papers were picked up, moved that the contractors be asked to discontinue the practice. The Rev. A. S. Rankilor, seconding, said there could not be such an amount of rubbish as to necessitate Sunday scavenging. Mr. Cooper thought the work could be done on Saturday evening, but that was not in the contract. On a division it was decided to defer the matter pending a report on the whole question of scavenging from the Rottingdean Parish Council.

ROADS AND MATERIALS.

Anglesey C.C.—The county surveyor, Mr. W. E. Jones, reported at the meeting on Tuesday that he had inspected the coastal main road, extending approximately 24 miles from Menai Bridge to Llanrhyddlad, and the council decided to take over the road as from April 1st.

Cumberland C.C.—In his annual report as county surveyor and bridgemaster Mr. Wm. Finch recommends the purchase of two additional steam rollers. He also expresses the opinion that a considerable saving would be effected by the purchase of at least one petrol-driven wagon for the haulage of stone from the railway stations.—The Road Board have granted £7,000 to the council on condition that the council carry out the whole of the works in the estimate of the Highways Committee, including the erection of a new bridge at Metal Bridge. With regard to the proposed new bridge, the Highways Committee recommend the council to build a ferro-concrete bridge, with necessary diversion of the road, at an estimated cost of £16,000.

Cornwall C.C.—The county surveyor, Mr. A. E. Brookes, has presented to the Highways Committee a report with reference to a proposed scheme of maining and dismaining, in which he states that in answer to the circular letter and schedule which were forwarded by the clerk of the county council to the various rural and urban councils setting out the proposals of the Main Roads Committee, the following councils had replied requesting that he should inspect their roads, confer with them or their surveyors, and afterwards submit detailed conditions of maining in each case: Liskeard, Camelford, Stratton, West Penwith, Redruth, Truro (Rural) and Madron and Paul (Urban). He proposed, with the committee's approval, to inspect all these roads during the summer months, and to supply the councils with the necessary information, and this the committee have approved.

Enniskillen R.D.C.—It is proposed to construct a new road from Belcoo to Derrygonnelly, at an estimated cost of £2,400.

Huddersfield T.C.—The Road Board have promised a grant of £10,000, spread over a period of five years, towards the road improvement scheme, which is estimated to cost £55,944.

Kensington B.C.—The tender of the Improved Wood Pavement Company, Limited, has been accepted for 23,770 sq. yds. of creosoted deal paving.

Lancaster T.C.—The council on Wednesday adopted a scheme for the improvement of the south approach to the town, according to the plan approved by the county council, and to which the county council are prepared to contribute £60 a year for twenty years.

Lewisham B.C.—It is recommended by the Works Committee that the tender of Messrs. J. Mowlem & Co., Limited, at £1,398, be accepted for kerbing in part of Bromley-road, and the tender of the Atlas Stone Company, Limited, at 3s. 7d. per yard super., be accepted for paving the footways.

Linlithgowshire C.C.—In the course of his annual report to the Linlithgow District Committee the road surveyor, Mr. J. D. Lapham, states: "It is now generally admitted that much of the failure of bituminous macadam road construction was directly due to the lack of knowledge of the properties of tar and its variabilities in character and composition. I have given much thought and consideration to this matter, and I am of opinion that it would be advisable to emerge, as it were, from the aqueous to the bituminous method of constructing certain roads within this division of the county. I am desirous of getting a better result for the sum of money expended without increasing the present expenditure." The chairman of the committee said he would be inclined to spend a good deal more rather than go back to the old system. Mr. J. G. Dudgeon, Dalmeny, said no doubt the new system was more economical, but, speaking on behalf of the farmers, who were the principal ratepayers in the district, the new system of road making was too slippery for horses.

Monaghan R.D.C.—Borrowing powers have been sanctioned for £9,000, to be expended in road improvement works during the next three years.

New Ross (Co. Wexford) R.D.C.—The county surveyor has intimated that he has obtained a free grant of £400 for a road from the Road Board. A resolution has been passed asking for another free grant for the rectification of dangerous curves on another leading road.

Notts C.C.—With a grant of £13,500 from the Road Board for the completion of the Fosse road, it has been decided to tarmac the road wholly or partially throughout its entire length.

Woolwich B.C.—The tender of the Improved Wood Paving Company, Limited, has been accepted for over 16,000 yds. of creosoted deal paving on the Eltham-road, mainly for the purposes of the motor omnibus traffic.

SEWERAGE AND SEWAGE DISPOSAL.

Branston R.D.C.—A committee has been appointed to consider a scheme for the sewerage of the Swallowbeck district.

Cannock R.D.C.—The scheme of sewerage for Great Wyrley has been amended, and an application is to be made to the Local Government Board for sanction to borrow £4,925.

Cockermouth R.D.C.—The Local Government Board having written stating that they could not consent to any further delay over the Rosthwaite sewerage, the council have forwarded to that authority the plans prepared in 1910, and which, it was explained, had been held back chiefly on the ground of expense. The estimated cost of the proposed scheme is £620.

Epsom R.D.C.—For the extension—in accordance with the plans of Mr. W. T. Wooldridge, the surveyor—of the sewer in Sandy-lane seven tenders have been submitted, and that of Messrs. Kavanagh & Co., amounting to £211, has been accepted.

Royston (Herts) U.D.C.—The tender of Mr. C. F. Ball, of Letchworth, at £1,630, has been accepted for works in connection with the extension of the sewers.

St. Ives T.C.—The tender of Messrs. Daniel & Son, at £237, has been recommended for acceptance for sewerage work in Bullan's-lane.

Swansea T.C.—The tender of Mr. Griffith Davies, at £726, has been accepted for the sewerage of Oakfield-road, Bryn Mill.

Whitby R.D.C.—A scheme for the sewerage of Sleights has been referred to a committee. It was stated that the proposal involves 2¼ miles of pipes, the purchase of 2¾ acres of land, and an expenditure of £4,828.

WATER, GAS, AND ELECTRICITY.

Birmingham T.C.—The amount to be handed over for the relief of the rates from the profits of the gas undertaking last year is approximately £74,000.

Blackpool T.C.—The profits from the gas undertaking for the year just ended amount to £12,219, after paying £11,257 for interest and sinking fund, and placing £2,114 to reserve fund.

Colwyn Bay U.D.C.—The profit from the gas undertaking last year was £2,132, and the electricity undertaking earned a nett profit of £1,319.

Moffat T.C.—Mr. W. E. Townsend has received instructions to prepare a scheme of electric lighting for the town. The proposal is to obtain the power from the Well Burn. There would be ample power to provide a sufficient supply of electricity for the burgh. It is stated that the proprietors of the land adjacent are willing to deal generously with the council in the matter of land for the construction of the lade.

St. Pancras B.C.—The council have instructed Mr. Percy Griffith, M.INST.C.E., M.I.MECH.E., to prepare specification and form of tender for providing new pumping machinery at the Prince of Wales'-road public baths to replace the air-lift plant at present in use. This alteration will, in the first place, be carried out at No. 1 boring, and if the results are satisfactory a similar alteration will be made at No. 2 boring.

Scarborough T.C.—The Water Committee recommend the purchase of improved plant for the Irton waterworks, at an estimated cost of £8,500.

Church Stretton U.D.C.—A loan of £21,000 is to be taken up for the purchase of the undertaking of the Church Stretton Water Company. The money will be borrowed for forty-five years at 4 per cent interest. It has also been agreed to borrow a further sum, not exceeding £2,000, in respect of costs, &c., connected with the transfer of the undertaking.

MISCELLANEOUS.

Blackpool T.C.—The tramway undertaking earned a nett profit of £18,000 last year.

Rugby R.D.C.—The surveyor, Mr. T. W. Willard, at the meeting on Monday last, reported that the men

employed on the steam-roller work asked for an increase in wages from 18s. to 20s. per week, the reason being that they had to be away from home and thus pay for lodgings or travel in their own time considerable distances on bicycles provided and maintained at their own expense. The men on the sewage farms also made a similar application. The requests were considered to be reasonable, and after some discussion the council agreed to accede to them.

PERSONAL.

Mr. C. H. Waithman, surveyor to the Cleethorpes Urban District Council, has been voted an increased salary of £50 a year.

Mr. Robert Moir, of the Carrick district of Ayrshire, has been appointed county road surveyor to the Mid-Lothian County Council.

Mr. W. M. B. Smale, assistant surveyor to the St. Thomas (Devon) Rural District Council, has resigned, having obtained an appointment in Cornwall.

Mr. A. Burton, borough surveyor of Stoke-on-Trent, was among those who were presented to the King and Queen upon their recent visit to the Pottery districts.

Mr. James Eadie, a graduate of Glasgow University, has been appointed clerk of works of the public technical school to be built at Toronto at a cost of £280,000.

Mr. A. E. Brookes, county surveyor of Cornwall, has made application for the use of a motor-car, and the Highways Committee recommend the council to accede to the request.

Mr. Chas. A. Howard, surveyor to the Glanford Brigg Rural District Council, has had his salary increased by £20 per annum, various tributes to his efficiency being at the same time paid by members of the council.

Mr. Frank Staley, senior engineering assistant to the borough and water engineer of Bedford, was recently, as announced in our issue of the 18th ult., appointed to the position of junior engineer assistant under the Road Board. Mr. Staley, who served his

Mr. Frank Staley.

articles with Mr. R. Read, the city surveyor and water engineer, was engaged under the City of Gloucester from 1905-8, and before going to Bedford served for a little over a year as engineering assistant under the Stoke Newington Borough Council. He is an associate member of the Institution of Municipal and County Engineers, and a member of the Royal Sanitary Institute.

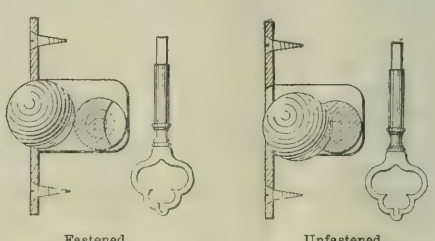
Mr. W. J. Fletcher, whose death, we regret to state, has taken place at Wimborne at the age of seventy-one, was for some forty years surveyor to the Dorset County Council. An enthusiastic Freemason, he was the second oldest past-master of the local lodge, and was provincial senior warden in 1888. In his professional capacity he designed many county buildings, and in his leisure he was devoted to education and music.

Mr. F. Chapman Clemesha, of Regina, the senior member of the firm of Clemesha & Portnall, the successful architects in the competition for a design for Winnipeg's £600,000 new city hall, was born at Preston, Lancashire, in 1876, and at an early age studied architecture in various European countries and in India. Later he went to the Argentine Republic. He went to Canada twelve years ago, and in Regina has designed some of the finest public and residential buildings. Thirty-nine plans were submitted in the competition for the Winnipeg city hall, the prize for the first being £1,000, which will be merged in the commission if the contract is awarded. The adjudicator was Mr. Leonard Stokes, president of the Royal Institute of British Architects.

WINDOW AND DOOR FASTENER.

A device which attracted not a little attention of visitors to The Surveyor section during the recent Building Exhibition at Olympia is Friend's patent ball lock, the principle of which is illustrated by the accompanying diagrams. By the use of this lock hung sashes can be securely fixed either shut or open as much as required in such a manner that they cannot be moved from outside. The invention is also applicable to doors and casements.

It is important to note that the lock, being made to be fixed between the frame and sash, is quite out of sight, and its simplicity is such that the Patent Ball Lock Company, of 27 Glasshouse-street, Piccadilly-circus, W., who have placed it on the market, claim that it is impossible for it to get out of order.



Fastened. Unfastened.

Friend's Patent Ball Lock.

Its application may be briefly described as follows: A narrow metal plate, in which are a number of circular holes, is screwed to the side of the frame. In the adjacent face of the sliding sash of the window there is fixed, by means of a screwed plate, a small metal box with a non-resisting steel ball and a metal cylinder hollowed on one side, which, actuated by a key from the room side of the sash, can be locked or opened at will. For doors we understand that the lock is best fixed into the frame of the door.

Mr. R. Kuhn, the manager of the company, informs us that since it was exhibited at Olympia many large wholesale firms have expressed their intention of taking up the device, while many architects and builders have been impressed by the ease with which it is fixed, and its reliability generally

New Water Supply at Braintree.—The new water supply which has been provided for the parish of Bocking by the Braintree Rural District Council was inaugurated recently. In the course of the proceedings, Mr. H. H. Sands, of the firm of Messrs. Sands & Walker, Nottingham, engineers, gave particulars of the scheme, which had cost altogether £9,300. The water is pumped from a bore 325 ft. deep, and 164 ft. into the chalk. The machinery, which is all in duplicate, is capable of raising 20,000 gallons per hour. The water is carried by a rising main to a tower on high ground about ¾ mile on the Halstead road, and stored in a tank with a capacity of 64,000 gallons, equal to two days' normal supply. There are 9 miles of mains, with hydrants, stop-valves and fire alarms. The engines are worked by gas generated on the premises, and the actual cost of raising 1,000 gallons is only ½d. The large area over which the mains are carried has greatly added to the cost, which works out at £2 15s. per head of the population.

INSTITUTION OF MUNICIPAL ENGINEERS.

VISIT TO ROCHESTER.

The members of the Southern and South-Eastern Districts of the Institution of Municipal Engineers paid a visit last Saturday to the Portland cement works of Messrs. Martin, Earle & Co., Limited, at Wickham, Rochester. Arriving at Strood Station at 10.30 a.m., they drove direct to the works, where they were met by Mr. James Watson, the manager.

The works are ideally situated on the North Bank of the river Medway, and the only requisites in connection with the manufacture of cement that have to be brought any distance are coal and coke. No difficulty is experienced in obtaining the raw material—chalk and clay. Immediately adjacent to the works are immense chalk pits, from which the company have extracted great quantities of material, and the visible supply is sufficient to keep the works going at their present capacity for many years to come. The company owns about 40 acres of freehold land with all the mining rights attached, while a lease is also held on an additional 60 acres with the right to remove all chalk. The company have secured as well the rights to large deposits of clay in the river Medway—not far from the works—of a character particularly suitable for cement manufacture. The wharf frontage is nearly ½ mile long, and railway sidings from the main line of the South-Eastern and Chatham Railway run right up to the cement stores. Under the guidance of Mr. Watson, every process in the manufacture and output of cement was viewed, including the cooperage where the firm make all their own barrels.

The members then drove back to Strood to inspect the building of the new Rochester Bridge, a work which has one particular point of interest, inasmuch as the existing structure is being used as a staging on which to build the new steel one. Mr. J. J. Robson, M.INST.C.E., engineer to the Bridge Wardens, gave a full and detailed explanation of the plans of the new structure, after which the works themselves were viewed.

FOR OTHER ADVERTISEMENTS

See End of Paper.

SETTLE RURAL DISTRICT COUNCIL.

APPOINTMENT OF ASSISTANT HIGHWAY SURVEYOR.

The above Council invite applications for the Office of Assistant Surveyor of Highways of the above District, which comprises 31 Townships and about 270 miles of Highways, of which 36 miles are Main Roads.

The person to be appointed will be required to reside in Settle, or in some other place within the District approved by the Council, and to devote the whole of his time to the services of the Council.

Applicants must have had previous experience in a Surveyor's Office.

The Salary will be £60 per annum inclusive of travelling expenses.

Applications, marked "Assistant Surveyor," with copy of testimonials, to be sent to me on or before 10 a.m. on Saturday, the 10th May next.

By Order of the Council,
T. E. PEARSON,
Clerk.

Council Offices,
Town Hall,
Settle.
April 30, 1913. (421)

REQUIRED by the Surveyor of a County Borough in the Midlands, a Junior Engineering Assistant, at a salary of £75 per annum. Candidates must have had experience in the general work of a Municipal Engineer's Office, and be neat and capable Draughtsmen. Applications, in own handwriting, stating age, qualifications and experience, accompanied by copies of three recent testimonials, and endorsed "Assistant," must be sent, not later than Wednesday, May 14th, to Box 1,247, office of THE SURVEYOR, 24 Bride-lane, Fleet-street, E.C. (422)

BOROUGH ENGINEER AND SURVEYOR, East Coast, has vacancy for Pupil.—Box 1,248, office of THE SURVEYOR, 24 Bride-lane, Fleet-street, E.C. (424)

THE URBAN DISTRICT COUNCIL OF ESHER AND THE DITTONS.

APPOINTMENT OF SURVEYOR'S CLERK.

The Council invite applications for the above appointment. Applicants must have had experience in a Municipal Surveyor's Department, including the keeping of all the various books, and be an efficient shorthand-typist.

The salary will commence at £65 per annum and rise (subject to satisfactory service) by annual increments of £10 to a maximum of £85.

Applications, in candidate's own handwriting, to be addressed to the undersigned, accompanied by copies of three testimonials, not later than 5 p.m. on the 9th proximo, endorsed "Surveyor's Clerk." Canvassing will disqualify.

JOHN T. METCALFE,
Clerk to the Council.

Council Offices,
Portsmouth-road,
Thames Ditton.
April 30, 1913. (423)

BOROUGH OF CHELMSFORD.

SURFACING OF STREETS WITH BITUMINOUS MACADAM.

The Town Council of Chelmsford invite Tenders for the Surfacing of Portions of High-street, Moulsham-street and Springfield-road, containing together an area of about 9,000 square yards, with Tar-macadam or other Bituminous Materials.

Form of Tender and Specification may be obtained upon application to the Borough Engineer, 16 London-road, Chelmsford, who will produce the plans for inspection and furnish any additional information which may be required.

Tenders, which must be on the form provided, enclosed in sealed envelopes (endorsed "Surfacing of High-street"), stating—

(1) The price per square yard at which the person tendering is prepared to carry out the work;
(2) The price per square yard per annum for which he is prepared to maintain the same in good order for a period of 5 years,

must be delivered at my office by not later than 4 p.m. on Thursday, 15th May.

The Contract will contain a clause providing that the Contractor shall, so far as regards any work executed in the Borough, pay rates of wages not less favourable than those commonly recognised by employers in the Borough for the particular class of work to be performed under the Contract.

The Council do not bind themselves to accept the lowest or any Tender, and reserve the right to divide the Contract between two or more persons, and to accept a part only of any Tender.

GEORGE MELVIN,
Town Clerk.

Municipal Offices,
Chelmsford.
May 1, 1913. (420)

URBAN DISTRICT COUNCIL OF ENFIELD.

PUBLIC STREET IMPROVEMENT WORKS.

The Council invite Tenders for providing and laying about 8,500 yds. super. of Artificial Stone Paving in Southbury-road.

Specifications can be seen, Form of Tender and all information obtained, on application to Mr. Richard Collins, the Council's Surveyor, any day except Saturday, between the hours of 9 a.m. and 5 p.m.

The Contractor will be required to observe trade union hours of labour, and to pay the recognised trade union rates of wages in force in the district where the work is to be executed.

Sealed Tenders, endorsed "Tender for Street Works," to be sent in to me not later than noon on Thursday, the 15th day of May, 1913.

The Tenders must be accompanied by a schedule of hours of labour and of prices and wages to be paid for different classes of work, which schedule will be embodied in the contract.

The Council do not bind themselves to accept the lowest or any Tender.

(By order)
T. W. SCOTT,
Clerk.

Public Offices, Enfield.
April 30, 1913. (425)

House Drainage Regulations on the Continent.*

By FRANK R. DURHAM, ASSOC.M.INST.C.E.

As the author's experience has been chiefly acquired in Germany, it will be to that country that the following remarks will, as a rule, refer. However, the same ideas which have influenced the drafting of the German regulations are to be found in other countries, such as Austria, Russia, &c. This being the case, the author has selected the following regulations as representing some of the existing conditions on the Continent: The standard regulations of the Verband deutscher Architekten und Ingenieur Verein (Associated German Architectural and Engineering Societies), those of Berlin, Cologne, Elberfeld, Frankfurt-on-the-Maine, Mannheim, Prague, Vienna, and Paris.

Historical.—Before commencing the subject of the paper, a few remarks on the history of the development of sewerage works in Germany are necessary in order to appreciate better the influences that have been at work in house drainage. The late Mr. William Lindley, M.INST.C.E., was the pioneer of systematic drainage on the Continent. His great works at Hamburg, constructed in the 'forties of the last century, prescribed that all house drains were to be of cast-iron with lead joints, air and water tight; all connections in the houses—private and public—properly trapped; all soil pipes carried above the roofs to insure perfect and ample ventilation. Frankfurt-on-Maine followed Hamburg in the 'sixties. These works have largely been carried out by Sir William H. Lindley, under whom the author had the pleasure of working for thirteen years. From that period onward the development of German sewerage works had taken place. The remarkable feature, and one of great importance, is that the cities and towns have been drained, almost without exception, on broadly-conceived plans embracing a large area of extension and providing for a remote future. For example, at Frankfurt-on-Maine, when the designs were originally drawn up in 1863, the population was considerably less than 100,000, and even now sewers are being carried out on the lines laid down at that time, although the population has increased to nearly 450,000. It may be here incidentally remarked that the development of rational town planning has to a great extent arisen out of this system of planning of the drainage of the towns and cities in Germany. It is an exception to find a development of a sewerage system as may be found in this country where a property may be privately developed and sewered quite regardless of a general and uniform system for the whole district and neighbouring districts concerned.

Now, to return to the subject of the paper, no comparisons will be made with English practice. The sequence of the standard regulations of the Associated German Architectural and Engineering Societies will be followed, and the more interesting regulations commented on.

Obligation to Connect to Sewers.—All houses, &c., must be connected where sewers exist. In certain cases unbuilt-on areas must be drained where surface water, &c., may give rise to a nuisance. At Frankfurt we find a regulation with regard to a private road with a sewer. Such a sewer will only be connected to the main drainage system provided any and all houses, &c., along the said road have access to the sewer. In Elberfeld there is a regulation providing that, should no sewer exist, the house drainage works should be so constructed that when a sewer is laid the connection can be made without any or much alteration.

Sewage Allowed to be Drained.—Special conditions are enforced for the separate system of drainage to prevent the access of rain or surface water to the dirty water system. A complete detailed list of all matters not allowed to be discharged into the sewers will be found in all regulations: for instance, all solid house refuse, inflammable or explosive substances, or fluids; all effluents with temperatures exceeding 85 deg. to 95 deg. Fahr.; all effluents likely to cause damage to the sewers or to endanger the lives of sewermen; all effluents likely to cause difficulties in the working of the system, such as condenser water in large quantities, &c., or likely to have a deleterious effect on the purification works. As regards temperature, the Berlin regulations provide for the contingency by requiring in certain cases a control thermometer to be installed.

Flushing.—Ample flushing must be provided. No sink or fixed basin, lavatory, gullies within buildings, &c., may be installed without a water tap.

CONNECTION OF SEVERAL PROPERTIES BY MEANS OF A COMMON DRAIN.

Connections of several properties or houses by means of a common house drain is prohibited in all regulations. Each house must have its own drain. Even if a complex of houses, such as large tenement buildings, is afterwards divided into one or more separate house properties, each division must then have its separate main drain. The only exception occurs when the configuration of the land makes it unavoidable, and then a permanent easement must be arranged for and officially recorded.

Removal of Old Works.—After completion of the new house drainage works, the old cesspits, &c., must be removed. The latter may not be emptied into the sewer system.

Inspection and Control.—All work must receive the sanction of the municipal authorities. For this purpose nearly every city or large town has a special department dealing with house drainage. The officials have free entrance and full powers of control for the examination of work executed, and also of the maintenance and working of the house drainage system. Usually notice is served prior to such a visitation.

Contractor Permits.—Contractors have to give an undertaking to carry out the works in accordance with the regulations. At Frankfurt the Municipality records a list of suitable contractors. Contractors in default may be struck off the list, and a new contractor must be approved of by the municipality.

Data Supplied by the Municipalities.—Position and level of the nearest benchmark. All German and most Continental towns have their own surveys with benchmarks based on the Government surveys. Position and level of the junction piece or pipe. The level of any water level that may affect the drainage, such as river flood level, storm-water levels in the sewers, &c. These data must be repeated on the plans.

Plans.—All plans must be in duplicate, and on imperishable material. These plans are separate from those required for new buildings, as they are examined in the engineers' and not in the architects' offices. All plans must be of uniform size, the dimensions being multiples of the standard foolscap 21 by 33 cm. (about 8½ in. by 13 in.), a most important regulation for the methodical system of filing of records. Scales for situations must be 1: 500, 1: 1,000, or 1: 2,000, according to the size of the object to be drained. For details—1: 100, 1: 200, 1: 500. In sections heights 1: 100 reduced to ordnance datum, the datum line on the plan being figure to a round number, such as 50, 100, 250, &c. For important details, 1: 10. The plans must contain all details, and the colours are standardised to indicate the various materials used, green being reserved for the approbation of the plans. All levels and gradients of the main drain and its side branches must be recorded. All alterations occurring during construction must be recorded, and substantial differences must be recorded on new plans to be submitted to the municipal authorities. Plans must be signed by the house owner and the contractor.

Inspection During Construction.—No work may be covered in without inspection, and one day's notice must be given.

Testing.—All necessary plant must be supplied by the house owner. A water test to street level is usually made for the ground drains, and smoke tests for the fall pipes, &c.

Certificate.—After completion and satisfactory construction a permit or certificate is given. The municipalities undertake no responsibility for the work or its proper working. Defects and alterations must be notified.

DETAILS OF CONSTRUCTION.

Junction Blocks or Pipes.—Invariably, throughout all the sewerage systems in Germany, junction blocks or pipes are provided at the time of the construction of sewers for every house and for every plot of land, whether built on or not. These connections are provided at such points where the best drainage can be

* Paper read before the Institute of Sanitary Engineers at a meeting held on the 21st ult., Mr. H. Percy Boulnois, M.INST.C.E., President, in the chair.

effected. At Frankfurt no house drain connections are allowed to be made between December 1st and March 1st; Elberfeld from November 15th to March 15th. These regulations refer to climatic conditions of the Continental winter. As a rule, the actual connection to the sewer is carried out by the municipality at the cost of the house owner, and for that purpose a schedule of costs is often attached to the regulations. Sometimes the whole of the drain below public property is laid by the officials. This is a safeguard against bad workmanship at the sewer. In Paris the main connection to the sewers is of interest, owing to its special character. The connection to the sewer must be made in a branch egg-shaped culvert of the following dimensions: 6 ft. high by 3 ft. wide, with an invert radius of 20 in. This culvert must be prolonged to the basement of the house and ventilated. It is closed at the sewer end with a blind wall of 1 ft. in thickness, a vertical wall on the house side, and profiled to the sewer cross-section on the sewer side. This wall carries a plate with the numbers, &c., of the house connection. In the case of houses with a lesser rentable value than £200, the connection may be made by means of a cast-iron pipe with leaded joints, laid with a gradient of 1: 30. Rain water connections are treated in the same way. These branch sewers are carried out by the municipality, and paid for by the house owners.

Drains Below Ground.—The drains must be laid in straight lines and along the shortest way. Changes of direction must be made with bends, and junctions must have an angle of 60 degrees. The pipes should be laid, if possible, parallel to the walls. The terminal bend to take a fall or soil pipe must be a duck's foot bend.

Soil or Fall Pipes.—All soil or fall pipes must be carried down vertically *inside* the buildings; slanting or sloping directions must be avoided. All changes of wall thickness causing a set-back must be negotiated by means of swan-neck bends. All pipes, especially the sockets, must be accessible and fastened to the wall securely. The junctions must have angles of 60 degrees. Berlin admits 70 degrees. At Frankfurt there is a recommendation that the fall pipes should be in the neighbourhood of the kitchen chimney. No rain water is allowed to be drained into these internal pipes. The climatic conditions of the Continent—Germany and eastwards—demand that the pipes should be carried inside the houses. This has the further great advantage of assisting the ventilation of the house drainage.

Rain-water Pipes.—The rain pipes must be carried vertically down *outside* the buildings. The gathering together of several pipes into one pipe above ground must be avoided if possible. No dirty water or sewerage may be drained through these pipes. Small rain pipes from balconies are sometimes allowed to be connected to the internal fall pipes, but in these cases they must be trapped.

Gradients.—The available difference of level between the sewer junction and the farthest point must be distributed as a uniform gradient. A change of gradient is permitted when the through gradient exceeds 1: 25. Sharper gradients than 1: 3 are not permissible for underground drains. The change of gradient must not be under the street level. As a rule, 1: 30 is recommended, and 1: 50 in exceptional cases. Gradients of 1: 100 or 1: 200, to be found in Berlin, require special flushing arrangements.

Size of Pipes.—The size of pipes are laid down in the standards of 1903, and are, in English measure, approximately: 1-in., 1¼-in., 1½-in., 2-in., 2¾-in., 4-in., 5-in., 6-in., and 8-in. The main drain should be 6 in. Other dimensions may only be allowed by special permission; single sinks, lavatories, &c., 2 in.; groups of sinks, lavatories, baths, &c., 2¾ in.; water-closets, 4 in., sometimes 5 in.; 1½-in. pipes may sometimes be permitted for single small sinks, &c., and pipes of smaller dimensions only as overflows.

Standardisation of House Drainage Pipes and Regulations.—The house drainage pipes were standardised in Germany and Austria in 1903, after five years' work. A committee of the Associated Architectural and Engineering Societies, previously mentioned, carried out this work in conference with their Governments and manufacturers. . . . Prior to the standardisation there were 50-60 types for straight pipes and 200-250 specials. They are now reduced to 30 and about 150. The Standard Regulations were completed in 1907, and are gradually forming the basis of all house drainage regulations; for instance, they have been adopted at Berlin, Frankfurt, &c., and adapted to the local requirements.

MATERIALS TO BE USED.

Main Drains. Main drains must be made of cast-iron with lead joints within the buildings, and to a distance of 4½ ft. to 5 ft. beyond the outside of the walls, or when running parallel to a wall on the outside of the building within this danger zone of 4½ ft. to 5 ft. The rest of the drain may be of stoneware pipes with asphalt jointing.* This method of jointing is not, so far as the author knows, used extensively in this country, but is now used almost universally throughout the whole of Germany, Austria, &c. Other methods of jointing cement and clay are in most cases prohibited. At Prague, however, an exception has been made, and stoneware pipes are allowed, though not recommended, under cellar floors, provided a cover of at least 2½ ft. is obtainable; preference is to be given to iron pipes with leaded joints. This relaxation, the author believes, was made on account of financial burdens, in the case of the poorer class of properties, arising out of the complete resewering of the city.

Soil Pipes and Fall Pipes.—All soil and fall pipes must be of cast-iron; pipes of lesser diameter than 2¾ in. may be of lead of standard sizes.

Rain Pipes.—Rain pipes may be made of zinc, copper, or iron; the lower section, however, up to a height of 6 ft. 6 in. above ground, must be of iron of the standard types.

Vent Pipes.—Ventilation pipes should be of cast-iron with lead jointing; brazed airtight copper pipes, lead pipes, or weldless wrought-iron or steel pipes may be used. Zinc piping of standard gauge may only be used outside, and then from 6 ft. 6 in. above the ground level.

VENTILATION.

Great importance is attached to ventilation, for the following reason: No intercepting traps are permitted, and all drains, with one or two exceptions, are in direct communication with the sewers. A disconnecting system, not only impossible from climatic conditions, but considered also a serious impediment to thorough ventilation of the sewerage system, is not practised on the Continent. It must therefore be remembered that all soil pipes, fall pipes, and rain pipes form active elements in the ventilation of both the house drainage systems and of the main sewerage systems.

Main Drains.—If the main drain does not end in a ventilation stack, the authorities may insist on one.

Soil Pipes and Fall Pipes.—All fall or soil pipes must be carried up with their full cross section 20 in. above the roof, or at least 3 ft. above any window, and about 10 ft. laterally from such a window. A collection of fall pipes into one ventilating stack is not permissible. Pipes unavoidably slanting or sloping must have a rise of 1: 5. The upper end of the ventilation pipes must be 2 in. larger in diameter, and the capping should allow free area of twice the cross section of the pipe. No connections may be made with chimneys, factory chimneys excepted. Secondary ventilation is allowed, but its avoidance is recommended wherever possible by a suitable arrangement of the fall pipes. Elberfeld regulations contain the provision of secondary ventilation in the case where closets are more than 4 ft. away from their respective soil pipes.

Rain-water Pipes.—All rain-water pipes must be carried up as ventilating pipes, and only in cases where the head is close to a window must the rain pipe be disconnected over a deep-seated gully or trapped. Where it is considered necessary, special traps for intercepting slates, tiles, &c., must be provided, but so constructed that there is unimpeded ventilation.

Protection against Frost.—All main drains must be laid below the frost level, and all water levels in the gully traps must likewise be free from danger of frost. According to the various districts of the Continent, the earth cover required varies from 2¾ ft. to 5 ft. All pipes in rooms exposed to frost danger must be protected. All fall pipes, sinks, lavatories, should be preferably placed on *inside* walls.

Inspection Chambers, Manholes, &c.—At a distance of 6 ft. 6 in. behind the building line, and when the gradient is less than 1: 50, an airtight inspection box must be provided. If this box is below ground level, it must be placed in a rectangular manhole,

* After a stoneware pipe is truly laid and two strands of well-tarred gasket have been caulked home, a thick roll of canvas, or a rubber or cork ring, smeared with clay, leaving a small opening at the top for pouring in the hot melted asphalt, is pressed hard up against the annular socket space, so as to prevent any outside leakage. The asphalt is then poured in as in making a lead joint. This method is simple, and the result is a perfectly flexible pipe line, not liable to fracture through settlement of the ground.

3 ft. 3 in. by 2½ ft., or in a circular one of 3 ft. diameter. These inspection boxes, wherever necessary, must, as a rule, be placed not less than 50 yds. apart. If no manhole is provided, the position of the inspection box must be marked in a conspicuous manner. Manholes with open invert are only allowed in exceptional cases.

Fat Traps. Fat traps of recognised design must be installed wherever necessary; in small establishments they should be of cast iron, otherwise in masonry work. Proper ventilation must be provided.

Gullies. The gullies for outdoor courts and yards, as well as those within the premises, must be trapped and have iron grids with the bars spaced at ⅞ in. clearway between the bars. The water level in the trap must be below the frost level. In cases of separate systems careful arrangements must be made to keep the dirty-water gullies separate from the rain-water gullies. All gullies inside houses must be of cast-iron. In Elberfeld and other cities all gullies within 4½ ft. of the houses must be of cast-iron.

Protection against Floods. All gullies, closets, &c., which lie below the flood level, as indicated by the municipal authorities, are forbidden. The drainage of low-lying rooms, cellars, &c., must be provided with arrangements to prevent back water entering from the sewers. These should consist of self-acting flap-valves and a hand stop valve. Permission for such drainage is only given on the responsibility of the house owner. These levels, where necessary, must be carefully recorded on the plans. If the rooms lie below the possible drainage level, other methods of evacuation must be resorted to, where necessary.

Sinks, Scullery, Wash-ups, &c. All sinks, wash-ups, &c., must have *fixed* grids, the holes not to exceed ⅜ in. in diameter, and fitted with traps. The larger types may have cross grids, but the square perforations must not exceed ⅞ in. Only non-porous material may be used. All boarded surrounds to the sinks, &c., are not recommended, and in many towns prohibited. The water pipe supply must be at least 1 in. above the rim of such sinks, &c.

Closets.—Closets must stand free without being boarded in, the outlet of the basins must be visible, and not more than 2¾ in. in diameter. All flap valves and similar mechanical contrivances to hold water in the basin, and automatic flushing devices, are prohibited. The trap must be connected as closely as possible to the soil pipe. The flushing tank must be at least 6 ft. above the floor, and contain 2 to 3 gallons. In Prag the flushing pipe must have 1¼ in. in diameter, and the closet basin contain a depth of water of at least 1½ in. The seat must be hinged, and suitable arrangements made to prevent the flush pipe being damaged. Lavatories for large establishments, or factories, or barracks, must be planned and receive special sanction. The basin must be of porcelain or enamelled cast-iron. Urinals are subject to much the same conditions, and both fittings must only be placed in rooms ventilated and free from frost.

Baths.—Baths must be fitted with *fixed* grids of the same dimensions as those for sinks, &c. Boarded surrounds are not recommended.

Overflows.—Overflows from cisterns, &c., may not be connected to the drainage system. Overflows from washing basins, urinals, and baths must be connected above the respective traps of these fittings.

Refrigerators, Fish Tanks, &c.—Refrigerators, fish tanks, &c., may not be connected to the house drainage system.

Traps.—No intercepting traps are allowed, except in the case of certain rain-water pipes, as already described. The traps must be of the U or S form; all dip traps, bell traps, D traps, &c., are prohibited. Traps may be of iron, lead, copper, brass, earthenware, but in no case of zinc. The diameters are: Small wash basins, &c., and urinals, 1¼ in.; large wash basins, &c., and urinals, 1½ in.; sinks, wash-ups, baths, &c., 2 in.; closets, 2¾-4 in.; floor gullies, 2-2¾-4; outdoor gullies, 4-5 in. In the case of fittings requiring grids the sum of the area of the outlet perforations must not exceed one-half of the area of the trap opening. The depth of water seal in the closet must be 2 in., and in the case of gullies 4 in., and in all other fittings 2½ in. All traps must be able to be cleansed. The cleaning holes must be fitted with caps and not with screwed plugs. The traps should be fitted close under the object in question, and connected with the respective fall pipe by as short a length of pipe as possible, to avoid the necessity of secondary ventilation. All gullies, sinks, &c., when out of use for long periods of time *e.g.*, when a house is empty must be closed up.

Materials.—The materials are all standardised, and must be of the best quality. Most towns have a sample museum where approved fittings may be seen. The lead pipes, for instance, must have the following weights: 1 in., 2 lb. per foot; 1⅜ in., 2·8 lb. per foot; 1⅞ in., 4·2 lb. per foot; 2 in., 5·2 lb. per foot. Zinc must be about 3/64 in. thick. The cast-iron pipes must have the following thicknesses: 2 in., $\frac{13}{64}$; 2¾ in., $\frac{13}{64}$; 4 in., $\frac{13}{64}$; 5 in., $\frac{13}{64}$; 6 in., $\frac{13}{64}$; 8 in., $\frac{30}{64}$ inches. The stoneware pipes are likewise standardised as regards length, thickness, and socket dimensions.

Construction of Work.—All pipes above ground must be accessible. Pipes are not allowed to be boxed in or hidden in slots in brickwork, &c. Concrete is, as a rule, not recommended for laying pipes below ground, and the pipes should be laid in good soil or sand, so that the pipe line may retain its flexibility. Only lead jointing is to be used for iron pipes, and asphalt for stoneware pipes. The house owner is responsible for the proper condition and working of his drainage system.

Besides these regulations, there are certain additional regulations referring to the transition during the period of the gradual development of the drainage of towns, in which certain parts of an existing house drainage may be retained, although it may be not quite in accordance with the newer regulations. But these permissions to retain may be annulled as and when the authorities deem it necessary.

In the cases of small towns with a number of poor house owners, the towns have made exceptional regulations as regards the house drainage in order to attain quickly a satisfactory state of affairs. The municipal authorities have lent money on the security of the property in order to provide the necessary capital. In these instances the work has been carried on by the municipal authorities, and the loans are repaid at the time of the collections of rates, taxes, &c. Relief of heavy expenditure has thus been obtained by the house owner, and the town has the satisfaction of getting quicker to the better state of sanitation.

There are several other regulations which the author has not touched on, but all the more important ones have been cursorily reviewed.

In summing up the position of house drainage, more especially in Germany, the chief characteristics may be said to be the following: (*a*) Standardisation of regulations and materials; (*b*) departmental system of approval of plans and work; (*c*) direct connection to the sewer system without main, intercepting traps; (*d*) ventilation of the sewerage and drainage system; (*e*) necessity of placing all pipes within the houses, with the exception of rain pipes.

New County Hall for Westmeath.—The new Westmeath county hall, built at Mullingar, from designs by Mr. A. E. Joyce, the county surveyor, was opened recently. The contractor was Mr. James Wynne, of Dundalk, and the building cost over £5,000.

Business Announcement.—Messrs. William Muirhead & Co., Limited, have removed from their late address, 35 Queen Victoria-street, London, E.C., to more suitable offices at 41 Parliament-street, Westminster, S.W. The telephone number is Gerrard 6420. Mr. R. Macdonald Wilson, ASSOC.M.INST.C.E., has joined the board of directors. The company has been given an extension of the contract by the Southend-on-Sea Corporation for the improvements of Sea Front and Esplanade, to the amount of £30,700.

Bradford's Improvement Scheme.—A Committee of the House of Lords, presided over by the Marquis of Bristol, have under consideration a Parliamentary Bill promoted by the Corporation of Bradford, seeking sanction for an important improvement scheme. The corporation are taking advantage of the contemplated carrying by the Midland Railway Company of their main line to Scotland right through the centre of the Yorkshire city to make a wholesale clearance of dilapidated property and narrow streets, and to substitute for them buildings and thoroughfares worthy of the headquarters of the woolstapling industry. The original estimate of the cost of carrying out the improvement was £1,138,550, but this has been somewhat reduced by the exclusion of certain properties orginally comprised in the plans. The first witness called was the city engineer and surveyor, Mr. W. H. S. Dawson, whose evidence was explanatory of the details of the scheme.

INSTITUTION OF CIVIL ENGINEERS.

AWARDS FOR PAPERS.

The council of the Institution of Civil Engineers have made the following awards for papers read and discussed during the session 1912-1913:

A Telford Gold Medal to Mr. Murdoch Macdonald, C.M.G. (Cairo); a George Stephenson Gold Medal to Mr. G. D. Snyder (New York); a Watt Gold Medal to Mr. H. A. Humphrey (London); Telford Premiums to Messrs. C. W. Methven (Durban), B. Hall Blyth, junr. (Edinburgh), C. J. Crotts (Durban), Frank Grove (Canton), B. T. B. Boothby (Hankow) and Francis Carnegie (Enfield Lock); and the Manby Premium to Captain C. E. P. Sankey, R.E. (London).

The award for papers published in the "Proceedings" without discussion and for students' papers will be announced later.

INSTITUTION OF MUNICIPAL AND COUNTY ENGINEERS.

President—Mr. R. J. Thomas, M.Inst.C.E., County Surveyor, Buckinghamshire.

VISIT TO AMSTERDAM AND THE HAGUE, WHITSUNTIDE.

A party of members of the Institution of Municipal and County Engineers will leave London next Thursday evening on a visit to Amsterdam, The Hague, and other parts of Holland.

Ladies have been especially invited to attend this meeting.

Programme.

Thursday, May 8th.

Leave London (Liverpool-street Station) at 8.30 p.m. via Harwich and the Hook of Holland.

Friday, May 9th.

Arrive at the Hook of Holland and proceed to Amsterdam, arriving 7.30 a.m.

12.45 p.m.—Carriages leave hotels.

1.0 p.m.—Reception at the town hall by the Burgomaster and Aldermen of Amsterdam.

1.25 p.m.—Leave the town hall.

1.30 p.m.—Arrive at the Exchange, where the party will be received by Mr. A. W. Boss, the Director of Public Works, who, with Mr. F. S. Jacob and Mr. P. Lohr, city engineers, will give a description of the drainage and sewerage works of Amsterdam, dealing with the special difficulties presented by the peculiarities of the country, after which the members will proceed to visit works in course of construction (*inter alia*), the sewage pumping stations (electric pumps), the old and new sewage outfall works, tramway garage.

6.0 p.m.—Return to hotels.

Saturday, May 10th.

9.30 a.m.—Carriages leave hotels; visit to the city gasworks. These works are described as an installation with apparatus up-to-date in every detail.

1.0 p.m.—Return to hotels.
Afternoon free.

Sunday, May 11th.

10.0 a.m.—Leave Amsterdam for trip to the Isle of Marken.

6.0 p.m.—Arrive back at Amsterdam.

Monday, May 12th.

Leave Amsterdam by train for Leyden. Take steamer trip; luncheon on board.
Return by train from Leyden to Amsterdam.

Tuesday, May 13th.

8.40 a.m. Leave Amsterdam for The Hague. On arrival at The Hague, leave luggage at the Consigne. Carriages will convey the party to the abattoirs (these are considered the best example in Europe). The members will be received by Mr. Lindo, the Director of Public Works.

1.0 p.m.—Luncheon.
The members will visit "The House in the Wood," by kind permission.
Drive to Scheveningen.
Dinner at hotel.

10.47 p.m.—Leave The Hague for the Hook of Holland.

11.50 p.m.—Leave the Hook of Holland by steamer for Harwich.

Wednesday, May 14th.

Arrive Harwich and proceed by train to London, reaching Liverpool-street Station at 8.0 a.m.

SCOTTISH MEETING.

A meeting of the institution will be held in the Scottish District at Dundee on June 6th and 7th.

ANNUAL MEETING.

The annual meeting of the institution will be held from July 16th-19th.

Thomas Cole,
92 Victoria-street, S.W. *Secretary.*

INSTITUTION OF MUNICIPAL ENGINEERS.

President Mr. Frank Latham, M.Inst.C.E.I., F.S.E., Borough Engineer and Surveyor, Penzance

NORTH-WESTERN DISTRICT.

A meeting will be held at the Town Hall, Salford, on Saturday, May 31st, at 2 o'clock, when a paper on "Sludge Disposal," by Dr. J. Grossmann, M.A., F.I.C., will be presented for discussion.

J. W. Gleave,
Hon. District Secretary.

Heywood.

A visit will be paid to the works of the Metropolitan Water Board at Chingford and Enfield Lock on May 14th.

Programme.

12.30 p.m. Meet at Liverpool-street Station (G.E.R.), Continental booking hall.

12.50 p.m. Train leaves for Enfield Lock Station.

1.26 p.m. Train arrives at Enfield Lock Station.

1.35 p.m. Leave Enfield Lock Station and proceed to pumping station.

1.50 p.m.—Arrive at pumping station and proceed thence on round of visits kindly arranged by Mr. William B. Bryan, M.Inst.C.E., chief engineer to the Metropolitan Water Board.

COUNCIL MEETING.

A council meeting will be held at the Town Hall, Salford, on Saturday, May 31st, at 4 o'clock.

B. Wyand,
39 Victoria-street, S.W. *Secretary.*

LOWER THAMES VALLEY DISTRICT SURVEYORS' ASSOCIATION.

The annual dinner of the above association will be held to-morrow (Saturday) at the Flower-pot Hotel, Sunbury-on-Thames, at 6.40 p.m. Previous to the dinner visits of inspection will be made to Sunbury-on-Thames sewage works, Staines joint hospital at Ashford, Ashford Boys' Home, and the gauging chamber on the Staines Workhouse joint drainage.

It is hoped that members will make a very special endeavour to attend both the visits and the dinner to support the president on this occasion.

At the last ordinary meeting of the session, which was well attended, Mr. F. Sadler, engineer and surveyor to the Acton Urban District Council, read a paper entitled "The Control and Inspection of New Buildings." In the paper Mr. Sadler raised several important matters dealing with buildings, and suggested greater uniformity of by-laws, the construction of steel-framed buildings, the greater supervision in setting of fire places, and means of escape in case of fire. A long discussion ensued, the majority of those present taking part.

The association were pleased to be able to welcome again Mr. S. H. Chambers, who unfortunately has been unable to attend for some time, owing to ill-health.

The nominations for officers for the next session were taken, when the following gentlemen were nominated:—

President: Mr. R. Wilds, Walton.

Vice-president: Mr. James W. Croxford, Brentford.

Hon secretary and hon. treasurer: Mr. R. H. Jeffes, Malden and Coombes.

Hon. auditors: Mr. C. H. Cooper, Wimbledon, and Mr. J. S. Crawshaw, Weybridge.

The association also had under consideration the question of new houses built on old roads, with regard to the setting back and widening of the roadway as properties are erected.

ROYAL SANITARY INSTITUTE.

A sessional meeting of the institute will be held at 90 Buckingham Palace-road on Tuesday, May 20th, when an address on "London's Water Supply" will be delivered by Mr. E. B. Barnard, J.P., M.A., chairman, Metropolitan Water Board. The chair will be taken at 7.30 p.m. by Sir Alexander Binnie, M.INST.C.E., vice-president.

On Wednesday, May 21st, a visit will be made to the King George Reservoir, Chingford.

PROVINCIAL SESSIONAL MEETING, CHESTER.

A sessional meeting will be held on Friday, May 30th, in the council chamber, Town Hall, Chester, at 7.30 p.m., when a discussion will take place on "Modern Methods for the Purification and Softening of Water Supplies," to be opened by Mr. Joseph Parry, M.INST.C.E., chief engineer, Liverpool Corporation waterworks.

It is hoped that the following, among others, will take part in the discussion: Prof. J. Radcliffe, M.SC.TECH., Municipal School of Technology, Manchester; Messrs. W. Matthews Jones, M.INST.C.M.E., city surveyor and engineer, Chester; Coard S. Pain, ASSOC.INST.C.E., F.S.I., Liverpool; F. Storr, M.INST.W.E., water engineer, Wrexham, and James Wilding, F.S.I., surveyor and water engineer, Runcorn.

The chair will be taken by Mr. H. Percy Boulnois, M.INST.C.E., chairman of council of the institute.

On the following morning an inspection will be made of the Permutit softening plant at the West Cheshire Water Company's pumping station (Hooton). The visit to these works, it is expected, will take about two hours and a-half. Chester waterworks will be visited in the afternoon.

E. WHITE WALLIS,
Secretary.

APPOINTMENTS VACANT.

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ASSISTANT SANITARY INSPECTOR.—May 3rd.—Perth County Council. £85 per annum and travelling expenses.—Mr. R. McNicoll, county and chief district sanitary inspector, county buildings, Perth.

SURVEYOR'S SHORTHAND CLERK.—May 5th.—Beckenham Urban District Council. £75—£115.—Mr. F. Stevens, clerk.

CLERK OF WORKS.—May 5th.—Wombwell Urban District Council. £3 3s. per week.—Mr. P. M. Walker, clerk.

ASSISTANT WATER INSPECTOR.—May 5th.—Corporation of Coventry. £2 5s. per week.—Mr. J. E. Swindlehurst, water engineer.

CLERK OF WORKS.—May 5th.—Rawtenstall Town Council. 35s. per week.—Town Clerk.

CLERK OF WORKS.—May 6th.—Axbridge Rural District Council. £2 2s. per week.—Mr. J. Knight Dunster, surveyor.

SANITARY INSPECTORS.—May 6th. Finsbury Borough Council. £130—£180.—Mr. G. W. Preston, town clerk.

INSPECTOR OF NUISANCES.—May 7th.—West Lancashire Rural District Council. £90—£100 per annum.—Mr. A. Dickinson, clerk, 2 Railway-road, Ormskirk.

ARCHITECTURAL ASSISTANT. May 7th.—Corporation of Huddersfield.—Waterworks Manager, Town Hall.

SURVEYOR.—May 9th.—Liskeard Rural District Council. £120 per annum.—Mr. A. De Castro Glubb, clerk.

CLERK OF WORKS.—May 9th.—Mayo County Council. £3 3s. per week.—Mr. J. T. Kelly, secretary, Court House, Castlebar.

BOROUGH SURVEYOR'S ASSISTANT.—May 10th.—Paddington Borough Council. £180—£250.—Mr. Arthur W. J. Russel, town clerk.

CLERK OF WORKS.—May 12th.—Corporation of Aberavon. £2 10s. per week.—Mr. M. Tennant, town clerk.

SECOND-CLASS CLERK (Surveyor's Department).—May 13th.—Leyton Urban District Council. £120—£150.—Mr. E. H. Essex, engineer and surveyor.

BUILDINGS SURVEYOR.—May 13th.—Shoeburyness Urban District Council. £125 per annum.—Mr. F. Gregson, clerk.

SURVEYOR'S CLERICAL ASSISTANT.—May 13th.—Cirencester Urban District Council.—Surveyor, Council Chambers, Cirencester.

WATER ENGINEER.—May 15th.—Corporation of Sheffield.—Mr. R. M. Prescott, town clerk.

ASSISTANT ENGINEER.—May 15th.—Board of Trustees for the Improvement of Calcutta. 500—700 rupees per mensem.—Mr. C. H. Bompas, chairman, 5 Clive-street, Calcutta.

SECOND ASSISTANT SURVEYOR.—May 15th.—Heston and Isleworth Urban District Council. £90—£120.—Mr. J. G. Carey, engineer and surveyor, Council House, Hounslow.

INSPECTOR OF NUISANCES.—May 19th.—Corporation of Chester. £150—£200.—Mr. J. H. Dickson, town clerk.

SEWAGE FARM MANAGER.—May 21st.—Wanstead Urban District Council. £120—£150.—Mr. Bruce Blewitt, clerk.

BUILDING ENGINEER.—June 6th—25th.—Municipality of Rangoon. 600—800 rupees per mensem.—The Secretary, Rangoon Municipality, Burmah. The latest date of despatch of letters to reach Rangoon by June 25th is by the Indian mail leaving London on June 6th.

MUNICIPAL COMPETITIONS OPEN.

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BLACKBURN.—June 2nd.—Schemes for street improvements, for the corporation.—Borough Surveyor.

DEVONPORT.—June 14th.—Designs for municipal buildings and a guildhall, for the Corporation of Devonport. Premiums of £350, £150, and £100 are offered. The assessor is Mr. Ernest Newton, A.R.A., F.R.I.B.A.—Mr. R. J. Fittall, town clerk.

NEWCASTLE-ON-TYNE.—June 14th.—Designs for proposed public baths, for the corporation. Mr. H. W. Wills, F.R.I.B.A., has been appointed as assessor.—Mr. A. M. Oliver, town clerk.

NEWCASTLE-ON-TYNE.—June 19th.—Designs for laying out portion of the Walker estate, for the corporation. Premiums £50, £30, and £20.—Mr. A. M. Oliver, town clerk.

CHEPPING WYCOMBE.—September 1st.—Designs for town-planning the borough and an area immediately adjoining. Premiums, £25, £10 and £5.—Mr. T. J. Rushbrooke, borough surveyor, High Wycombe.

MONAGHAN.—No date.—Plans for the conversion of barracks into working-class dwellings, for the urban district council. Cost of scheme not to exceed £4,000.—Mr. P. MacGeough, town clerk.

MUNICIPAL CONTRACTS OPEN.

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Buildings.

DUNMOW.—May 5th.—For rebuilding a bridge, for the rural district council.—Mr. A. E. Floyd, clerk.

SHEFFIELD.—May 5th.—For excavating, erecting retaining wall, and extending reservoir, for the corporation.—Mr. S. E. Fedden, electric supply department, Commercial-street, Sheffield.

WOLSTANTON.—May 5th.—For the erection of an infants' school, for the urban district council.—Mr. W. F. Slater, architect, Overhouse Chambers, Burslem.

SELBY.—May 5th.—For the erection of forty-two cottages, for the urban district council.—Mr. Bruce Gray, Council Chambers, Selby.

BILLERICAY.—May 5th.—For the construction of a timber bridge, for the rural district council.—Mr. R. J. W. Layland, surveyor.

SLEAFORD.—May 5th.—For the construction of a culvert, for the rural district council.—Mr. F. H. Ellis, surveyor.

HAVERFORDWEST.—May 5th.—For the construction of a foundation for a gasholder tank and construction of a pipe-pit, for the corporation. Mr. R. T. P. Williams, town clerk.

STAFFS.—May 6th.—For the enlargement of a school, for the Education Committee.—Mr. G. Balfour, Director of Education, County Education Offices, Stafford.

NOTTINGHAM.—May 7th.—For the erection of a school, for the Education Committee.—Mr. A. Dale, city architect, Guildhall.

BIRMINGHAM.—May 7th.—For the erection of public baths, for the Baths Committee.—Messrs. Jones & Sons, Warwick Chambers, Corporation-street.

BOSMERE AND CLAYDON.—May 8th.—For the erection of a hospital observation ward, for the rural district council.—Mr. H. Smith, building surveyor, High-street, Needham Market.

COVENTRY.—May 8th.—For the erection of tramway car sheds, for the corporation.—Mr. T. R. Whitehead, general manager, Priestley's Bridge Depot, Coventry.

GOSPORT.—May 8th.—For the construction of a waiting-room, for the urban district council.—The Surveyor.

MALDENS AND COOMBE.—May 10th.—For the erection of boundary walls, piers and gates, and the construction of surface-water drainage, for the urban district council.—Mr. R. H. Jeffes, engineer and surveyor

ALSAGER.—May 13th.—For the boring and lining of Borehole No. 2 in connection with the Oak Farm water supply, for the urban district council.—Mr. John J. Nelson, clerk.

LEIGH (Lancs).—May 13th.—For the erection of 100 cottages, for the corporation.—Borough Engineer.

LARNE.—May 14th.—For building twelve single and three double labourers' cottages, for the rural district council.—Mr. S. M. Wallace, clerk.

HASLINGDEN.—May 14th.—For the erection of a school, for the corporation.—Mr. J. S. Green, borough surveyor.

RHONDDA.—May 16th.—For the erection of a school, for the urban district council.—Mr. Jacob Rees, architect, Hillside Cottage, Pentre.

ST. HELENS.—May 19th.—For alterations at a school, for the Education Committee.—Messrs. Biram & Fletcher, architects, George-street.

CHESTERFIELD.—May 24th.—For the erection of a filter-house and valve-house, for the rural district council.—Mr. G. Frith, waterworks engineer.

SOUTHMOLTON.—May 24th.—For the erection of ten cottages, for the corporation.—Mr. H. C. E. Rayner, borough surveyor.

HERTS.—June 27th.—For the construction of a bridge, for the county council.—Mr. Urban A. Smith, Hatfield.

FARNHAM.—For the erection of seven pairs of cottages, for the urban district council.—Mr. A. J. Stedman, architect, South-street, Farnham.

Iron and Steel.

LANGHOLM.—May 8th.—For an extension of the water supply, for the corporation.—Mr. G. Irving Bell, town clerk.

MACROOM.—May 9th.—For the construction of an additional water supply, for the urban district council.—Mr. T. Murphy, clerk.

BELFAST.—May 19th.—For the supply of a circulating water pump, for the corporation.—Mr. T. W. Bloxham, city electrical engineer, East Bridge-street.

BIDEFORD.—May 21st.—For the extension of the water supply, for the corporation.—Mr. W. O. Seldon, town clerk.

Roads.

SWANSEA.—May 5th.—For the completion of a new road, for the rural district council.—Mr. Edward Harris, clerk.

SELBY.—May 5th.—For the making of streets and sewers, for the urban district council.—Mr. Bruce Gray, Council Chambers, Selby.

SOUTHAMPTON.—May 5th.—For work of road widening and surface-water drainage, for the county council.—Mr. H. Barber, clerk, The Castle, Winchester.

HORNCASTLE.—May 5th.—For the supply of road material, for the urban district council.—Mr. R. W. Clitheroe, clerk.

SOUTH BANK IN NORMANBY.—May 5th.—For flagging and kerbing, for the urban district council. —Mr. C. W. Cockersoll, surveyor.

CHORLEY.—May 5th.—For work of road reconstruction, for the rural district council. Mr. John Whitfield, clerk of highways.

HORNCASTLE.—May 5th.—For the supply of X granite, XX granite, X slag, and slag chips, for the urban district council.—Mr. F. Weeber, surveyor.

ALDERSHOT.—May 6th.—For making up a roadway, for the urban district council.—Mr. W. E. Foster, clerk.

LONDON.—May 6th.—For the supply of 447,000 Jarrah wood and 508,000 creosoted deal paving blocks, and 2,450 tons of Guernsey granite paving setts, for the county council.—Sir Laurence Gomme, clerk.

HAZEL GROVE.—May 6th.—For laying rock asphalt, tar-macadam, paving, kerbing, flagging, and surface-water drainage, for the urban district council. —Mr. F. Pidgeon, clerk.

CRAMLINGTON.—May 6th.—For the supply of broken whinstone, whin chippings, slag chippings, and tarred slag, for the urban district council.—Mr. W. I. Coulson, surveyor.

LONDON.—May 6th.—For the supply of 2,450 tons of Guernsey granite paving setts, for the county council.—Sir Laurence Gomme, clerk.

CAERLEON.—May 6th.—For kerbing, channelling and paving, for the urban district council.—Mr. T. R. P. Herbert, clerk, Skinner-street, Newport, Mon.

PORTSLADE.—May 6th.—For the supply of screened dug flints, granite chippings and coarse sand, for the urban district council.—Mr. A. T. Allen, surveyor.

CHISWICK.—May 7th.—For work of making up, for the urban district council.—Mr. Ernest F. Collins, clerk.

HORNSEY.—May 7th.—For work of making good, for the corporation.—Mr. E. J. Lovegrove, borough engineer and surveyor, Municipal Offices, Highgate.

HAMMERSMITH.—May 7th.—For paving the macadam carriageways of Wood-lane (part of) and Scrubbs-lane with creosoted deal blocks, and making up Ducane-road between Wood-lane and H.M. Prison, for the borough council.—Mr. Leslie Gordon, town clerk.

BRIGHOUSE.—May 7th.—For paving work with granite setts, for the corporation.—Mr. S. S. Heywood, borough engineer and surveyor.

ORSETT.—May 7th.—For the supply of broken granite or basalt and broken Kentish ragstone, for the rural district council.—Mr. F. T. Johnson, highway surveyor, 2 Orsett-road, Grays.

LEICESTERSHIRE.—May 7th.—For work of road improvement, for the county council.—Mr. S. Perkins Pick, county engineer, Leicester.

DEVON.—May 8th.—For the haulage of 15,000 tons of material and steam rolling, for the county council. —Mr. E. Stead, county surveyor, No. 1 Division, The Square, Barnstaple.

HOLYWOOD (co. Down).—May 8th.—For the supply of road metal and screenings and steam rolling, for the urban district council.—Mr. D. Bell, clerk.

CORK.—May 8th.—For laying Durax pavement, for the corporation.—Mr. F. W. McCarthy, town clerk.

SKIPTON.—May 8th.—For the supply of 400 tons of tarred limestone, for the urban district council.— Mr. Richard Wilson, clerk.

BRECON.—May 8th.—For taking up and relaying kerb, channel and paving, for the corporation.—Mr. H. L. Griffiths, borough surveyor.

CLEETHORPES.—May 10th.—For making up a road, for the urban district council.—Mr. C. H. Waithman, surveyor.

LEEDS.—May 12th.—For making up tar-macadam carriageways and asphalt footways, for the corporation. —City Engineer.

FAREHAM.—May 12th.—For the supply of granite, basalt, or other hard stone, for the rural district council.—Mr. J. F. Whitear, surveyor.

ROCHDALE.—May 14th.—For work of making up and sewering, for the corporation.—Borough Surveyor.

ENFIELD.—May 14th.—For the making up of private streets, for the urban district council.—Mr. T. W. Scott, clerk.

HOUNSLOW.—May 15th.—For making up two streets, for the urban district council.—Mr. J. G. Carey, engineer and surveyor.

WOODHALL SPA.—May 21st.—For laying limestone tar-macadam and tar painting and spraying, for the urban district council.—Mr. E. E. T. Bolton, surveyor.

NORTH WALSHAM.—May 24th.—For the supply of granite, tar, and road rolling, for the urban district council.—Mr. J. W. Stevens, surveyor.

RUNCORN.—May 26th.—For laying tar-macadam in certain streets, for the rural district council.—Mr. R. Garnett, Sankey-street, Warrington.

Sanitary.

BURNLEY.—May 3rd.—For laying earthenware pipe sewers, manholes, concrete tanks and percolating filters, for the rural district council.—Mr. H. Pritchard, engineer, 18 Nicholas-street, Burnley.

BULKINGTON.—May 3rd.—For the removal of night soil, for the urban district council.—Mr. H. W. Wilson, surveyor, Attleborough, Nuneaton.

BIRMINGHAM.—May 5th.—For the construction of a sewer, for the corporation.—Mr. Henry E. Stilgoe, city engineer and surveyor.

RUNCORN.—May 5th.—For laying stoneware and cast-iron pipe sewers, and supplying pipes and specials, for the rural district council.—Mr. George F. Ashton, clerk.

STROUD.—May 6th.—For the construction of sewage disposal works, for the urban district council.—Mr. G. P. Milnes, 7 Rowcroft, Stroud.

POOLE.—May 6th.—For emptying cesspools, for the rural district council.—Mr. G. H. Seymour, inspector, Longfleet, Poole.

NORTH BROMSGROVE.—May 6th. For the construction of about 2,477 lin. yds. of 6-in. diameter stoneware pipe sewers, with manholes, flushing chambers and ventilating columns, for the urban district council.—Mr. Robert Green, engineer, 37 Waterloo-street, Birmingham.

EPSOM.—May 6th.—For the construction of engine house, bacteria beds, storm-water tanks, and other works, for the rural district council.—Mr. Arthur R. Cotton, clerk.

STALYBRIDGE AND DUKINFIELD.—May 7th.—For the supply and erection of No. 5 rotary sewage sprinklers, with all necessary pipes and fittings, for the Joint Sewerage Board.—Messrs. J. P. Wilkinson & Son, 301 Cathedral-street, Manchester.

CAMBORNE.—May 7th.—For works in connection with sewerage and sewage disposal, for the urban district council.—Mr. C. V. Thomas, clerk.

READING.—May 8th.—For erecting a public convenience, for the corporation.—Mr. John Bowen, borough engineer and surveyor.

DENTON.—May 14th.—For the construction of brick and stoneware pipe sewers, for the urban district council.—Mr. William Richards, clerk.

OLDHAM.—May 14th.—For the supply of six rotating sprinklers, for the corporation.—Mr. J. H. Hallsworth, town clerk.

WOOD GREEN.—May 14th.—For constructing surface-water sewer, culverting, and laying out gardens, for the urban district council.—Engineer and Surveyor.

ASHBY-DE-LA-ZOUCH.—May 15th.—For constructing sewers, manholes and ventilators, for the rural district council.—Mr. T. L. McCarthy, Central Chambers, Coalville, near Leicester.

LYMINGTON.—May 17th.—For the construction of main intercepting sewers, manholes, storm overflows, screen chamber, and alterations and additions to the existing low-level pumping station, for the corporation.—Mr. J. Davis Rawlins, town clerk.

LYMINGTON.—May 17th.—For repairing and cleansing the sewer outfall, for the corporation.—Mr. J. Davis Rawlins, town clerk.

LYTHAM.—May 19th.—For the construction of a 30-in. concrete and cast-iron main sewers and storage culvert, for the urban district council.—Mr. A. J. Price, engineer and surveyor.

BINGLEY.—May 19th.—For alterations and additions to sewage disposal works, for the urban district council.—Mr. H. Bottomley, engineer and surveyor.

HARPENDEN.—May 23rd.—For the provision and erection of sewage pumping machinery, for the urban district council.—Mr. Chas. S. Tuckey, clerk.

FINCHLEY.—May 26th.—For the construction of 456 yds. of 15-in. and 9-in. surface-water sewer, part under highways and part under open land, for the urban district council.—Mr. E. H. Lister, clerk.

WHITSTABLE.—May 27th.—For the construction of a brick and concrete tank sewer, concrete tube sewers, stoneware pipe sewers, cast-iron rising main, cast-iron outfall sewer, manholes, pumping station, tanks, cottage, and percolating filters, for the urban district council.—Messrs. Strachan & Weekes, civil engineers, 9 Victoria-street, Westminster.

OAKENGATES.—May 31st.—For sewerage and sewage disposal works extension, for the urban district council.—Messrs. Berrington, Son & Watney, Prudential Chambers, Lichfield-street, Wolverhampton.

Stores.

WALSALL.—May 5th.—For the supply of shovels, forks, picks, bowls, brooms, sewer grates, manhole covers, sewer pipes, paving, and road materials, for the corporation.—Borough Surveyor.

ARBROATH.—May 8th.—For the supply of fireclay pipes, bricks, lime and cement, pavement, kerb and channel, whin and granite setts, cast-iron pipes, and other castings, brass and lead work, coals, oils and waste, for the corporation.—Mr. P. C. Smith, burgh engineer.

RICHMOND (Surrey).—May 12th.—For the supply of coal, lime, sulphate of alumina and green copperas and filter cloth, for the Main Sewerage Board.—Mr. W. Fairlie, engineer, West Hall-road, Kew Gardens.

Miscellaneous.

CONWAY.—May 3rd.—For cleaning, scraping and painting the suspension bridge, for the corporation.—Mr. Hugh Parry, town clerk.

RICHMOND.—May 12th.—For the supply of Welsh steam coal, house coal, Buxton lime, grey lime, sulphate of alumina and green copperas, and filter cloth, for the Sewerage Board.—Mr. J. Leslie G. Powell, clerk.

TORONTO.—May 28th.—For the removal of 35,000,000 cub. yds. of material by hydraulic dredging, for the Toronto Harbour Commissioners.—Mr. E. L. Cousins, chief engineer.

TENDERS FOR MUNICIPAL WORKS OR SUPPLIES.

The Editor invites the co-operation of Surveyor *readers with a view to making the information given under this head as complete and accurate as possible.*

* Accepted. † Recommended for acceptance.

BILSTON.—For the construction of about 600 yds. of pipe sewers and manholes in various streets, for the urban district council.—Mr. Vincent Turner, engineer and surveyor:—

F. Williamson & Co., Pleasant-street, Birmingham ..	£747
Martin & Element, Woodlands-street, Smethwick	727
Jukes & Co., Burnt Tree, Tipton	716
G. P. Trentham, Limited, Victoria-square, Birmingham	622
Childs & Withers, Elm-street, Bilston	616
R. Holloway, Bilston-road, Wolverhampton *	581

CHICHESTER.—The following tenders for stone have been accepted by the corporation:—

British Macadams, Limited.—Penmaenmawr Granite 13s. 2d. per ton, chippings 12s. 8d. per ton.
Teign Valley Company.—Teign Valley granite 11s. 10d., 11s. 4d.
Clee Hill Granite Company.—Clee Hill granite 13s. 4d., 10s. 4d.
Abdon Clee Stone Quarry Company.—Clee Hill granite 13s. 4d., 10s. 4d.
Roadstone Supply Company.—Moons Hill basalt 11s. 6d., 8s. 6d.
Tytherington Stone Company.—Cement paving slabs 4s. per yard super.
Wainwright & Co.—Cement paving slabs 3s. 11½d.
Empire Stone Company.—Cement paving slabs 3s. 8d.

GRIMSBY.—Repair of boundary wall at Old Cemetery, for the corporation.—Mr. H. Gilbert Whyatt, borough engineer and surveyor:—

C. W. Dixon, Grimsby	£368
Borrill & Cheesman, Grimsby	345
Swaby & Walsham, Grimsby	328
W. Gilbert, Grimsby	328
H. & C. Thompson, Grimsby	318
G. H. Hipkin, Grimsby	309
E. Smith, Grimsby	299
Emerson Brothers, Grimsby	286
Edwards & Raynor, Grimsby	284
Taylor & Richardson, Grimsby *	218

KENSINGTON.—For paving work with creosoted deal blocks, for the borough council.—Borough engineer and surveyor:—

Elgin-crescent, from Ladbroke-grove to Clarendon-road.—J. Mowlem & Co., Limited, 7s. 11d. per square yard; Acme Flooring and Paving Company (1904), Limited, 7s. 7½d. per square yard; W. Griffiths & Co., Limited, 7s. 6d. per square yard; Improved Wood Pavement Company, Limited, 7s. 5½d. per square yard.

Kensington-road, from Holland-lane to the Borough Boundary at Addison-road Bridge.—J. Mowlem & Co., Limited, 9s. 1d. per square yard; Acme Flooring and Paving Company (1904), Limited, 8s. 11½d. per square yard; W. Griffiths & Co., Limited, 8s. 11½d. per square yard; Improved Wood Pavement Company, Limited, 8s. 10½d. per square yard.*

Palace-gate and Gloucester-road, from Kensington-road to Canning-place, and from Elvaston-place to Cromwell-road.—J. Mowlem & Co., Limited, 8s. 6d. per square yard; Acme Flooring and Paving Company (1904), Limited, 8s. 4d. per square yard; W. Griffiths & Co., Limited, 8s. 4½d. per square yard; Improved Wood Pavement Company, Limited, 8s. 2d. per square yard.*

King-street, from Kensington High-street to Ball-street.—J. Mowlem & Co., Limited, 7s. 10d. per square yard; Acme Flooring and Paving Company (1904), Limited, 7s. 6½d. per square yard; W. Griffiths & Co., Limited, 7s. 7½d. per square yard; Improved Wood Pavement Company, Limited, 7s. 6½d. per square yard.*

Young-street, from Kensington High-street to Ball-street.—J. Mowlem & Co., Limited, 7s. 10d. per square yard; Acme Flooring and Paving Company (1904), Limited, 7s. 6½d. per square yard; W. Griffiths & Co., Limited, 7s. 7½d. per square yard; Improved Wood Pavement Company, Limited, 7s. 6½d. per square yard.*

Richmond-road, from Warwick-road to Eardley-crescent.—J. Mowlem & Co., Limited, 9s. 2d. per square yard; Acme Flooring and Paving Company (1904), Limited, 9s. per square yard; W. Griffiths & Co., Limited, 9s. per square yard; Improved Wood Pavement Company, Limited, 8s. 10½d. per square yard.

MAIDENHEAD.—For laying 10,000 yds. of tarred footway, for the corporation.—Mr. P. Johns, borough surveyor:—

Wellerman Brothers, Hyde	£6,562
W. Shepherd & Sons, Rochdale	5,385
Permanite, Limited, Finsbury Park	5,299
J. Coales & Son, Bristol	5,147
H. P. Palmer, Bromley	5,143
J. Wainwright & Co., Shepton Mallet	5,033
R. Free, Maidenhead	4,876
North of England Asphalt Company, Manchester	4,851
S. Gibbons, Maidenhead	4,823
La Brea Asphalte Company, Birmingham	4,708

NORTHMOOR.—For supplying and fixing two wrought-iron Lancashire boilers, for the drainage board:

Arnott & Co., Limited, Bridgwater	£1,275
Davey Paxman & Co., Bridgwater	1,160
Holdworth & Sons, Limited, Bridgwater	1,120
H. & T. Danks, Limited, Bridgwater	995
F. Danks, Limited, Bridgwater	930
T. Hill & Sons, Bridgwater	905
W. & F. Wills, Limited, Bridgwater*	875

NORTHUMBERLAND.—For the erection of a school, for the education committee:—
R. & A. P. Tait, Seaton Delaval, £2,852.

ST. IVES.—For the construction of sewers and manholes at Bullen's-lane, for the corporation.—Mr. S. Palmer, borough surveyor:—

Nicholas & Son, Penzance	£601
J. Noall, St. Ives	506
J. Jenkin, St. Ives	483
A. Carkeek, Redruth	293
J. Daniel, St. Ives	237

WILTS.—For (1) carrying out alterations and additions, and (2) installation of electric lighting at the Old Swindon County Police Station, for the county council. Mr. J. G. Powell, county surveyor:—

ALTERATIONS AND ADDITIONS.

Cripps & Franklin, Marlborough	£1,698
A. F. Colbourne, Swindon	1,690
Tydeman Brothers, Swindon	1,665
C. R. Palmer, Rodbourne Cheney	1,436
J. G. Norman, Swindon†	990

ELECTRIC LIGHTING.

Kendall & Son, Bath	£330
Bays & Co., Swindon	242
Wilkins & Brother, Limited, Liverpool	204
L. Howell, Swindon	187
Hutton Brothers, Swindon	186
Lott & Sons, Swindon†	149

MEETINGS.

Secretaries and others will oblige by sending early notice of dates of forthcoming meetings.

MAY.

2-3.—Institution of Municipal and County Engineers: Meeting at Newcastle-on-Tyne.

3.—Institution of Municipal and County Engineers: Bohemian Concert, Holborn Restaurant. 8 p.m.

5.—Society of Engineers: Mr. C. A. Battiscombe on "Tidal Waters as a Source of Power." Institution of Electrical Engineers. 7.30 p.m.

8-14.—Institution of Municipal and County Engineers: Visit to Amsterdam and the Hague.

9-16.—Society of Architects: Visit to Paris.

14.—Institution of Municipal Engineers: Visit to Metropolitan Water Board's Works at Chingford and Enfield Lock.

14-18.—Royal Institute of Public Health: Annual Congress in Paris.

19.—Institute of Sanitary Engineers: Dr. H. R. Kenwood on "Micro-Organisms and Public Health." 8 p.m.

20.—Royal Sanitary Institute: Mr. E. B. Barnard, chairman, Metropolitan Water Board, on "London's Water Supply." 90 Buckingham Palace-road, S.W. 7.30 p.m.

21.—Royal Sanitary Institute: Visit to King George Reservoir, Chingford.

21-24.—Institution of Electrical Engineers: Meeting in Paris.

23-24.—Surveyors' Institution: Meeting at Oxford.

24.—Association of Managers of Sewage Disposal Works: Meeting at Kettering.

30-31.—Royal Sanitary Institute: Sessional Meeting at Chester. Discussion on "Modern Methods for the Purification and Softening of Water Supplies." Visit to Waterworks.

31.—Institution of Municipal Engineers: Meeting at Salford: Dr. J. Grossmann on "Sludge Disposal."

JUNE.

4.—Royal Institute of British Architects: Annual Dinner, Whitehall Rooms

6-7.—Institution of Municipal and County Engineers: Meeting at Dundee.

23-28.—International Road Congress in London.

APPOINTMENTS OPEN.

WANTED—Engineering Assistant from 27 to 35 years of age, in Civil Engineer's Office in the North of England; must be a good draughtsman, with practical knowledge of sewerage or waterworks constructional details. At least 12 months' engagement to suitable person. Salary, from 3 to 3½ guineas per week. Applications, stating age and experience, giving references, and enclosing copies of 3 recent testimonials (which will not be returned), to be sent to Box 1,244, office of THE SURVEYOR, 24 Bride-lane, Fleet-street, E.C., not later than May 12th. (403)

HESTON AND ISLEWORTH URBAN DISTRICT COUNCIL.

SECOND ASSISTANT SURVEYOR.

The above Council are prepared to consider applications for the Appointment of Second Assistant in the Engineer's and Surveyor's Department. The person to be appointed must be a good Draughtsman and Surveyor, and possess practical knowledge of the work of a Municipal Engineer's Office. Preference will be given to candidates who hold the diploma of the Institution of Municipal and County Engineers, and who have had experience in the preparation of Plans, Specifications, Estimates and Quantities. Age not to exceed 28 years. Salary £90 per annum, rising, subject to satisfactory service, by annual increments of £10 to a maximum of £120.

Applications, on Forms to be obtained from Mr. J. G. Carey, ASSOC.M.INST.C.E., Engineer and Surveyor, Council House, Hounslow, together with copies of three recent testimonials, to be sent to the undersigned not later than noon on Thursday, the 15th day of May, 1913, endorsed "Second Assistant Surveyor."

Canvassing will be deemed a disqualification.

(By order)

H. J. BAKER,
Clerk to the Council.

Council House,
Hounslow.
April 26, 1913. (402)

TOWN SURVEYOR'S ASSISTANT.

CIRENCESTER.

A vacancy has arisen for a Clerical Assistant with some experience as a Draughtsman, in the Office of Town Surveyor.

Applications, from persons not exceeding 25 years of age, stating qualifications and salary required, to be sent to the Surveyor, Council Chambers, Cirencester, not later than the 13th May next. (410)

ARCHITECTURAL ASSISTANT.

HUDDERSFIELD CORPORATION WATERWORKS.

Required, temporarily, an Architectural Assistant to prepare Plans, Specifications, and take off Quantities for the Buildings, &c., necessary in connection with Mechanical Filtration Plants. He must also be able to make surveys and take levels. The appointment will probably extend over a period of 18 months if satisfactory, but can be determined at an earlier date on one month's notice being given by either side. Applicants must state age, salary required, previous experience, and also enclose copies of three recent testimonials. Applications must be sent to the Waterworks Manager, Town Hall, Huddersfield, endorsed "Architectural Assistant," not later than 9 a.m. on Wednesday, the 7th day of May, 1913. (411)

CITY OF SHEFFIELD.

WATER DEPARTMENT.

WATER ENGINEER.

CONSTRUCTION OF EWDEN VALLEY WORKS.

The Council invites applications for the appointment of Engineer to act in the construction of two Reservoirs to provide a daily yield of about 7½ million gallons. The Engineer to be responsible for preparation of plans and carrying out of the engineering part of work by administration. The works are to be constructed in the Ewden Valley, about 7 miles from Sheffield. Applicants to state age, qualifications, experience and salary required. The Gentleman appointed must, during the construction of the works, which are expected to occupy a period of 12 years or thereabouts, reside in the Valley or within a distance to be specified by the Water Committee. It is essential that applicants should have had extensive experience in the construction of gravitation waterworks. The council will, by their officers, control the administration of the works, and the Council reserves the right to consult such Engineering Experts from time to time as they may deem advisable. Canvassing will be a disqualification, but prints of applications and testimonials may be sent to Members of the Water Committee. Applications, on form to be obtained on request, to be sent to me endorsed "Water Engineer Application," not later than the 15th day of May, 1913.

R. M. PRESCOTT,
Town Clerk.

Town Hall,
Sheffield. (394)

LEYTON URBAN DISTRICT COUNCIL.

ENGINEER AND SURVEYOR'S DEPARTMENT.

APPOINTMENT OF SECOND-CLASS CLERK.

Applications are invited for appointment as Second-class Clerk in the Engineer and Surveyor's Department, at a commencing salary of £120 per annum, rising, subject to satisfactory service, by annual increments of £10 to a maximum of £150 per annum.

Candidates must be expert Shorthand-typists, not less than 25 years of age, thoroughly conversant with the routine of a Municipal Engineer's Office, accustomed to conducting correspondence, filing (card index system), and the keeping of records generally.

Applications, in candidate's own handwriting (upon forms to be obtained upon application to the Surveyor to the Council, Mr. E. H. Essex, ASSOC.M. INST.C.E., Town Hall, Leyton), accompanied by copies of three recent testimonials, must reach the office of the Surveyor not later than 1 p.m. on Tuesday, the 13th May, 1913.

The appointment will be made subject to the selected candidate passing a medical examination by the Council's Medical Officer of Health.

Canvassing members of the Council, either directly or indirectly, will disqualify.

(By order)
R. VINCENT,
Clerk to the Council.

Town Hall, Leyton.
April 30, 1913. (418)

AXBRIDGE RURAL DISTRICT COUNCIL.

The Axbridge Rural District Council invite applications for the Appointment of a Temporary Clerk of the Works in connection with the reconstruction and improvement of about five miles of road.

It is anticipated that the work will take about 12 months

Applicants must have a thorough knowledge of modern methods of road construction, be able to set out the work, and be prepared to keep the same hours as the workmen, whose time he shall check.

The salary will be at the rate of £2 2s. per week.

Applications, endorsed "Clerk of Works," stating age, qualifications and experience, and accompanied by not more than two recent testimonials (copies), to be sent to the undersigned on or before the 6th May, 1913.

J. KNIGHT DUNSTER,
Surveyor to the Council.

Surveyor's Office,
Winscombe,
Somerset. (393)

ENGINEER AND SURVEYOR, South of England, has vacancy for Pupil. Large sewerage scheme projected.—Box 1,238, office of THE SURVEYOR, 24 Bride-lane, Fleet-street, London, E.C. (366)

GENERAL ASSISTANT required in Office of Engineer and Surveyor to Urban District Council for between two and three months. Salary £2 10s. per week.—Apply, stating age and experience, to Box 1,243, office of THE SURVEYOR, 24 Bride-lane, Fleet-street, E.C. (395)

TEMPORARY ASSISTANT Wanted for about six to nine months. Must be good and expeditious Surveyor and Leveller, and neat and accurate Draughtsman. Salary 35s. per week.—Apply on or before 12th May, stating age and experience, and enclosing copies of not more than three testimonials, to D. M. Jenkins, Borough Engineer, Neath, South Wales. (414)

TENDERS WANTED.

HARPENDEN URBAN DISTRICT COUNCIL.

SEWERAGE AND SEWAGE DISPOSAL.

CONTRACT NO. 6.

The above Council invite Tenders for the Provision and Erection of Pumping Machinery comprising Oil or other suitable Engines, Dynamos, Pumps and Motors, and other incidental works at the new Sewage Disposal Works for the above District in accordance with the Specification prepared by their Engineer, Mr. A. P. I. Cotterell, M.INST.C.E., of 17 Old Queen-street, Westminster, and 28 Baldwin-street, Bristol.

Contractors are to submit their own designs in compliance with the terms of the Specification, copies of which, together with Forms of Tender, may be obtained from the Engineer at his Office, 17 Old Queen-street, Westminster, by intending Contractors on and after the 6th May on payment of the sum of £2 2s., which will be returned on receipt of a *bond-fide* Tender.

Tenders, on the forms provided, must be delivered to me under Seal, and endorsed "Tender for Harpenden Sewerage Contract No. 6," not later than Noon on Friday, the 23rd May next.

The Council do not bind themselves to accept the lowest or any Tender.

CHAS. S. TUCKEY,
Clerk to the Council.

High-street,
Harpenden.
April 30, 1913. (419)

URBAN DISTRICT COUNCIL OF ENFIELD.

TO CONTRACTORS.

The Council invite Tenders for making up the following Private Streets in their District—viz.,

Lawson-road, Enfield-highway.
Gordon-lane (part of), Enfield.

Plans and Specifications can be seen, Forms of Tender and all information obtained, on application to Mr. Richard Collins, the Council's Surveyor, at these Offices, any day (except Saturday) between the hours of 9 a.m. and 5 p.m.

The Contractor will be required to observe Trade Union hours of labour, and to pay the recognised Trade Union rates of wages in force in the district where the work is to be executed.

Separate Tenders for each road (on the form supplied only) to be sent in to me not later than noon on Wednesday, the 14th day of May, 1913, endorsed "Tender for——."

The Tenders must be accompanied by a schedule of hours of labour, and of prices and wages to be paid for different classes of work, which schedule will be embodied in the Contract.

The Council do not bind themselves to accept the lowest or any Tender.

(By order)
T. W. SCOTT,
Clerk.

Public Offices,
Enfield, Middlesex.
April 21, 1913. (417)

(Continued on p. xviii.)

The Surveyor

And Municipal and County Engineer.

Vol. XLIII. MAY 9, 1913. No. 1,112.

Minutes of Proceedings.

The Country Roads Board of Victoria: First Year's Work.

As may be seen from the summary which we prepared for our issue of April 25th, the Country Roads Act of Victoria has created what is practically a sub-department of the public works department, the active directions of which will, administratively and executively, be in the hands of a board of three persons, the Country Roads Board. Attention was drawn to the important fact that no limits are set to the aggregate mileage of roads which may eventually be declared to be main roads; nor is any limit assigned to their mileage per unit traversed, or to the proportion of main road mileage to total road mileage. Since, on the other hand, the roads to be controlled by the board are not yet in being, it will be possible for the board to devote its energies to the work of organisation and preparation without being hampered by a larger amount of executive work than could reasonably be undertaken in the earlier stages of its existence. In an article which is evidently based upon definite information, our contemporary the Melbourne *Age* indicates what will probably be the programme for the first year of the board's work. As a matter of urgency, a few roads will, it is expected, be proclaimed to be main roads, and attention will at once be given to these. The chief work of the year will, however, be that of organisation.

First, as regards the general scheme of road planning, this will be based upon the State roads map of Victoria, which will be completed as soon as possible, and upon the provisional schedule of main roads which will be made with the aid of this map. Having regard to the area and population of the State, and the manner in which that population is distributed, it is clear that it would not be good policy to leave the chief main routes to be formed, link by link, out of the main roads found necessary for the development of the various districts; and we find, accordingly, that it is intended to give separate consideration to the chief through routes of this State. The point is one of importance, for there are small states, such as Massachusetts, in which a scheme of principal through routes is unnecessary, simply because when the local main roads have been provided such through routes as are necessary are found to be in existence, whatever be the points between which one desires to travel. In California, on the other hand, it was found desirable to construct great main routes as one of the first items in the programme of main road construction. In Victoria the schedule of routes will, it is understood, be prepared in consultation with the defence department, in order that the State and national authorities may have one policy, in so far as the planning of main roads affects measures of national defence. It is expected that if works are desirable purely for military purposes the Australian Government will contribute liberally towards their cost. As regards other main roads, it may be noted that the schedule of these is expected to include roads connecting settlements with railway stations and with market towns. Testing work will be begun at once. Laboratory tests will be made at the engineering school of the university, the new equipment of which includes testing apparatus for road materials; and trial lengths of road crusts will be put down for test under service conditions. As regards these, use will be made of the reports issued by the Imperial Road Board. The resources of the State in road materials will be studied in conjunction with the shire engineers, and the supply of materials at given centres will be organised, with regard to the positions of quarries and other sources of supply, the means of transport and so forth. We are glad to learn that the co-operation of practically all the municipal engineers has already been secured, and that various official and unofficial organisations are prepared to assist the board in their work.

* * *

Registration of Surveyors.

The desirability of some form of statutory registration for the professions the exercise of which requires special knowledge and skill unless the public are to be misled or defrauded has been urged for a long time now in many well-informed quarters. The history of the "closed" professions is interesting in this connection, and the able *résumé* of what has been accomplished towards the suppression of the charlatan and quack by the members of the various callings whose domain he has invaded which is contained in the paper on "Trades Unionism as applied to

Professions," recently submitted to the Quantity Surveyors' Association by Mr. A. B. Howes, should certainly be read by all who are interested in this question. Some extracts from the paper will be found in last week's issue. It should be observed that even the "closed" professions are not all in the same position. Thus, all that the Medical Acts are able to secure is that the public can distinguish qualified from unqualified practitioners. The latter are not debarred from carrying on business so long as they are careful not to represent themselves as qualified or registered doctors. This is not the case with solicitors, however, who not only occupy a fiduciary position in relation to their clents, but are also officers of the Supreme Court of Judicature. Of those professions with which our readers are most closely identified, that of architecture has perhaps made the greatest progress towards some form of statutory recognition, a Bill providing for compulsory registration having been introduced into Parliament on at least one occasion. In the words of Professor Blomfield, the object is not to create a monopoly, but to put a stop to incompetence and to establish a reasonable level of accomplishment, and to see that that level is reached by those who undertake the very responsible work of an architect.

Mr. Howes fairly pointed out that there is a fundamental difference as regards the necessity for registration, from the point of view of the public, between the medical profession and such professions as those of architecture, surveying and engineering. In the first place every one needs medical assistance at times, whereas architects, surveyors and engineers are only employed by a limited section of the public. Moreover, urgency often necessitates recourse to the nearest doctor, but a man desirous of building a house does not take a cab to the nearest architect. Nevertheless, he ought to have some means of knowing that the man whom he is about to employ is reasonably capable of undertaking the work which it is proposed to entrust to him. Some form of registration would, therefore, appear to be highly desirable, and, if adopted, would bring in its train such ancillary advantages as effective discipline in regard to matters of professional conduct, regulation of fees, and a general improvement of professional tone and character. Although the observations of Mr. Howes were directed more particularly to the profession of quantity surveying, the position is much the same in regard to civil and municipal engineering, and the subject is one which merits the closest attention and the fullest discussion.

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Strood Water Supply.

A rather serious outbreak of enteric fever which occurred at Strood in August last having led the medical officer of health to the opinion that the water supply was the vehicle of infection, the matter was reported by that official to the Local Government Board. In consequence of this Dr. S. W. Wheaton, one of the board's medical inspectors, was instructed to visit the Borough of Rochester, within which Strood is situated, and to make inquiry as to the outbreak. Dr. Wheaton's report fully confirms the suspicion which attached to the water supply, and incidentally forms an object lesson in the dangers which are inseparable from antiquated means of sanitation by which excrement and other filth is permitted to soak away into the subsoil. It appears that Strood is supplied from waterworks which were purchased by the town council from the Strood Water Company in 1881. There is no systematic sewerage in the town, the drainage being usually received into cesspools or cesspits, the contents of which soak away into the subsoil. The Local Government Board have from time to time urged the town council to provide sewers for the borough, and have suggested combination with the adjoining Borough of Chatham for this purpose. Nothing appears to have been done so far, however, and Dr. Wheaton reports that in the neighbourhood of the well and connected with water-closets are numerous cesspools, the walls of which are formed by the bare chalk and the contents of which soak away into the chalk. There are also drains which are known to be defective. In the immediate neighbourhood of the well are four cesspools which have been made watertight by the town council, and which are said to be the only ones in Strood in this condition! One of these is on the waterworks site. In the vicinity of the waterworks, within a radius of 300 yds., there are at least fifty cesspools, the liquid contents of which soak away into the chalk. The report naturally concludes with a recommendation that the town council should seek for a fresh source of water supply which will not be liable to risk of pollution. It also appears, however, that they would be well advised to consider the sufficiency and safety of the present drainage arrangements. Economy in such matters generally proves to be an expensive policy in the long run.

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An Ontario Road Convention.

The Canadian road problem is in many respects similar to our own, except of course that while we have to deal with the improvement of old highways the main question in Canada is the construction of new roads to meet the rapidly-growing demands of a new community. From the circumstances of the case there is more justification in Canada than there would be here for an appeal to the Government for assistance, and it is interesting to know that this appeal found definite expression at the convention recently held of the Ontario Good Roads Association, at which papers were read by several Canadian road engineers, including Mr. W. A. McLean, chief engineer of highways for Ontario, Mr. E. R. Blackwell, county road engineer for Leeds, Mr. Charles Talbot, county engineer for Middlesex, and others. By these resolutions grants are asked for from the Government towards the maintenance as well as the construction of roads, and it is insisted that the Government's proportion towards the cost of building county roads should be increased from one-third to one-half. The taxation of automobiles according to weight and the proceeds thus obtained applied to the maintenance of roads is the subject of another resolution, together with a demand for the increase of the licence on motors; and it is likewise represented that the Government should make grants for the construction of county bridges over 100 ft. in length. That the Federal Government is quite alive to the importance of the road problem is gathered from an authoritative statement made at the convention that it is their intention to investigate the kinds of materials suitable for roads in various parts of Ontario, and further evidence with respect to the advance in constructional methods is afforded by Mr. McLean's paper, wherein it is stated that owing to the high cost of manual and horse labour attention is being given to the use of machinery for road-making. The interest aroused by the convention was very considerable as well as gratifying, and it is specially notable that the proceedings were responsible for the birth of a new journal, entitled *Good Roads, Canada*, which has for its object the voicing of the "good roads movement."

House Drainage Abroad. In our last issue we reproduced at length a paper on "House Drainage Regulations on the Continent," which had been read before the Institute of Sanitary Engineers by Mr. Frank R. Durham, ASSOC.M.INST.C.E. We are constrained to return to the subject this week because we feel that ideas and conventions in regard to house drainage are very apt to become stereotyped, and that the outlook of many sanitary engineers requires broadening by a proper appreciation of the work which is being done in other countries. In the first place, Mr. Durham makes it clear that in Germany sewerage systems have, as a rule, been designed much more with reference to future requirements than has generally been the case in this country. For example, Frankfurt-on-Maine is still carrying out sewers on lines laid down in 1863, although the population has more than quadrupled since that date. The effect of such comprehensive designing of sewerage schemes is seen to-day in the superior town planning of many German cities. Dealing now with the house drains which are connected to the sewerage systems, it is interesting to observe that the connection of several properties or houses by means of a common house drain is prohibited in all regulations. Each house must have its own drain, so that German sanitary engineers are presumably entirely unfamiliar with those legal discussions as to whether a pipe is a "drain" or a "sewer," which are the despair of their English brethren. The Frankfurt regulations provide a novel, if rather drastic, method of securing good workmanship in the construction of drainage systems. Only contractors on an approved list kept by the municipality may carry out this work, and those in default are liable to have their names removed from the panel.

The intercepting trap is apparently unknown on the Continent, a disconnecting system being not only impossible from climatic conditions, but also considered a serious impediment to a thorough ventilation of the sewerage system. Many other features of interest are described in Mr. Durham's paper, which deserves wide attention from British sanitary engineers.

* * *

The Newcastle Meeting. Judging by the large attendance and the interest in the four papers which were read, as shown by the long discussions, the meeting of the Institution of Municipal and County Engineers at Newcastle on Friday and Saturday last must be accounted a highly successful one. Two of the papers, together with a report of the discussion which followed their presentation, will be found in the present issue, and the remaining two papers, discussed on the second day, will appear next week. Mr. W. J. Steele, M.INST.C.E., the city engineer, submitted a paper on "Municipal Work in Newcastle-upon-Tyne," but, inasmuch as three members of his staff contributed separate papers on works of magnitude with which they had been respectively more closely identified, Mr. Steele's observations were perforce of a general character. Having called attention to the important part which the river has played in the development of Newcastle, the author of the paper proceeded to make some observations as to the municipal quays, which have recently been extended; the water supply, which is in the hands of a company; and the drainage, which is disposed of by discharge into the river without treatment. In regard to town planning, operations under the Act of 1909 have been commenced in two areas, the Local Government Board having already sanctioned the preparation of one scheme. Mr. Hubert Laws read a paper on "The Quay Extension Works," of which he has been the resident engineer-in-charge. The greater part of the work has been carried out direct by the corporation, and not let to contract, and the whole forms a very worthy achievement on the part of the city engineer and his department.

While speaking of the doings of the institution, it may be mentioned that a small party of members and their friends left London last night for Amsterdam *viâ* Harwich and the Hook of Holland. The response to the invitation to join in this tour has been disappointing, but, in spite of the small attendance, an interesting and profitable meeting is anticipated.

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Standard Notation. All who have had occasion to consult frequently various text-books on engineering subjects must have felt the need for some standard notation for formulæ and calculations, so as to avoid the confusion which must arise by reason of different authors using different symbols to express the same meaning. It is indeed a pity that some recognised system of engineering shorthand cannot be devised by some central authoritative body—such as the Engineering Standards Committee—in consultation with mathematical and technical experts. Meanwhile, the Science Standing Committee of the Concrete Institute has had the subject under consideration, with special reference to the algebraical symbols used in structural engineering. The report which was submitted by this committee at the last meeting of the institute contains separate series of symbols applicable to reinforced concrete, steelwork, brickwork and masonry, and woodwork respectively, together with a further series of symbols common to all branches of structural engineering. The recommendations are based on certain broad principles, so as to give some freedom of choice, while still retaining the maximum of consistency and allowing the fullest possible development of the uneconomic principle. For example, the symbol chosen is wherever possible the initial letter. The committee further recommend the adoption of certain standard forms for equations, so that, in setting out the terms, constants should be written before variables, and terms which are naturally associated should be grouped together. The report is a most valuable document, and it is to be hoped that technical writers will render the excellent work done by the committee of practical value by adopting the system of notation which they recommend.

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"The Surveyor" Road Conference. It will be remembered that at THE SURVEYOR conference held at Olympia in April last there were, among the five propositions submitted, two (numbered 1 and 3) which depended for their real effectiveness on being brought to the attention of the highway authorities of the kingdom. We undertook that this should be done, and it is now due to those who were good enough to take part in the conference that we should convey to them that this undertaking has been carried out. The text of the two propositions has been sent to the clerks to authorities in England and Wales, Scotland and Ireland (some 2,186 in all), with an intimation that they were adopted as resolutions by an "engineering conference at Olympia, held under the presidency of Sir George Gibb, chairman of H.M. Road Board," and a request that they should be brought by the clerks to the attention of the authorities. That this will be generally carried out is indicated by the great number of formal assents we have already received.

Institution of Municipal and County Engineers.

MEETING AT NEWCASTLE-UPON-TYNE.

Mr. R. J. Thomas, the president, occupied the chair at the meeting of the Institution of Municipal and County Engineers held at Newcastle-upon-Tyne on Friday and Saturday last. In the course of the proceedings—which took place at the town hall consideration was given to four papers: "Notes on Municipal Works in Newcastle-upon-Tyne," by Mr. W. J. Steele, M.INST.C.E., the city engineer; "Newcastle Quayside Extensions," by Mr. Hubert Laws; "Ouseburn Valley Works, Newcastle-upon-Tyne," by Mr. F. I. Morgan; and "Newcastle-upon-Tyne Tramway Extensions," by Mr. J. McKellar. The attendance at the meeting included Messrs. E. W. Booth (Manchester), H. A. Boullbee (Newcastle-upon-Tyne), J. E. Brown (York), J. Cooper (Newcastle-upon-Tyne), E. Darnell (Newcastle-upon-Tyne), A. J. Denton (South Shields), F. J. Edge (Newcastle-upon-Tyne), G. Gregson (Durham), R. Grieves (Blyth), H. C. Hilton (Newcastle-upon-Tyne), J. E. Johnston (Bedlington), H. Kerr (Newcastle-upon-Tyne), H. Laws (Newcastle-upon-Tyne), H. G. E. Lightfoot (Newcastle-upon-Tyne), N. Macdonald (Newcastle-upon-Tyne), F. Massie (Wakefield), J. D. Milner (Uganda), J. C. Mitchell (Stockton-on-Tees), J. F. Morgan (Newcastle-upon-Tyne), G. Nelson (Gosforth), A. M. Oliver (Newcastle-upon-Tyne), W. P. Pattison (Benwell), C. C. Rivers (Harrogate), E. W. Robson (Newcastle-upon-Tyne), L. Roseveare (South Shields), A. J. Roussell (Whitley and Monkseaton), G. E. Sawsener (Newcastle-upon-Tyne), J. F. Smillie (Tynemouth), J. P. Spencer (North Shields), W. J. Steele (Newcastle-upon-Tyne), F. W. Sykes (Newcastle-upon-Tyne), H. W. Taylor (Newcastle-upon-Tyne), W. B. Thomas (Southwick-on-Wear), T. J. Trowsdale (Annfield Plain), J. P. Wakeford (Wakeford, hon. district secretary), R. R. Wedderburn (Newcastle-upon-Tyne), J. S. Weir (Jarrow), S. Winter (Sheffield) and G. W. Wright (Newcastle-upon-Tyne).

The Lord Mayor (Alderman J. F. Weidner) said it was a pleasure to give a hearty and sincere welcome to the members of the institution. The brightness of the morning, he hoped, was a happy augury that the visit to Newcastle would be of a pleasurable and useful nature. He had particular pleasure in welcoming them because he knew and appreciated the work that had been done by their valued and highly respected city engineer, Mr. Steele. The work upon which municipal and county engineers were engaged was of vital importance to the community, having much to do with the happiness and prosperity of the inhabitants. He could assure them that he appreciated the value of conferences such as that. They had had a town planning conference in the city during the past two days, and he thought the gentlemen who attended it, and who represented all the great urban councils of the North of England, had gone away carrying with them the most pleasurable recollections of Newcastle. When they went down the Tyne that afternoon they would see what to his mind was practically one of the greatest sights in the world. The late Mr. Gladstone, in that hall, when receiving the freedom of the city, said he did not think that anywhere else in the world could there be seen so large and varied a number of industries as were to be seen on the banks of the Tyne in the 9 miles from Newcastle to its mouth.

The Sheriff (Councillor G. T. Loriol) said he could only endorse every word that had been spoken by the Lord Mayor. Personally, as an old civil engineer whose career had been diverted into commercial channels, he naturally took a very keen interest in everything connected with engineering, and therefore it was an especial pleasure to be with them that day. He had read with great interest the papers that were to be discussed, particularly that of Mr. Steele, which was such as could be read with advantage, profit and interest by every ratepayer in the city. It was brimful of useful information. Mr. Laws' paper he had also read with great interest because the quayside was under the control of a committee of which he had the honour to be chairman.

The President (Mr. R. J. Thomas) said on behalf of the institution he accorded to the Lord Mayor and Sheriff their sincere thanks for the hearty welcome given to them. They appreciated it very keenly, coming from the civic head of such a great city as Newcastle, and as evidence of the confidence and respect in which their colleague the city engineer (Mr. Steele) was held by the city. The institution which he represented had as its first object the betterment of its members and the increasing of their knowledge and of their usefulness to the authorities which they served. He knew that none could visit Newcastle without benefiting from an engineering point of view. They had excellent papers from Mr. Steele and his staff, and he was sure from the papers and discussions they would learn very much. No body of men could wish Newcastle greater prosperity and greater success than the members of that institution.

Mr. J. P. Wakeford, the hon. district secretary, read the minutes of the last district meeting at Bridlington, which were confirmed.

Mr. Wakeford then announced that the district representatives on the council from the North-Eastern District were Messrs. Matthews and Martin, the same representatives as last year. The district chairman, Mr. Frank Massie, had been re-elected, and he had himself been re-elected as district secretary.

LEGAL DEFENCE FUND.

Mr. Wakeford informed the members that the Executive Committee that morning had taken into consideration the question of a district defence fund. They had decided to circularise all the members in the district, and they would receive the circular in a short time.

The President asked the members to respond to the circular which the district secretary would send out on the question of the defence fund. It was very desirable that they should have the opinions of the members individually.

Mr. Wakeford read letters of apology from Messrs. Matthews (Bridlington), Senior (York), Lund (Cleckheaton) and Whittaker (Sunderland).

Consideration was then given to the following paper:—

MUNICIPAL WORK IN NEWCASTLE-UPON-TYNE.

By W. J. Steele, M.INST.C.E., City Engineer.

[Mr. Steele was a pupil of Mr. J. W. Brown, M.INST.C.E., late borough engineer of West Hartlepool. After serving on his staff for some time, he was promoted to the position of deputy borough engineer. In May, 1896, he was appointed chief assistant to Mr. P. E. Murphy, M.INST.C.E., surveyor and water engineer at Tottenham, and in November, 1897, commenced duties as deputy city engineer at Bristol. In January, 1910, he was appointed city engineer and town surveyor at Newcastle-upon-Tyne.]

At district meetings of the institution it is usual for a description of the municipal works in the town where the meetings are held to be given, but as

members of the author's staff are contributing the following papers: "Quayside Extension Works," Mr. Hubert Laws; "Ouseburn Valley Works," Mr. F. I. Morgan, ASSOC.M.INST.C.E.; "Tramway Extensions," Mr. J. McKellar—these few notes will be of quite a general character.

Newcastle-upon-Tyne is essentially a city of commerce, and in the popular mind the terms Newcastle and coal are synonymous. While large quantities of coal are still won from some five collieries within its boundaries, and workings of great antiquity and extent exist under various parts of the city, at the present time it is the commercial rather than the industrial centre of the Northumberland and Durham coalfield. Shipbuilding, marine engineering, and the numerous industries attached to a shipping port are its principal features. The city is situated on the north bank of the river Tyne, about 7 miles from its mouth, and much of its progress is undoubtedly due to the fact that it rests upon what has been aptly expressed a great commercial highway. In addition to Newcastle and in close proximity thereto the important boroughs of Gateshead, Jarrow, South Shields, Tynemouth, and Wallsend lie upon the banks of the river, which, together with the adjacent urban and rural districts, form what is known as Tyneside.

RIVER TYNE.

As the river plays such an important part in the life of the district, a little information concerning it may be interesting.

Between the seaward end of the Tyne Piers to Hedwin Streams, a distance inland of about 19¼ miles, it is controlled by the Tyne Improvement Commission, a spirited body which has carried out works of considerable magnitude in creating a safe harbour and navigable channel. For a distance of about 3¾ miles from the sea the channel of the river is being dredged to a depth of 30 ft., and for a further distance inland of about 11 miles to a depth of 25 ft., at low water of ordinary spring tides. High water is about 15 ft. above low water of ordinary spring tides. Vessels of between 3,000 and 4,000 nett register tons frequently proceed to the Derwenthaugh Staiths, a distance of about 14 miles inland. During 1912, 2,132,494 tons of material were dredged by the commissioners from the river and taken to sea. The largest quantity of coal and coke exported from the river in any one year was 20,543,683 tons, in 1911. During 1912 ninety-four vessels were launched into the river. This number included the battleship "Queen Mary," 700 ft. long by 89 ft. beam, from the yard of Palmer's Shipbuilding and Iron Company, Limited, Jarrow.

There are two docks on the north side of the river and one on the south side. Those on the north side are the property of the commissioners, the respective water areas being—Northumberland Dock 50 acres, and Albert Edward Dock 22¾ acres. Tyne Dock, on the south side, is the property of the North-Eastern Railway, and has a water area of 50 acres. The gross revenue receipts of the commissioners in 1912 were £441,000, but in 1911, when there was no miners' strike, they were £483,005. The revenue expenditure in 1912 was £313,373.

A somewhat striking feature of the river is that it has a considerable reputation for salmon fishing, and, in spite of being so much used for industrial purposes, large numbers of these fish are taken every year from the upper reaches.

NEWCASTLE QUAYS.

This undertaking is the property of, and controlled by, the corporation. It extends from the high-level bridge to a point about 120 yds. east of the Ouseburn, a tributary of the river, and is about 1,842 yds. in length. The imports and exports at the quay are grain and general merchandise, no coal being shipped here. During the last year the number of vessels arriving and departing from the quay was 1,810, and the total volume of trade was over 500,000 tons. The general depth of the water at low water ordinary spring tides varies from 12 ft. to 20 ft., but in all new work provision is being made for a depth of 25 ft., or 40 ft. at high water ordinary spring tides. Since 1908 the railway along the quay has been relaid, the road repaved in wood or granite setts, three transit sheds built, new approach roads constructed, and electrical cranes with other dock equipment installed, for improving the facilities of the undertaking. East of the Ouseburn the quay has been extended, which work is to be described in a paper by Mr. Hubert Laws, as previously mentioned. A contract has just been let for the reconstruction of the London Wharf. This is a timber quay providing for a depth of 25 ft. at low water ordinary spring tides, the longest piles being 57 ft. The drawings are submitted for observation. A new transit shed is to be erected at this wharf, and another immediately west of the Ouseburn, but the drawings are not in a sufficiently advanced stage for exhibition.

WATER SUPPLY.

An abundant supply of water of excellent quality is provided by the Newcastle and Gateshead Water Company, and the author is indebted to Mr. A. L. Forster, M.INST.C.E., the engineer to the company, for the following information: The company, which came into being in 1845, is the successor of numerous other companies, the first Act of Parliament being obtained in 1699, by William Yarnold, an attorney, from New Woodstock, in Oxfordshire. There is a trade supply and domestic supply respectively. In the event of a shortage of water from the drainage area the trade supply is pumped from the river Tyne at Wylam into the trade reservoir at Whittle Dene, about 12 miles from the city, from whence it is distributed to manufactories on both sides of the river. The domestic supply is obtained by impounding the waters of the river Pont and several burns, by means of reservoirs at Whittle Dene, East Hallington, West Hallington, Little Swinburne, and Colt Crag respectively, and situated at distances from the city varying from 12 to 24 miles, and also by impounding the river Rede at Catcleugh, 4 miles from the borders of Scotland, and about 41 miles from the city. The reservoir at Catcleugh, whose top water level is 815 ft. above ordnance datum, has a capacity of 2,305 million gallons, and is calculated to give a daily supply of about 9,000,000 gallons. Showing the excellent position of this reservoir in relation to the drainage area, there has annually passed over the overflow to waste quantities varying from 3,383 million gallons in 1908 to 8,223 million gallons in 1912. The whole of the domestic supply is filtered. In 1912 the total population supplied was 575,000, the consumption 19,000,000 gallons per day, the storage 5,366 million gallons, and the drainage area 32,470 acres. The charges for trade supply are on a sliding scale, for the low service from 1s. to 5½d. per 1,000 gallons, and for the high service from 1s. 2d. to 7½d. per 1,000 gallons; for public purposes from the domestic supply, 5d. per 1,000 gallons.

DRAINAGE.

The city may be said to be particularly fortunate in its drainage, as, with the river as an outfall, and no treatment of its sewage, the total annual cost of this service, including capital charges, is the comparatively small amount of 1·08d. in the £, the cost of maintenance only being 0·63d. in the £. In some quarters it is held that the sewage should not be permitted to enter the river in a crude state, but its treatment, or interception by a culvert by which it would be made to discharge directly into the sea, would be such a costly undertaking that an exceptionally strong case will have to be established before the present means are altered. The city is built on land sloping towards the river. For a distance varying from 400 yds. to 700 yds., the slope is rapid, the gradients of many roads being 1 in 7, but from the top of this slope northward to the boundaries it is gradual; the general level of the highest part of the city is about 300 ft., and the lowest about 15 ft. above ordnance datum. Several valleys running in a northerly direction from the river formerly divided the present area, but many of these have been filled in. With such a configuration the inclinations of the main sewers are, of course, generally good, and although a certain number of the sewers are of con-

SIZE AND INCLINATION OF SEWERS.

Internal diameter of pipe.	Inclination.		Number of houses to be drained.	
	Minimum.	Maximum.	Minimum	Maximum.
6 inches	1 in 48	1 in 3	1	15
9 ,,	1 ,, 64	1 ,, 5	16	100
12 ,,	1 ,, 96	1 ,, 10	101	200
15 ,,	1 ,, 120	1 ,, 10	201	300
18 ,,	1 ,, 120	1 ,, 10	301	400
21 ,,	1 ,, 150	1 ,, 10	401	700
24 ,,	1 ,, 150	1 ,, 10	701	1,000

siderable age, and therefore not in an ideal condition, systematic flushing enables them to fulfil their

functions in a reasonably satisfactory manner. In the case of new branch sewers, the conditions of each case are of course considered, but, with the object of saving repetition in calculation, the foregoing rules have been formulated, and, generally speaking, can be observed.

LIGHTING.

In addition to the Newcastle and Gateshead Gas Company, two electrical companies—the Newcastle-upon-Tyne Electric Supply Company, Limited, and the Newcastle and District Electric Lighting Company, Limited, respectively—supply the means of light, in addition to which the corporation, through its Tramways Committee, provide the public street arc lighting. It will be seen that the means are plentiful, and the service is not only efficient, but moderate in cost. The charges for private lighting are 3¾d. per unit, with 5 per cent discount, for electrical current, and 2s. 1d. per 1,000 cu. ft., with a minimum discount of 10 per cent. for gas. The street lighting is controlled by a sub-committee of the Watch Committee, and with its lighting inspector, Mr. George Lamb, has given considerable attention to the automatic lighting and extinguishing of gas lamps, and the use of high-pressure gas. At the present time 3,497 out of a total of 9,048 street gas lamps are automatically lighted and extinguished by a system of wave pressure from the gasworks; this system has given such satisfactory results that it is to be extended to the whole of the lamps. Like all automatic methods of lighting and extinguishing, it, of course, has the slight disadvantage of requiring a pilot light, consuming 0·20 cub. ft. per lamp per hour during daylight hours, but this is unavoidable. In Grey-street seventeen lamps have been supplied with gas at a pressure of 80 in. against the average low pressure of 4 in., which gives a candle-power of 1,500 per lamp. The number of electrical arc lamps is 428, and electrical incandescent 399, so that the total number of public street lamps is 9,875.

HIGHWAY.

The wood-paved surface of the highway, with the exception of a very small area, is wholly composed of jarrah wood, and has proved to be very durable. The blocks are wholly immersed in refined tar before being brought to the site of the work. In four streets for which a loan has just been obtained creosoted redwood is to be used, owing to the gradient being unsafe for hardwood. The stone sett-paved roads are principally surfaced with granite from Aberdeen. On gradients exceeding 1 in 10 sandstone setts are used with great success; although somewhat costly, this surface is safer for traffic than bituminously-bound macadam, and water-bound macadam is difficult to keep in place.

The Northumberland whinstone, exclusively used for ordinary macadam surfaces, is an excellent road stone, and costs an average of 7s. 11d. per ton at the various railway stations. In repairs the stone is laid and thoroughly rolled without water, a mixture composed of pitch and creosote oil, heated to boiling point, being then poured into the interstices. The top is then covered with ¾-in. steel slag or whinstone, lightly covered with the pitch mixture, and finally sprinkled with clean dry sand and thoroughly rolled again. In all streets constructed under the Public Health or local Acts tarred slag on a hand-packed stone foundation, 8 in. in thickness, is exclusively used for the carriageway. The thickness of this "tar-macadam" is 5 in., separately rolled in three layers, the first being 3 in. thick of 2-in. material, the second 1½ in. thick of 1-in. material, and the topping ½ in. thick of ¾-in. material. The cost per square yard, including foundation, is about 5s. 6d.

A large proportion of the surface of the highway (over 100 miles) is paved with granite or whinstone chips, a species of "rag pitching." This surface has only one advantage, although that is somewhat important—its maintenance costs are low. Each year, as funds permit, a number of streets are resurfaced by laying tarred slag on the surface of the chip paving. During the last three years about 3 miles of road have been treated in this manner. The cost is about 2s. 6d. per square yard. With one or two exceptions, the results have been good; the exceptions have not been successful owing, so far as at present known, to water having percolated through the new surface to the old depressions in the chip paving, and this having been more or less impervious, traffic has forced the standing water into the macadam, and in time caused disintegration. The total cost of maintenance of the highway for the current year is the comparatively low sum of £26,000, and is equivalent to 4d. per £ of the rateable value.

NEW BUILDINGS.

Like every town, the last few years have been remarkable for a notable decline in the erection of dwelling-houses. A chart is submitted showing the houses erected each year since 1882, and the approximate value of the work included in the plans approved under the by-laws for each year since 1910. In 1912 new by-laws for new buildings and streets were made, and, *inter alia*, provided for reinforced concrete buildings and steel-framed structures, although many such were erected before this date. The by-laws provide that, when plans are deposited for buildings of this character, the applicant shall submit detailed drawings and calculations of every part of the structure. The work of checking these drawings and calculations has, of course, considerably increased the work of the department, but while the local authority may not be legally liable for any failure in a structure approved under the by-laws, there is a moral responsibility; consequently it is necessary for such work to be done. From his experience in the use of reinforced concrete, and the supervision under the by-laws of buildings erected in this method of construction, the author is of opinion that too much care cannot be taken in design and execution. In the working stresses sanctioned by the rules of the Royal Institute of British Architects the concrete is allowed a working stress of 600 lb. per square inch in compression. This is a reasonable allowance with sound concrete, but, as the members of the institution are well aware, there is an exceedingly wide latitude in the strength of this material, as its strength depends upon such a variety of conditions.

In some tests recently carried out as detailed in the paper by Mr. F. I. Morgan on the "Ouseburn Valley Works," to be submitted to the institution at this meeting, test cubes of concrete of a proportion of 4½ of gravel and sand to 1 of cement, made under most rigid conditions, three months old, failed under an average compressive stress of 2,432 lb. per square inch, or about four times the stress allowed, which is a small factor of safety when the variable nature of the material is considered. With the present severe competition in this method of construction, and the sometimes doubtful character of the concrete and its application to the reinforcement, where the structure is designed upon the stress allowed by the Royal Institute of British Architects, it is desirable for a careful examination to be made during every stage of the erection of a building. It is obvious that the inspectors employed by a local authority have insufficient time to act as clerks of works upon buildings; therefore any proposal to depart from regulations now generally accepted as applying to this form of construction is only approved of on condition that the principal members of the structure are tested with a load equal to its full calculated working load.

The granting of a licence under the Cinematograph Act, 1909, is vested in the corporation. The remarkable growth of this class of entertainment has been such that there are now twenty-one halls devoted to it, in addition to which there are four theatres and three music halls. Supplementary to police supervision, an inspector attached to the author's staff makes systematic inspection during the performances, to ascertain that the regulations are complied with.

TOWN PLANNING.

Newcastle was a walled town with towers at numerous points in the length of the wall, and there are several portions of the wall, with some of the towers, still standing in a good state of preservation. Owing to the marvellous foresight of Richard Grainger, a prominent contractor, assisted by John Dobson, an architect of unusual ability, a large part of the central area of the city was rebuilt between 1834 and 1845, with a spirit revealing a remarkable breadth of view in the planning of an important town. The principal streets in this area are Grey-street, 73 ft. to 80 ft. in width, Grainger-street, 63 ft. in width, Clayton-street, 50 ft. in width, and Market-street, 63 ft. in width, together with several connecting streets on the same bold plan. Grey-street is a symmetrical curve on plan, with a gradient of about 1 in 21, and forms a thoroughfare of striking dignity. The architecture is classical throughout, the whole of the many handsome buildings being built in stone. This is an example of the fact that "town planning" is only a revival of the bold ideas that animated some of the citizens of our towns, and it is a matter for regret that during

the last seventy years commercial competition has demanded that everything should be sacrificed to immediate needs.

By general consent, if the provisions of the Housing and Town Planning Act, 1909, are carried out in a reasonable manner, the areas still to be developed will at least be an improvement upon the wearisome monotony of the streets in the modern suburb. Operations under the Act have been commenced in two areas. The smaller area (53½ acres) is partially within the city and partially within the district of the Gosforth Urban District Council. The Local Government Board have sanctioned the preparation of a scheme, after inquiry, and the draft scheme is in preparation. The larger area (1,540 acres) is wholly within the city, except a small portion in the borough of Wallsend and the district of the Longbenton Urban District Council respectively. In this area the corporation own about 749 acres of the land; the first notices under this area have been served prior to the inquiry by the Local Government Board.

Some little difficulty has been experienced in defining the boundaries of the scheme, as the adjoining authorities very properly regard an intrusion in their district as an act requiring careful consideration. From a town-planning aspect, the boundaries of the city are not suitable in every part, as one of the cardinal principles of the Act is that any projected roads or other requirements shall be of full service to the general public, irrespective of the boundaries of a town or the ownership of land; conferences have been held with representatives of the local authorities concerned, with the object of arriving at such areas as shall be mutually satisfactory.

Another feature which has demanded consideration is that of cost to the local authorities and owners of land respectively. If a scheme requires a road to be forthwith constructed at the cost of the owner, he may suffer an injustice, as he may thereby incur an expenditure many years before receiving any income from the development of his land; on the other hand, if the local authority bears the cost of construction the general body of ratepayers are carrying a burden that should be borne by the landowner. Of course, it may be held that the local authority should bear the cost and recover it from the owner when the land is in a certain state of development; this seems the most reasonable way out of the difficulty, but considerable discretion is necessary in fixing upon the roads to be forthwith laid out.

PARKS AND OPEN SPACES.

The citizens are justly proud of the numerous parks and open spaces. Inclusive of the Town Moor and Castle Leazes, the total area is 1,295 acres, or more than 15 per cent of the total area of the city. Exclusive of the Town Moor and Castle Leazes, the aggregate area of parks proper is 285 acres. An interesting point for discussion might be raised as to whether such a large proportion of the total area of the city as is comprised in the 1,010 acres of the Town Moor and Castle Leazes, situated in one district, does not make for too close building in other districts, inasmuch as it inevitably influences the value of the land in the central zone. If, say, 200 acres of the Town Moor were developed for building purposes, there would remain some 727 acres, which is an abundance, in one complete open space, for any provincial city. Instead of great areas of land, often inaccessible to a large number of the inhabitants of the town—except on rare occasions, such as a public holiday—being given up for one or two public open spaces, more space is required about the dwellings, together with small ornamental spaces in the midst of the dwellings.

The principal park is that known as Jesmond Dene. Formerly the private grounds of the late Lord Armstrong, that munificent benefactor to the city presented it to the citizens in 1884. Its natural beauties were very greatly enhanced by the unique taste of the owner, and when the rhododendrons are in full bloom it forms a place of infinite charm. A striking feature of the parks is the extent to which the games of bowls, lawn tennis, boating, &c., are indulged in. For the year ended March 31, 1912, the receipts derived from these games amounted to £1,132, of which £633 was received at the bowling greens, there being twenty of these greens distributed over the various parks.

STREET CLEANSING AND REFUSE DISPOSAL.

The humble but essential duty of removing refuse from the highways and dwellings of the citizens is one which presses with much greater force as our knowledge of public health administration is increased.

The house refuse is disposed of by—

(1) Burning at one of the three destructors, about 34,000 tons per annum.

(2) Conveying by means of hoppers to a point not less than 3 miles outside the piers at the mouth of the river and discharging it into the sea, about 35,000 tons per annum.

(3) Given to farmers, who receive it at certain goods stations in the city, about 9,000 tons per annum.

(4) Discharged on tips within the city boundaries, about 12,000 tons per annum.

Destruction by burning is undoubtedly an effectual method of disposal, but it is comparatively costly. The nett cost per ton, inclusive of capital charges, is 1s. 11d. at the Byker destructor, 3s. 3d. at the Walker destructor, and 5s. 4d. at the Benwell destructor. The nett cost per ton of sea disposal is about 1s. 7d. The unusually high cost at the Benwell destructor is largely due to the capital charges, which amount to 3s. per ton, the site being a very costly one.

The quantity amounts to 6½ cwts. per head per annum, or an average of 35 cwts. per house, and, including capital charges, costs 1s. 11·5d. per head for collection and disposal, or an average of 10s. 6d. per house.

The street refuse is disposed of -

(1) Discharged on fields and tips within the city boundaries, about 32,000 tons per annum.

(2) Given to farmers, about 8,500 tons per annum.

(3) Conveyance to sea, about 4,800 tons per annum.

The quantity collected per annum amounts to an average of 181 tons per mile of highway cleansed, and its cost of collection and disposal to 2s. 2d. per head of population.

COSTS OF MAINTENANCE.

The maintenance costs only of some of the municipal services for the year ended March 31, 1912, are given below:—

Fund.	Per head of population	Per £ of rateable value.
	d.	d.
Macadamised roads	8·39	1·37
Flagging and paving (inclusive of wood paving, granite paving, and chip paving) ...	11·88	1·94
Sewers (inclusive of flushing)	3·86	0·63
Street watering	1·46	0·24
Street cleansing	25·83	4·21
Snow removal	1·24	0·20
House refuse removal and disposal	21·12	3·45
Public lavatories and urinals	1·98	0·32
Town moor and parks	8·64	1·41
	84·40	13·77

[The paper on "Quay Extension Works at Newcastle-upon-Tyne," by Mr. Hubert Laws, resident engineer in charge of the works, which was discussed jointly with that of Mr. Steele, is reproduced elsewhere in this issue.]

DISCUSSION OF MESSRS. STEELE AND LAWS' PAPERS.

Mr. F. Massie, as chairman of the North-Eastern District, proposed a hearty vote of thanks to Mr. Steele and Mr. Laws for the excellent papers which they had prepared. They had given to the institution material which would be a credit to it, and useful in after days for the members as a whole. A hasty glance at the diagrams on the walls, as well as the most excellent copies they had in the papers, showed there was a good deal of work there, not only in the city engineer's department, but in the interests of Newcastle as a whole. The city must be progressing favourably, or else they could not undertake such large works as had been going on for the past ten or eleven years. Mr. Steele had called their attention to the smaller number of houses erected in recent years, but he had not called their attention to the more satisfactory chart exhibited, which showed that, although they did not build the same number of houses, the estimated cost of the buildings they did put up were increasing rather than decreasing, which was no doubt very satisfactory to the ratepayers of Newcastle-upon-Tyne. For 1913 the estimated cost of the buildings exceeded £500,000, whereas the year before it was £341,351. He hoped that rate of progress would be satisfactory

to the ratepayers. With regard to town planning, he was much interested in what Mr. Steele had to say as to the reasons which would warrant intrusion into the area of the adjoining authority, and also the attitude which he was advising his authority to take up as regarded landowners in the area suggested to be town planned. Both those paragraphs were conciliatory in tone, and such as should lead generally to success. He did not know very much about the inhabitants of Northumberland, but he did know a little about the inhabitants of Yorkshire, who were perhaps somewhat similar. They could lead a Yorkshireman, but it would take a great deal to drive him. If Mr. Steele and all other surveyors would always approach the owners of land in the spirit of the two paragraphs in the paper, it would save a good deal of trouble and probably a good deal of ill-feeling. With regard to Mr. Laws' paper, he could only admire the work he had done for the corporation of Newcastle, and he hoped they would have an opportunity of inspecting it closely, as that would impress it more upon their minds than even the reading of the paper or the inspection of the diagrams.

Mr. L. Roseveare (South Shields) seconded the vote of thanks. Mr. Steele spoke of the progressiveness and foresight of Newcastle. It was not only in the present time they had foresight, for he noticed that centuries ago they started town planning by trying to prevent the growth of South Shields. At the present time there was a population of 112,000 there. Then in 1645 they said they should not have any quayage there; so they were still trying to exercise their control over a large area. With reference to the quay work, the comparison of timber piles as against reinforced concrete was one which was interesting most of them very much. Most of them who had been advising their corporations to put in reinforced concrete after what they had seen would be inclined to follow the lead of Newcastle and advise timber piles. Then as to the question of drainage, Mr. Steele had remarked upon the expenditure necessary to carry the sewer outfall to the sea. Like Newcastle, they had been approached as to doing something in the way of sewage treatment. It would probably be cheaper, however, to purchase the salmon than to carry out such a scheme. As to the table of inclination of sewers, Mr. Steele had let light into it when he said they were laid so as to be self-cleansing between the hours of 8 p.m. and 4 a.m. There was the largest amount of elasticity between the maximum and minimum allowances in the table, and looking at the table it struck him that in certain instances the minimum inclination would be nothing like sufficient to deal with the rainfall, having regard to the fact that their time of concentration was so short with the sharp gradients. The whole table revolved round the number of houses to be drained. They wanted to have another fact, that was the number of houses per acre which Mr. Steele had based the table upon. Without that they could not gauge the drainage by the rainfall, which was one of the most serious factors as regarded size of sewers. Mr. Steele had experimented on his chip paving. He admired his moderation and self-control in his description of the chip paving. It was an abomination to a South countryman, and how the hard-headed Northerner tolerated it in front of his residence without making a complaint he did not know, but in the South such paving would cause an uproar, if not a riot. Then the question of flats struck him as a South countryman very forcibly. In certain parts of his borough, laid out under the by-laws, they managed to get 206 people to the acre, which in this age of town planning was not desirable, to say the least. His council had taken the same attitude as the Newcastle Corporation as to the advisability of going into the calculations for reinforced concrete building. This was very essential, not only from the point of freak designs, but from the fact that they were gradually increasing the stresses. They used to work to a 435 lb. pressure per square inch, but now it had gone up to the standard set by the Royal Institute of British Architects of 600 lb. They seemed to be making the margin of safety finer and finer. What he liked in Mr. Steele's paper was the acceptance of responsibility. The old idea was that the corporation should dictate terms, but accept no responsibility. This accepting of moral responsibility was a step in the right direction. The average building inspector could not be a clerk of works. They might design as well as they liked, but it was absolutely essential in most buildings to have their test afterwards. Anyone who had experience of reinforced concrete buildings knew it was not a question of design, but of workmanship afterwards. If the work was not properly done the soundness of the design was entirely counteracted. There had been a town planning conference in Newcastle that week, and he was much struck by one or two statements that town planning was not only best for the local authority, but for the landowner. In effect they said: "You need not worry at all; go into the question of town planning on proper lines, and the landowners will come to you cap in hand and welcome you with open arms." That was so different to the general experience of local officials that he would like to know the experience of Mr. Steele. The including of certain lands outside the boundary of the authority in the area to be planned was a difficult point. The average man did not desire to have his land included in the area to be town planned. They were told that there were to be no details given to the landowner. An owner asked, "What is a town plan?" The answer was to be: "Oh, a town plan is a town plan. We are limiting the area of land to so many houses per acre." The opinion of the Newcastle conference was that the average landowner was going to accept that. If he were a landowner he should know. Then he would like to ask whether the Newcastle Council proposed to make this town planning scheme pay for itself. It seemed to him that if town planning was to be carried out on proper lines they would not have to follow the example of Birmingham. They had started in Birmingham with spending £103,000 on roads; that seemed to be the wrong principle altogether. If a corporation had to put down £100,000 for the development of roads in a town planning scheme of 2,000 acres, they were on the wrong lines. If town planning was the best thing for the owner as well as the local authority, surely it should be capable of development without any substantial grant from the local authority, except in cases where they wanted a road to be widened considerably, say to 100 ft., and then it might be necessary to pay a moiety of the cost of widening over a 50-ft. to 60-ft. road. He would like to know whether Newcastle intended to make its town planning self-supporting. Turning to Mr. Laws' paper, the speaker said he liked the detailed statements of costs. It was rarely that they got details of the cost of work, which, at any rate, were a guide to one in works of a similar description.

Mr. J. F. Smillie (Tynemouth) said he had not much criticism to offer upon the paper of Mr. Steele, but he was constrained to make adverse comment upon one of the methods of disposing of house refuse which was adopted by the Newcastle Corporation. Mr. Steele told them that no less than 35,000 tons of refuse annually were dumped into the sea, and he had reason to believe that was the case. He thought of all the reprehensible methods of getting rid of town refuse this dumping of it into the sea beat the lot, except perhaps the tipping into disused pits and quarries. He knew that after a storm at high-water mark all along the beach from Tynemouth to Cullercoats there was a constant black line made up of old boots and other *débris*, which, in the interests of the inhabitants, and at their expense, had to be removed by the seaside corporation. He also knew that bathers who went down for their morning dip had returned without entering the sea, intimidated by the repulsive material which was lying there, and which they had to pass to get into the water. It was time that an enlightened corporation like Newcastle gave up such a disgusting practice. They were not the only riparian authority on the Tyne guilty of it, but as the leading authority they might show a better example. With regard to the table given by Mr. Steele of the size and inclination of the sewers, like Mr. Roseveare, he was not quite convinced of its infallibility. Putting down a sewer merely to carry off the drainage of a certain number of houses was certainly quite satisfactory where there was a separate system of drainage, but with a single system of sewers the extent of the area to be drained was the important factor to be considered. If the sewers were sufficient to carry off a ½ in. of rainfall in an hour, they need not worry very much about the size of the drains. But if a 9-in. pipe was put down because 100 houses had to be drained, and those houses were spread over a comparatively large area, there was a chance of a flood taking place. The very important factor of the area to

be drained had been omitted in this calculation. With regard to the work on the highways, he was in full agreement with Mr. Steele that pitch-grouting was not so good in its results as laying down tar-macadam. There was an indiscriminateness in putting down pitch-grouting which was very serious to traffic. They had the gutters in wet weather filled with material washed off the road, and this led to a very great loss of material and waste. His experience was that tar-macadam, properly mixed, was in the end cheaper than pitch-grouting. The labour seemed to be much less in putting the stone on the road and grouting it with the pitch as compared with that entailed in the proper mixing of the stone and tar at the stoneyard; but ultimately the pitch-grouting was the more costly of the two methods of road making. With regard to reinforced concrete, they must all admit that where reinforced concrete structures come under the purview of surveyors they must be carefully watched, whatever the design. The expected result would be falsified unless the workmanship was good. It was impossible for a town surveyor to keep under close observation all the work which went on with a building. His invariable rule was that after the work was finished it should be subject to satisfactory tests to see that it was capable of doing the work for which it was intended. That, in his opinion, was the only real safeguard for the public. In the early part of his paper Mr. Steele paid a very just tribute to the splendid achievements of the River Tyne Commissioners. There was no doubt about it, the prosperous development of Tyneside during the past sixty years was very largely due to the public spirit and enterprise which had been shown by that enlightened authority. The latest history of Newcastle and of the Tyne was not very interesting reading, and not altogether pleasant to the people of Newcastle, and one was tempted to say more about it, though that was not the occasion. But it did occur to him, and had been on his mind for some time, that the interests of the various communities on Tyneside were so identified, so interdependent, so inseparable, that in matter of real fact they were one community with one interest, and he thought the time would come when that fact would be generally recognised —it would come perhaps later than sooner—when the boundaries that separated those districts would be regarded as arbitrary and anomalous, and even ridiculous, and they would be obliterated, and the whole district of Tyneside would be concentrated into one great municipality, free from the petty and parochial jealousies which too often prevailed, and had prevailed in the past century, between Newcastle and its neighbours. And it would become one great municipality when the whole of the people of Tyneside would be inspired with a zeal for the welfare of the district, and one might well be proud to be citizens of a place which would then hold a still more honoured place among the cities of this Empire.

Mr. G. Nelson (Gosforth) thought they were rather hard on chip paving. No one would agree that it was an ideal paving, but it had done very well in the past; it had answered its purpose; and now, with improved conditions, it had to go into the background, he thought they might let it off easier than had been done. Ordinary tar-macadam in side streets where they had an occasional milk cart would answer the purpose, but on the main roads with heavier traffic tar-grouted macadam was a very good pavement. It was almost an ideal pavement where they had heavy traffic. Mr. Laws' paper was also very interesting.

Mr. J. S. Weir (Jarrow) asked why Mr. Steele did not put down whin sett paving. Whin sett paving was very much cheaper than granite paving, and from experience he had had of it it was as good as granite. It was as durable, though it might be more slippery. He found that tar-macadam was much better than pitch grouting.

Dr. Kerr, medical officer of health, Newcastle-upon-Tyne, suggested that Mr. Steele, in his reply, should state whether, in giving the number of houses built, he meant separate dwellings or separate buildings. In Newcastle they had large areas in which there were flats. Might he also suggest to Mr. Steele that, as he had such a large experience in the ventilation of sewers, he might give them some indication of his policy in Newcastle? It was a matter of great interest to himself and his committee, as they, perhaps, had similar difficulties to deal with. The whole question of the ventilation of sewers was such a vexed one that an expression of opinion from Mr. Steele would be of advantage to them.

The President (Mr. R. J. Thomas) remarked that before putting the vote of thanks to Mr. Steele and Mr. Laws he would like to express his keen appreciation of the trouble they had taken in preparing the papers. Mr. Steele had covered an enormous area of the very typical work the municipal engineer had to undertake in these days. The paper would always be a work of reference to himself when he wished to see what important municipalities were capable of doing, and doing well. He noticed they had a dual water supply; that, so far as he was aware, was not very usual nowadays. The only place he knew where the same system existed was in Paris, and those who attended the Paris meeting a year ago had some illustration of the difficulties of confining the use of trade water to trade purposes, and in that, it seemed to him, there was an element, not of danger, perhaps, but which required very careful watching to safeguard the health of the people, and make sure that they drank only the water they should drink. As to drainage, how very fortunate Newcastle was as compared with the inland towns! The figures given of the cost of sewage disposal would make many towns jealous. He hoped no great nuisance was caused. If some day it became necessary to carry an outfall to the sea, he hoped all the municipalities on Tyneside would join in the work. The street lighting seemed to be very cheaply done, and was another instance of the value of good, sound, solid competition. With regard to the highways, he was pleased to hear that the use of Jarrah wood was satisfactory there, because he heard that soft wood was rapidly replacing the use of hard wood. It was satisfactory to find that in Newcastle, where the traffic was very heavy, the Australian hard woods still held their own. With reference to pitch-grouted roads, he read that paragraph in the paper with great interest, and the discussion also appealed to him, because they had in Buckinghamshire—quite a rural district—been adopting both systems for some years. He sympathised with those who had experienced difficulties with pitch grouting. He candidly confessed that the pitch grouting which he had carried out had not given him satisfaction. It was not that the principle was unsound, but the application was most difficult. They found the utmost difficulty in distributing equally their concrete. They found certain portions of the road overcharged, other portions undercharged, and the wear was not even, and the road was very patchy indeed. But he admitted that he had seen very admirable results from pitch grouting. As they learned even more from their failures than from their successes, he confessed that his pitch grouting had not given him satisfaction. With tarred granites they had had very fair results. They could tar the stone for anything from 5s. 6d. to 6s. 6d., which represented a matter of 8d. per yard super. laid. It did seem that 8d. was money very well spent on provision for modern traffic. They had used also for the past nine years tarred slag on the heaviest used road in the county—the London and Bath road, which had an enormous motor traffic—and the results had been very satisfactory. They were blessed now, or cursed, with a service of motor omnibuses—a half-hour service. They found that these motor omnibuses, with heavy loads and small wheels, were punishing the roads in a way no other traffic had done. They were not only wearing the surface out, but compressing it, driving it into the foundation. The more they broke the arch of a road and compressed it, the larger the openings of the joints of the roads, and the more water got into the subsoil, which, as they knew, was fatal to a road. With reference to chip paving—which was quite a new name to him—he had not been over that recently, but in years past he had traversed some of the roads in Newcastle and he thought he remembered them. One thing that occurred to him was how in facing or carpeting these old chip roads with tarred slag Mr. Steele managed with his levels. Probably the old chip paving was very flat and allowed for raising in the middle of the road, but how did it affect the channelling? Town planning was a prominent part of the paper. In the past Newcastle had prominent men like Mr. Grainger and Mr. Dobson forecasting the system they were now more or less forced to act upon. With regard to Mr. Laws' paper, he heartily congratulated him upon it. It was an admirable paper, which he had read with the greatest interest. He had not had to do any river or dock work, and coming to it as an amateur it was an education in itself. It seemed that the cylinder had been aban-

doned in favour of the monolith. The reason was not given in the paper, but no doubt Mr. Laws would give them the reason why they had adopted the monolith. With reference to the reinforced piles, he thought it was a highly important matter. The whole secret of the strength of reinforced concrete was that they kept the steel reinforcement absolutely watertight and airtight; and if they did get any fractures they were starting a source of weakness that might have very serious consequences. As to the monoliths he would like to ask whether he was able to secure a complete alignment. He would like to know the weight of each monolith empty and charged. It was apparent that this construction was very massive indeed in the bulk, and he was very glad to find from the paper there had been no settlement of any kind. They would have an opportunity of examining this work, and no doubt appreciating its excellent points.

The vote of thanks having been accorded,

Mr. W. J. Steele, in acknowledgment, said one was always glad to receive some appreciation from one's colleagues. He was not at all surprised at the point raised by Mr. Roseveare and Mr. Smillie with regard to the size and inclination of the sewers. The point both raised was a very pertinent one, because the number of houses was misleading—but it was done for a reason. As a matter of fact, the drainage area was based on fifteen houses to the acre, and the reason for giving the number of houses was that it was an exceedingly easy method. They knew under the present by-laws there would be something like fifteen to twenty houses per acre, and they made themselves safe by making it fifteen houses to the acre. It was done for the practical reason that it saved calculation. The basis was acreage. It would have been better to put in acreage—it would have simplified it—but for their own use in the department it was done as the quicker method of arriving at the same result. He was much struck by Mr. Smillie's exceedingly bold forecast as to making the whole of the boroughs on the Tyne into one municipality. That was a dream which only Glasgow aspired to. Glasgow wanted to govern Scotland; Mr. Smillie thought that Newcastle should govern England. It was a question which did not want to be brushed lightly aside. Mr. Smillie had raised the very important point as to whether it would not be better for the public as a whole to be governed by one municipality than as at present. He thought it was a very bold view to put forward, and he hoped it would not be lost sight of by their councils. Mr. Roseveare raised a point as to letting the landowners know what were the intentions of the Town Planning Committee. That was a point they had a great deal of trouble with. A book had just been published by two barristers in which they took the view very strongly that the owners should not be told what the corporation had in view in town planning. They said it encouraged opposition. He thought that an exceedingly narrow view to take. If a man owned 40 acres or 50 acres or 100 acres, and they said, "We are going to town plan your land," he naturally said, "What do you mean by town planning?" They replied, "We are going to lay down the lines of new roads, and limit you to so many houses per acre." He then said, "Where are you going to put the roads and the houses?" They simply said, "We are going to town plan; we will tell you that afterwards." If they told an owner to begin with their general views they might convert that possible opponent into a supporter; but if they did not tell him very naturally they would have an opponent, because he did not know what their plans were. He agreed with Mr. Roseveare that the attitude taken up was a very stupid one. With regard to a town-planning scheme being self-supporting, their committee's idea was that it should be self-supporting. Their idea was that the Town Planning Act was intended to prevent the aggregating of houses, and to make a district more interesting and better to live in, but in doing that they did not think the authority should be saddled with any great cost. If the authority was going to be saddled with a cost of £100,000 for 2,000 acres of land, it was going to add enormously to the burdens of the ratepayer. They might do something, but they could not spend like that, and they thought it the weak point of the Birmingham scheme. Mr. Smillie raised a point about the burning of house refuse. Undoubtedly burning was the best way of getting rid of it, but burning was a costly thing. Their cheapest destructor cost 1s. 11d. per ton, whereas they could get it to sea for 1s. 7d. per ton. Then when they burnt the refuse they had the question: What could they do with the clinker? If they could not get rid of the clinker, there was the question of haulage and tips. Mr. Weir had raised the point as to why whinstone paving was not used instead of granite. They found that whinstone setts were slippery. They could get a better dressed whinstone sett and pave closer, but it was no use having a paving, however good and cheap it might be, if it was going to be a nuisance to the user. In reply to Dr. Kerr's question, they had counted each flat as a house. With regard to sewer ventilation there had probably been no question discussed more than sewer ventilation; indeed it had been discussed *ad nauseam*. He would tell them briefly his policy in Newcastle. Where they found that the air in the sewers would not be under pressure they closed all the covers. They did not put up any air-shafts, which were based on wrong conclusions. It was a big question and none of them could attempt to dictate. It was only a matter of opinion, and one could only use one's judgment after experience of a district. In his opinion, what they were doing was the right thing. As to the president's remarks as to two supplies of water, he admitted that it was unusual, but there was no trouble in Newcastle. The trade mains had only been in use for twenty years, and those mains were well known, and connections were only allowed to be made for trade purposes. With regard to the levels where they covered the old chip paving with tar-macadam, where they had from 4½ in. to 6 in. at the kerb it was lowered from 1½ in. to 3 in. They had thus reduced the depth of the kerb and raised the channel. The levels were not quite as good as they ought to be, but there was a very great improvement upon what there had been before.

Mr. Hubert Laws, in reply, expressed his appreciation of the vote of thanks passed to him for his paper. Mr. Roseveare was interested in the keeping of the costs of the work. He could assure him there was a good deal of work in keeping those costs. A careful analysis was taken each week and the work apportioned, a man doing nothing else; but they had been exceedingly useful since in other works. They were actual figures and not estimates. The president had asked why the construction was altered from a cylinder to a monolith quay. He might refer them to a paper read by his predecessor, Mr. Scott. The first section of the cylinder quay walls was recommended by Mr. James Abernethy, and consisted of two rows of cylinders, 25 ft. apart, with an arch thrown over, so it was not a constant cylinder. After the commissioners increased their dredging this structure was not found strong enough. The costs were not so expensive, the quays averaging from £125 per foot run. The next thing was the cylinders in close line. This was a very strong quay, and they could dredge to what depth they wanted. The cost of this cylinder quay amounted to about £220 per lineal yard. His late uncle, Mr. George Laws, and the late Mr. P. J. Messent were asked to make a report in 1888, and after visiting several quay works where they had the monolith quay, they recommended that construction as being cheaper but quite as strong, and capable of being dredged to the required depth of 25 ft., and it had proved very successful. The weight of the monolith empty and the shoe was about 880 tons; the filling amounted to about 500 tons, and the weight of the completed monolith about 1,300 tons. As to the alignment, they did not get them in an exact line, but near enough for their purpose. The quay wall was in a perfect line. Once the monolith had entered into the clay they could keep it well in line. Where there was quicksand there was much greater difficulty in keeping them in line. Some came forward, but none came too far forward. They had no settlements. They had to go through a tremendously heavy clay which would have been a splendid foundation, but it was impossible to stop there because the dredging afterwards would have carried the foundation away.

The members were entertained to luncheon by the Lord Mayor (Alderman J. F. Weidner). In the speeches of the Lord Mayor and Sir W. H. Stephenson high tribute was paid to the great ability and high engineering skill of Mr. Steele.

In the afternoon the members went for a cruise on the river Tyne on the steamer *Sir W. H. Stephenson*, kindly placed at the disposal of the institution by the River Tyne Commissioners. Leaving the fish quay the steamer proceeded up the river as far as the Scotswood Suspension Bridge, the vessel

then turning and proceeding down the river to the North Pier at Tynemouth, where the members landed. On passing the Elswick works of Sir W. G. Armstrong, Whitworth & Co., the members had the opportunity of seeing the fitting out of the largest battleship built on the Tyne. This vessel has been built for the Brazilian Navy, and was launched in January last. They also saw the new naval shipyard and equipment works of Armstrong. To form this yard 4,000,000 cub. yds. of material were excavated and conveyed to sea in a period of two years.

(To be concluded.)

JOHANNESBURG MUNICIPAL WORK.

TOWN ENGINEER'S REPORT.

There are 107 townships within the municipal area of Johannesburg, in extent over 20,585 acres. These townships, which comprise 74,222 stands or plots, contain nearly 674 miles of streets and roads. The area controlled by the council is 81¾ square miles.

In his report for the year ended June 30th last, Mr. G. S. Burt Andrews, M.INST.C.E., M.I.MECH.E., the town engineer, states that during that period just over 12½ miles of roads were constructed, a decrease of about 3½ miles on the previous year. Thirty-five miles of roadway were remetalled, 72,909 sq. yds. formed, and 847,112 yds. of roadway tarred. The work of concrete kerbing and channelling, which is only being carried out in the central area, has been vigorously proceeded with. During the year 27,346 lin. yds. of this class of kerbing and guttering were laid. In addition to this, 12,928 lin. yds. of concrete kerb and gutter, and 31,336 lin. yds. of rough minestone kerb and gutter were laid outside the central area. The work was carried out departmentally, with white labour, at piecework rates.

MAIN DRAINAGE

Main drainage works were continued throughout the year. A portion of the south-eastern section was completed, the work carried out extending over an area of approximately 128 acres. The remaining portion of Braamfontein was completed. The whole of the Malay location was also sewered, and a 12-in. main sewer was laid from the abattoir to the outfall sewer at the Main Reef-road. A 10-in. sewer which was laid from the Vrededorp sanitary intake will also serve as a main sewer for Vrededorp and the Malay location. A number of smaller sewer extensions were carried out, and, wherever sewers were laid, street connections were laid for the drainage of adjoining stands.

The total mileage of sewers laid, inclusive of the main outfalls, at the end of the year was nearly 73 miles. The total mileage of storm-water drains laid at the end of the year amounted to 46½ miles.

The total flow of sewage for the year was 552,337,442 gallons.

ABATTOIR DRAINAGE SUBWAY AND MAIN SEWER.

It was found necessary to provide an independent sewer for the abattoir, and the council voted a sum of £7,100 for a 12-in. sewer to connect the establishment direct with the main outfall sewer, the distance being 1,622 lin. yds. The work, as well as all other sewerage works, was carried out departmentally with white skilled and unskilled labour.

In connection with this main sewer, the whole drainage of the abattoir has been rearranged, and a large drainage subway constructed throughout the length of the abattoir. The length of the subway is approximately 500 ft., is 12 ft. wide and 8 ft. high. All waste from the slaughter halls, as well as all matter dealt with by the by-product plant, will pass through this subway to the manure-pit, where it will be disposed of through the sewers, and will enter the above referred to 12-in. main sewer. Manurial matter will be taken to the high level by a hydraulic lift, and from there it will be carted away. The hydraulic lift, which is designed to carry a load of 4 tons, will also convey to the by-product plant all matter which passes through the subway.

The subway has three lines of light tram tracks for conveying blood and heavy matter direct from the downtakes in the floors of the abattoir buildings. The liquid matter will be drained by gravitation through an open channel in the floor of the subway to the main sewer.

The estimated cost of the drainage subway is £8,850.

WATER SUPPLY.

During the year under review 998,763,250 gallons of water were purchased from the Rand Water Board; 810,703,200 gallons were disposed of, including street watering and water used for flushing out mains, &c. The quantity unaccounted for amounted to 188,089,360 gallons, or 18·73 per cent, against 16·68 per cent the previous year.

It will thus be seen that the percentage of wastage for the year increased by 2·05 per cent, notwithstanding the active measures taken by the council to reduce it. At the end of the preceding financial year the work of the department showed satisfactory results, in so far that the percentage on the previous year was reduced by 2·01 per cent, and it was hoped that a similar reduction would be brought about last year. Unfortunately, the waste-water meters could not be put into use for a certain period of the year, owing to the shortage of the supply. Johannesburg is somewhat exceptional with regard to the measurement of water, owing to the fact that the supply is measured in bulk by means of Venturi meters belonging to the Rand Water Board, and the consumption is measured by some 17,000 meters belonging to the council.

Considerable difficulty occurred with some of the mains in the southern suburbs; one main in particular gave a great deal of trouble. Every effort was made to ascertain the cause of the corrosion, but without success. The corrosion appears to be due to electrolysis, but from the tests made by the tramway and lighting department it is evidently not the cause. Analyses were made at the Government laboratory of the earth surrounding the pipes, the water in the pipes, and the metal, but nothing injurious could be found in either the water or the soil.

ROAD DIRECTION POSTS.

A NOVEL COMPETITION.

A competition for the design for direction posts and plates is announced by the Organising Council of the International Road Congress which is to be held in London next month. The council invite competitors to submit drawings and models of various types of direction posts and plates, with a view to obtaining the means of most effectually indicating the different routes at various junctions, both on rural and urban thoroughfares.

In preparing suggestions it is necessary to study the best size, shape and materials for the posts, also the style and colour of lettering, and any information which, in the opinion of the competitors, the post should contain.

Preference will be given to those competitors who design a direction post and plates that can be best adjusted to suit the varying conditions existing on the roads of this country; that can be cheaply manufactured and maintained, easily erected, soundly constructed, and visible at a sufficient distance. Prizes to the total of £35 will be awarded to the competitors who, in the opinion of the council, proffer the most practical and simple suggestions on the above lines. Free particulars and rules of the competition may be obtained from the hon. secretary, Mr. W. Rees Jeffreys, Queen Anne's Chambers, London, S.W., to whom all models, sketches, memoranda, &c., must be sent not later than June 19th.

Proposed Municipal Crematorium for Tunbridge Wells.—A proposal for a municipal crematorium at the local cemetery was discussed on Wednesday by the Tunbridge Wells Town Council, who instructed the burial board committee to go into details.

British Fire Prevention Committee.—The British Fire Prevention Committee's testing station near Regent's Park, which has been recently extended and altered, was reopened on Wednesday, when the chairman, Mr. Edwin O. Sachs, F.R.S.(ED.), the Earl of Londesborough, K.C.V.O., Sir Henry Tanner, C.B., Mr. Guy Pym, J.P., and other members of the council of the committee, received a large number of the members and visitors, the testing arrangements for the day comprising high temperature fire tests with fire resisting glazing and with fire resisting party wall doors. As heretofore, the committee will issue detailed illustrated reports on the day's testing operations.

Quay Extension Works at Newcastle-upon-Tyne.*

By HUBERT LAWS, Resident Engineer in Charge of Works.

When it is considered that the city of Newcastle owes so much of its prosperity to the river Tyne, it is not surprising that for a long time works of quay improvement have been a very important duty of the corporation. From the twelfth century, and probably even earlier, the conservancy of the river was vested in the corporation, but in 1850 the passing of the River Tyne Improvement Act entrusted the management of the tidal portion of the river, extending from the Bar to the Hedwin Streams, a distance of about 19 miles, to a commission, now known as the Tyne Improvement Commission. At this period the condition of the river was very bad for navigation, there being practically no depth at low water, and the channel having many awkward points and obstructions. It was then a common occurrence for ships to go aground on the various shoals, while vessels

Mr. H. Laws.

[Mr. Laws is a son of the late Mr. Hubert Laws, M.INST.C.E., and nephew of the late Mr. W. Geo. Laws, M.INST.C.E., past-president of the Institution of Municipal and County Engineers. He was a pupil with his father, and on the latter's death entered the city engineer's office, being engaged from July, 1891, until May, 1897, on general municipal work, parliamentary work, quay work, &c. From May, 1897, to August, 1898, he was resident engineer for the Consett Iron and Coal Company, on the Garesfield and Derwenthaugh Incline and Railway and Chopwell waterworks contracts. From August, 1898, to October, 1906, he was resident engineer on the Newcastle Corporation quay works. These works included the Mansion House timber quay, Hamburg and Rotterdam quay, and a 60-ton crane berth quay (concrete monolith foundations), the Dunn-street quay, a ferro-concrete quay at Ouse Burn, the milk market improvement, &c. From October, 1906 to 1911, Mr. Laws was engaged on the quay extension works, east of Ouse Burn, and has since been engineer-in-charge of the quay works, sheds, cranes, and maintenance.]

drawing 18 ft. to 20 ft. could only cross the bar at high water, and it was impossible for any of a greater draught to enter the river.

River and Quay Improvements.

From 1854, however, great improvement works have been carried out by the Tyne Improvement Commission, including the construction of the North and South Piers, the removal of the bar, and formation of a deep-water channel from the sea to the Hedwin Streams, the construction of the Northumberland and Albert Edward Docks, the removal of the old arched bridge at Newcastle, which was a great obstruction to traffic, and its replacement by the present hydraulic swing bridge (opened for traffic 1876), &c. A huge amount of dredging has been carried out, and there is now a depth at low water of from 25 ft. to 30 ft. or upwards from Newcastle to the sea. With these great improvements taking place in the river, and the increase in the size and draught of ships, it became necessary for the corporation to reconstruct their old quays and make extensions. Before the year 1763 the town wall ran along the quay, watergates connecting the town with the river, but in this year it was pulled down. In 1807 an old history describes the quay as "one of the most commodious wharves in the kingdom, since the removal of the old town wall." In 1830 the quay extended from the old Tyne Bridge to the Milk Market, a distance of about 1,500 ft. Between the years 1837 and 1866, under Acts of Parliament of 1837 and 1855, the quay was extended to the east, its total length then being 3,345 ft. These old quays were of light construction, being founded on short timber piles, and the depth at low water in front of them varied from 2½ ft. to 5 ft. They were not of sufficient strength to allow of deep berths being dredged. In 1866 a commencement was made with a permanent type of quay, built on cast-iron cylinders, and this was carried from the termination of the existing quay eastward to the Ouse Burn, while between 1872 and 1879, under the Acts of 1865 and 1870, certain sections of the older quays were rebuilt on cylinder foundations. During this time various sheds were erected, railways laid, and other subsidiary works carried out.

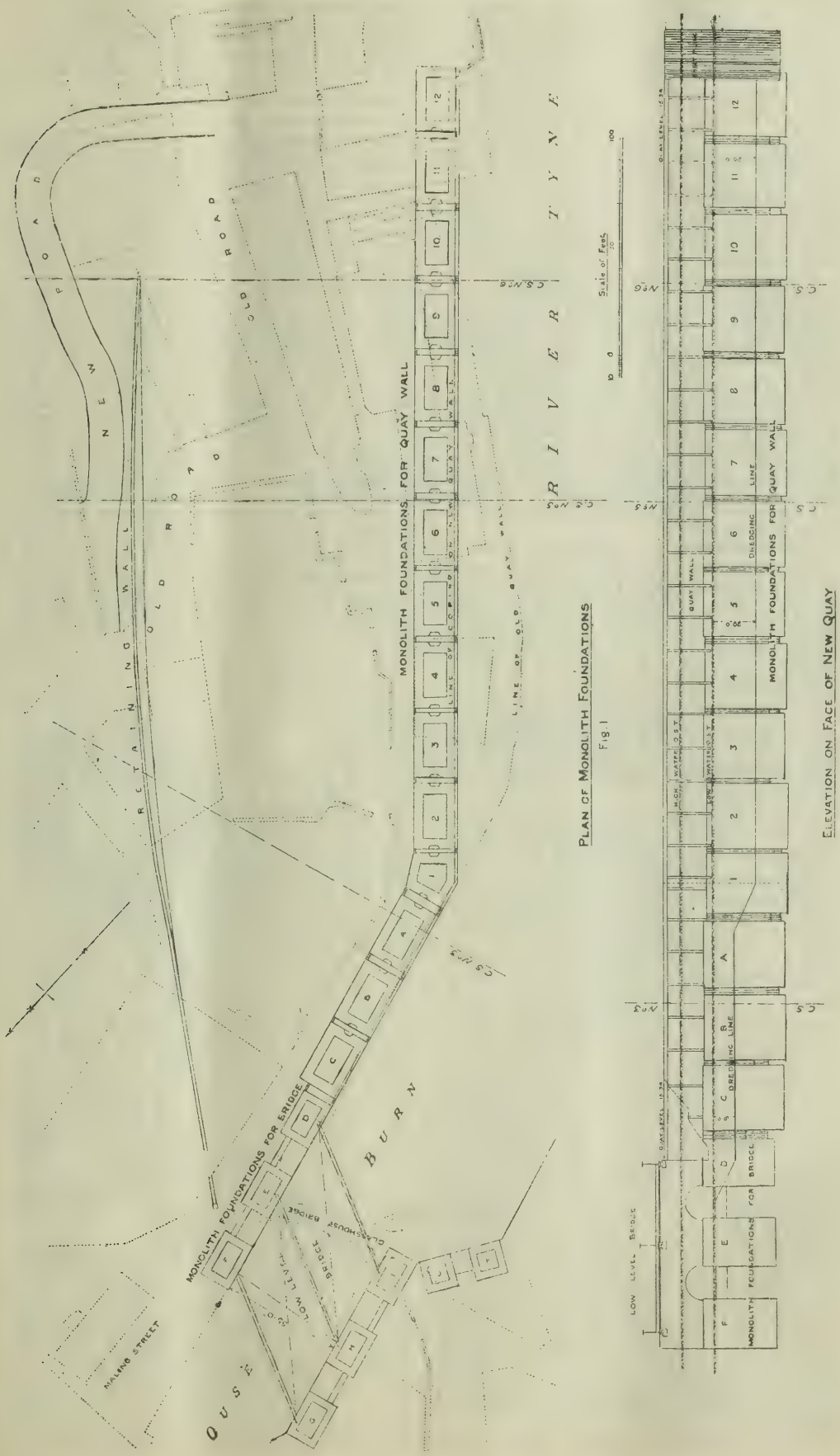
From 1888 to 1902 further sections of the old quay walls were reconstructed on concrete well-monolith foundations, the walls being designed to allow a depth of from 20 ft. to 25 ft. at low water ordinary spring tides. The quay now extended from the swing bridge to the Ouse Burn, a distance of about 4,620 ft., and with the exception of the old London Wharf and another short length of quay on timber piles, was all constructed on cylinder or monolith foundations, the former quays being dredged to from 15 ft. to 20 ft., and the latter to 20 ft. below low water ordinary spring tides. The extreme narrowness of the quay, shortage of berths, and difficulty of coping with the increased traffic being severely felt, the corporation in 1904 obtained an Act granting powers for further improvements and extensions, so as to more adequately deal with the demand for better facilities. By this Act the corporation, in addition to improvement works on the existing quay, were empowered to construct a new quay on the east side of the Ouse Burn, with bridges, railways, sidings, sheds, and other equipment required. The amount sanctioned in the Act for works of quay improvement was £200,000, and for quay extension works £313,000, and it is with the construction of the latter works that this paper will deal.

Quay Extension Works, East of Ouse Burn.

In 1906 the eastern limit of the permanent quay was the west side of the Ouse Burn. The Ouse Burn is a stream which flows in a southerly direction through the city, discharging into the Tyne about ¾ mile east of the swing bridge. The stream is tidal for about ½ mile from the mouth. The Burn, which is narrow in its upper reaches, had here a width of about 50 ft., and was crossed by an old stone arched bridge known as the Glasshouse Bridge, built in the year 1669, and having a span of 43 ft. 3 in., a width of 8 ft. 7 in. between the parapets, and a headway of 9 ft. 11 in. above high water ordinary spring tides. On the east side of the Burn was an old stone quay, built on the foreshore, of irregular line and in a very dilapidated condition. On and behind this quay some very old property existed, including a disused bottle works of ancient origin, the district being the site of the old glass-making trade, which dates back to the time of Queen Elizabeth, and was at one time a very flourishing trade in Newcastle and Gateshead. The ground was of a very irregular nature, rising rapidly to the north, a steep, narrow, zig-zag road, connecting the quay with the main road to the city (Fig. 3). The scheme sanctioned by the 1904 Act included the construction of a deep-water quay on the river front of a length of about 1,130 ft., and a short length of quay in the Ouse Burn, the building of a low-level bridge with a square span of 55 ft. and a width of about 60 ft. over the Burn, with the necessary approaches thereto, the building of a high-level bridge connecting the quay with the City-road by means of an inclined approach road having a gradient of 1 in 35, together with railways, sidings, roads, sheds, cranes, and other equipment required.

In May, 1906, the city engineer, Mr. C. R. S. Kirkpatrick, M.INST.C.E., presented a scheme to the Trade

* Paper read on Friday last at the meeting of the Institution of Municipal and County Engineers at Newcastle-on-Tyne.



NEWCASTLE-UPON-TYNE QUAY EXTENSION, EAST OF OUSE BURN.
(Plate 1.)

and Commerce Committee embodying a portion of the above proposals. This scheme comprised the building of a deep-water quay wall, 360 ft in length, on the river front and 120 ft. long on the east side of the Ouse Burn, a low-level bridge over the Ouse Burn with approach roads, railways and sidings, the formation of a quay about 140 ft. in width, with heavy retaining wall at the back, and new approach road, and building a transit shed 240 ft. in length by 70 ft. in width (Fig. 4). The estimated cost of this scheme was £39,537. The scheme was approved by the council in July, 1906, and negotiations were entered into to acquire certain lands and properties belonging to private owners. These negotiations were somewhat protracted, and the work was considerably delayed owing to the whole of the site not being available at the commencement. It was at first proposed to build the quay on ferro-concrete piles, but on account of the nature of the foundations and the depth of dredging afterwards to be carried out, provision being made for a depth of 25 ft. below low water ordinary spring tides, it was decided that the foundations should consist of concrete well monoliths, 30 ft. by 20 ft. This type of construction had been recommended to the council by the late Mr. W. Geo. Laws, M.INST.C.E., and the late Mr. P. J. Messent, M.INST.C.E., in 1888, and several sections of wall had been successfully built in this manner between 1888 and 1906. The foundations for the quay wall consisted of fourteen monoliths, each 30 ft. by 20 ft., and one monolith 26 ft. by 20 ft., and for the low-level bridge of six monoliths, each 22 ft. by 15 ft., together with two monoliths at the south-west corner of the bridge, each 15 ft. by 15 ft. (Figs. 1 and 2).

PRELIMINARY WORK AND TEMPORARY STAGINGS.

Plans of the works and of the temporary staging having been deposited with the Board of Trade and the Tyne Improvement Commission, and a contract let for the construction of the monolith shoes, a commencement was made on a portion of the work in October, 1906. It was decided that the work should be carried out direct by the corporation, as the previous monolith quays had been, and not let by contract. After the site had been fenced in, the preliminary work of demolishing the old buildings and levelling the ground was proceeded with. The excavated material was sent to sea in hoppers carrying 240 tons each, the cost of waterage being from 6d. to 7¼d. per ton. The materials from the old buildings were mostly sold on the site, though part of the stone was retained for future use.

The temporary stagings for the monolith sinking were next undertaken. Two stagings were erected, the front one being on the river side of the line of proposed monoliths, to carry the cranes to be used in the grabbing operations for sinking the monoliths, and for delivery of cement, gravel and other materials from craft on the river, and the back staging to carry cranes used for concreting, erecting standards and shutters, moving kentledge blocks, &c. The front staging was about 13 ft. wide, and carried on two rows of 12-in. by 12-in. pitch-pine piles spaced 10 ft. centres, and from 50 ft. to 57 ft. long. The deck level of the staging was at about 6 ft. above high water, and a crane track was laid the full length of the staging. Previous monolith sinking on other sections of the quay works had shown the advisability of driving the piles for the temporary staging down to nearly the same depth as that to which the monoliths were to be sunk, as otherwise the ground was apt to become loosened by the sinking, and the piles being disturbed would move out of line or sink, causing trouble with subsidence and movement of the staging. In the present case, in spite of these precautions, the staging moved out of line a trifle during the sinking and also subsided slightly in parts, but the amount was only small, and it was packed up, no damage occurring. The back staging was from 15 ft. to 20 ft. wide, also carried on two rows of piles driven to a similar depth to the front piles, and the ground behind was close timbered to prevent any material being washed out by the action of the tide and causing subsidence of the ground retained. The piles, which were driven to a depth of between 30 ft. to 35 ft. below low water ordinary spring tides, were exceedingly difficult to drive, the ground being very hard almost from the commencement. A large part of the driving was through very stiff boulder clay, and the difficulty of driving the piles to the desired depth foreshadowed the trouble which was afterwards experienced in sinking the monoliths.

While the staging was in course of erection work of excavation and diversions of water pipes, gas pipes and sewers were being proceeded with, and the monolith shoes, straps, timbering and shutters prepared. Between the two stagings, which were placed 25 ft. apart, the ground was excavated to a depth of 4 ft. above low water, and a level bed prepared on which the monolith shoes could be set.

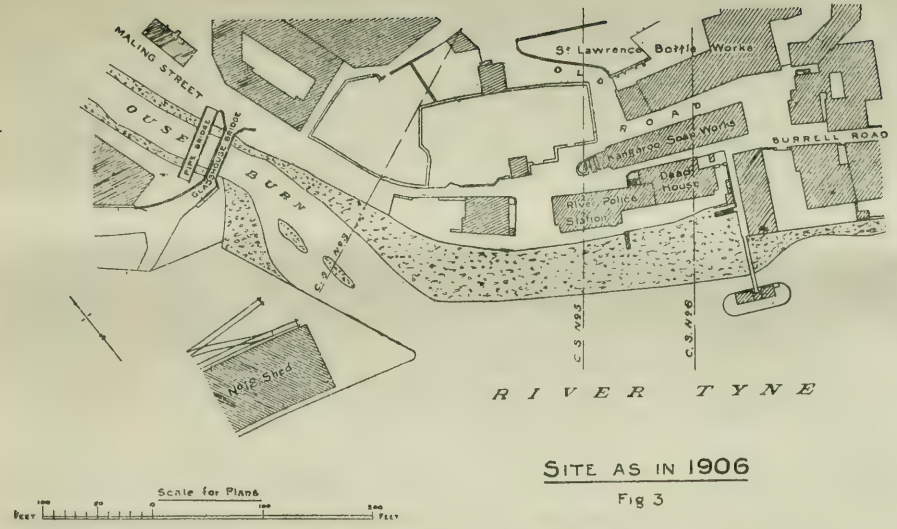
MONOLITH SHOES AND MONOLITH BUILDING.

The monolith shoes (Fig. 11) were made in four sections, the side castings being 27 ft. 5½ in. in length and the end castings 20 ft. 4 in. in length. The cutting edge was of cast iron, 2 ft. 1 in. in depth, with vertical wrought-iron straps riveted on by two 1-in. rivets. After the castings were received on the works they were temporarily bolted together and the straps squared up, after which timber lining, or cleading, was fitted and bolted to the straps. The timber lining consisted of pitch pine planks, from 10 in. to 12 in. wide by 2½ in. thick, laid longitudinally with vertical timbers at every strap 10 in. wide by 2 in. thick. After the timber lining had been fitted on, the four sections of the shoe were taken apart and lowered by cranes on to the bed prepared for them, where they were carefully set. The castings were fastened together by three 1¾-in. bolts at each corner, and, in addition to this, the side and end castings were joined by a sunk fishplate, 14 in. long by 3 in. wide by 1½ in. deep, riveted up with two 1¼-in. rivets. The completed shoe was 6 ft. high and 5 ft. wide across the top, which was the width the walls of the monolith were to be built. The shoe having been set in position, bolted and riveted up and carefully levelled, was next filled with cement concrete (1 part of cement to 5 parts of river gravel, in which the proportion of sand to small stones was about 1¼ to 3¾). After this, standards and shutters were erected and the building of the side walls proceeded with, the shutters being chiefly 4 ft. high, though in some cases they were 3 ft. After each filling of the shutters, sufficient time was given to allow the concrete to set, after which they were raised and another lift of concrete put in.

The work was, of course, tidal, and care had to be taken that the setting concrete was not disturbed by the action of the rising tide, and at the commencement of each concreting the previous work was washed over and roughened on the top. After the monolith had been built to a height of 18 ft., the standards were taken off, and when sufficient time had elapsed to allow the concrete to gain strength the kentledge blocks were put on and the monolith sunk, by the grab or otherwise, until the top was about 6 ft. above low water, when the kentledge was removed, the standards and shutters reset, and the second building proceeded with. The kentledge blocks were cast-iron blocks, part being 1 ton each and the remainder 2 tons each, and had holes cast in the centre to take a lifting key, with special arrangement for fastening and releasing. The second building was about 11 ft. 6 in. in height, making the depth of the monolith 29 ft. 6 in., and after this was completed the same process was again gone through and the monolith sunk a second time. The third, and final, building of 8 ft., making 37 ft. 6 in. in all, was then carried out, and the monolith finally sunk until the toe of the shoe had reached the depth required, which was from 33 ft. to 35 ft. below low water ordinary spring tide. As the ultimate dredging level was to be 25 ft. below low water, this meant that the monolith shoe would be 8 ft. to 10 ft. below this level. Two concrete mixers (Taylor's), one of ½ cub. yd. and the other of ¼ cub. yd. capacity, were used in the concreting, both being electrically driven from 10-horse power motors, and, in addition, hand labour was employed. The ½-yd. mixer was of great service, and 60 cub. yds. to 70 cub. yds. of concrete per day of nine hours could be passed through it, while the small mixer was capable of producing 35 cub. yds. to 45 cub. yds. per day.

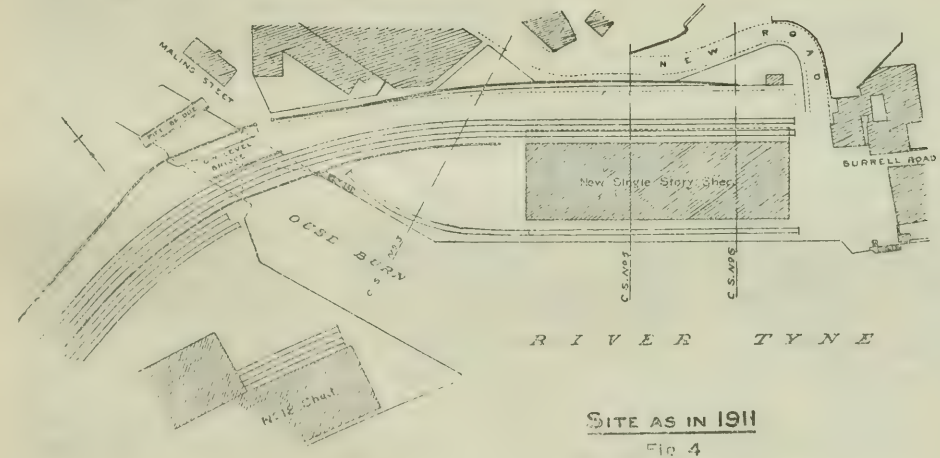
MONOLITH SINKING.

The most interesting and at the same time difficult part of the work was in sinking the monolith foundations. In monolith sinking on previous sections of the quay works the difficulties to contend with had been chiefly in keeping the monoliths to true line and level, as the strata passed through was mainly sand and mud, and the monoliths were very liable to heel over and get out of line. This was guarded against by careful adjustment and readjustment of the kentledge blocks and by the excavation. Trouble was also experienced through inrushes of quicksand, which occurred if the monolith was obstructed in sinking and the excavation carried below the level



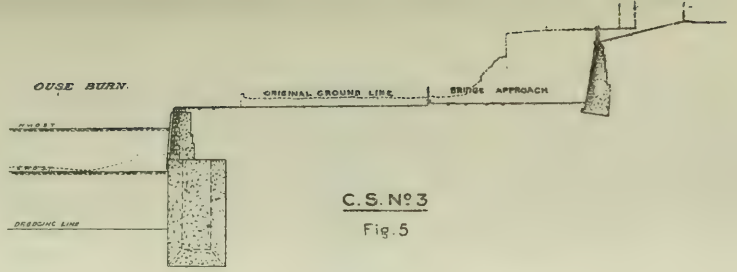
SITE AS IN 1906

Fig 3



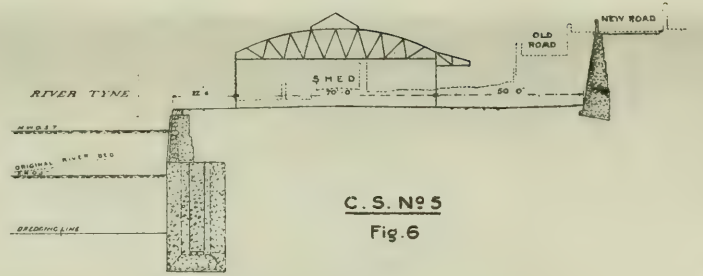
SITE AS IN 1911

Fig 4



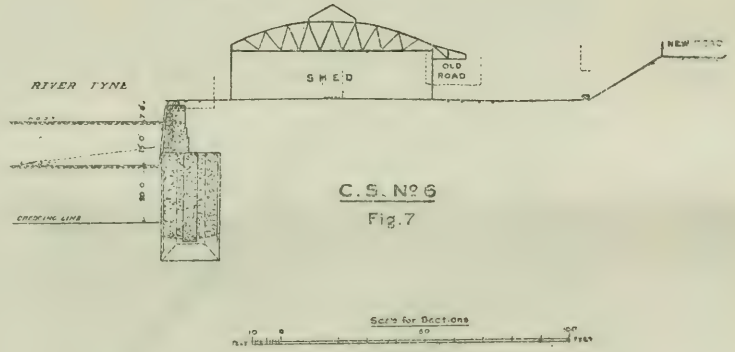
C.S. No 3

Fig. 5



C.S. No 5

Fig. 6



C.S. No 6

Fig. 7

NEWCASTLE-UPON-TYNE QUAY EXTENSION, EAST OF OUSE BURN.

(Plate 2.)

of the cutting edge. These difficulties were, however, overcome by careful working, and the rate of progress of the sinking was fairly rapid, it being a common thing to sink a monolith from 3 ft. to 5 ft. per day. In these cases the monolith sank as the sand was lifted out of the well by the grab dredger, its own weight and the superimposed kentledge being sufficient to accomplish this.

On the present section a totally different type of sinking was encountered, and the rate of progress was necessarily much slower. After the first 2 ft. or 3 ft. a very hard clay was encountered, and the weights of the monoliths and kentledge combined were not sufficient to overcome the stiffness of the ground. The heaviest grab dredgers used (Wild single chain grab dredgers of 1 cub. yd. capacity) made very little impression on the clay, and as the rate of sinking was extremely slow, it was found necessary to pump the water out of the well of the monolith when the tide was low and put men into the well to excavate and loosen the clay beneath the cutting edge. These men worked the whole time the water was clear of the monolith, and when the tide rose again and filled the well the loosened clay, &c., was removed by means of the grab dredgers. This was naturally slow work, as when the monolith was built to its full height of 37 ft. 6 in., during the final sinking, the amount of water to be pumped out of the well was about 50,000 gallons, and this had to be done after the tide had fallen and uncovered the monolith, in certain positions, only allowing a few hours for fixing the pump, pumping out the water, excavating in the well, and removing the pump. Pumping out the water also assisted the sinking, 6 in. to 9 in. being frequently gained by the pumping alone before other operations had commenced.

After the first two or three monoliths had been sunk, the rate of sinking had been so slow, and the clay so extremely hard to excavate, even with the use of pumps and the men working in the wells, that it was deemed advisable to resort to blasting in order to loosen the stiff material. This process proved most successful and was employed in the sinking of most of the remaining monoliths. The method adopted was to pump all the water out of the well and then lower men down in a skip, who drilled holes from 2 ft. to 2 ft. 6 in. in depth at regular intervals in the stiff clay below the monolith shoe. Small charges of gelignite were inserted in these holes with fuses of sufficient length to allow the men plenty of time to be lifted to the surface after igniting the fuses. These shots were fired singly, and by the time a series of charges had been exploded round the shoe a large quantity of material was loosened, and the monolith had generally sunk from 1 ft. to 2 ft., and after the loosened material had been removed would at times sink further.

Chiefly by means of this alternate pumping, blasting and grab dredging the monoliths were all sunk to a depth of about 33 ft. below low water, the great proportion of the excavation being sent to sea in hoppers. The work of sinking was carried out continuously, night and day, the works being lighted at night by electric arc lamps. No great trouble was experienced in keeping the blocks in line and level, though in one or two cases in the first sinking they heeled over considerably, but were righted by the kentledge blocks and careful excavation. The greatest weight of kentledge placed on any monolith was 530 tons, and as the monolith and shoe weighed about 880 tons, there was a total sinking weight of 1,410 tons. In spite of this, the skin friction of the clay on the sides of the monolith was so great that even when the clay was excavated to 7 ft. or 8 ft. below the level of the cutting edge the monolith would not sink until the water had been pumped out and explosives fired.

No. 3 monolith (Figs. 1 and 2) was the first sunk, and the work was then carried eastward, and afterwards, as the land was obtained, westward and up the Ouse Burn. The sinking was extremely hard from No. 3 eastward, but a change took place westward near the corner monolith (No. 1), and the sinking of the monoliths in the Ouse Burn and for the bridge foundations was very much easier, the clay being of a much softer nature. The six monoliths for the bridge foundations (D, E, F, G, H, I, Figs. 1 and 2) were carried down to depths of from 28 ft. 2 in. to 31 ft. 6 in. below low water ordinary spring tides, which was nearly twice the depth originally intended, but the clay and silt passed through here were of too soft a nature to found on, as a very heavy weight of abutment and superstructure was supported by each monolith. However, a sound foundation was found at the depth mentioned, and no movement in these or any of the monoliths afterwards took place. The pumps used in the sinking were a Cornish pump, lifting from 20,000 gallons to 25,000 gallons per hour, and a Pulsometer pump lifting about 7,000 gallons per hour. The cost of sinking, of course, varied according to the depth and the strata encountered, and the final sinking was naturally the most expensive. From 4s. 6d. to 5s. per cubic yard of excavation may be taken as a fair average of the cost, this including all charges and the removal of the material to sea. An average of £5 10s. per sinking foot per monolith would be a very near approximation to the cost.

DIVING AND WELL FILLING.

After each monolith had been sunk to its permanent position divers were sent down, who removed any loose clay or material from under the curb and packed bags of concrete under the curb in any spaces that occurred. The bottom was also levelled up, after which the "hearting," or concrete filling, was put into the well. The concrete, composed of 1 part of cement to 7 parts of river gravel, was lowered through the water in drop-bottomed skips containing from ½ cub. yd. to 1 cub. yd., care being taken to lower the skip slowly and evenly through the water to prevent the concrete being washed. When the skip had reached the bottom the doors were opened by means of a catch worked by a rope from the surface, and the skip gently raised to the surface, leaving the concrete deposited. The filling was kept as even as possible to prevent the cement running into hollows and forming soft deposits which would not set. When the filling was within 2 ft. of the surface, the water was lifted out and the remainder of the hearting filled in from the top. The hearting deposited in this manner was found to be perfectly sound, and, in a few cases, where low-water outlets for sewer diversions have been cut through monoliths filled in this manner, the concrete was found to be extremely good.

KEYWAYS.

(Figs. 8 and 9.)

The monoliths were spaced about 2 ft. 9 in. apart, with a keyway in the end walls, and the spaces at the front and back afterwards closed by means of sheeting piles. The front piles were about 35 ft. long and the back piles 30 ft. long. These piles had to be very carefully driven to prevent material coming into the keyways during excavation. The spaces were cleared out by means of small grabs and by pumping out the water and excavating by hand to a depth of 26 ft. below low water, after which they were filled in the same manner as the wells, very small skips having to be used and the concrete being composed of 1 of cement to 5 of river gravel.

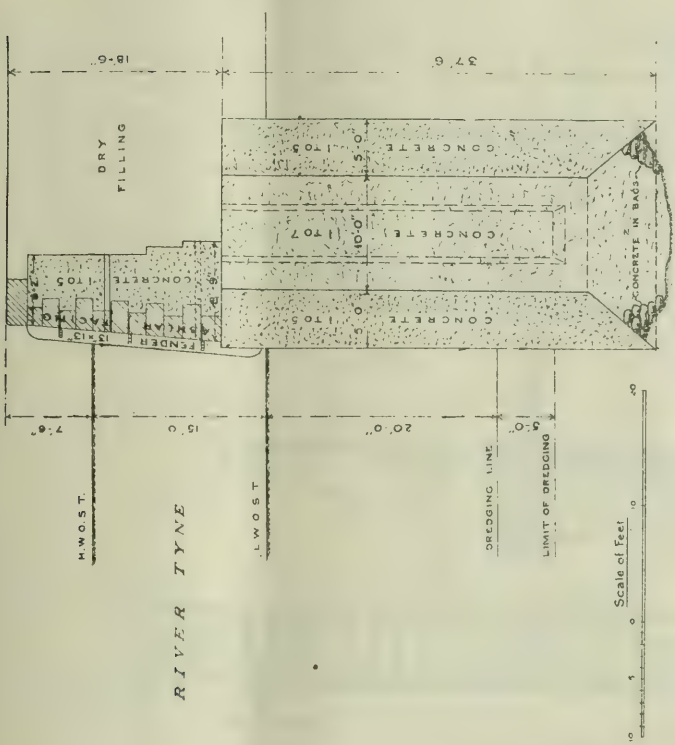
QUAY WALL.

(Figs. 8 and 10.)

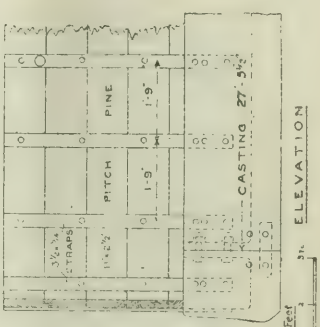
After the monoliths and keyways had been filled the tops were dressed level and the first course of the ashlar wall set. The wall consisted of ashlar facing and concrete backing (1 of cement to 5 of river gravel). The stone used in the wall was coarse-grained sandstone from local quarries, which had been found to wear well on previous works. The face-work was diamond hammered, with a drafted margin 1 in. wide, and had a batter of 1 in 12. The facework was built in alternate headers and stretchers, the stones being of large size and the headers having a bond into the concrete of not less than 12 in. The courses varied in depth from 1 ft. 8 in. in the lower courses to 1 ft. 5 in. in the top course. The wall was about 18 ft. 6 in. in height, and 6 ft. wide at the top and 8 ft. 9 in. wide at the bottom. Fender straps, 3½ in. by ¾ in., were built into the wall, being carried in about 18 in. and turned down 2 in. The fenders were originally intended to have been American rock elm, 13 in. by 13 in. square, and from 18 ft. to 20 ft. long, but on account of the high price of elm, American oak was substituted and appears to be lasting well. They were spaced 15 ft. apart and fastened with six bolts, 1-in. diameter, through three pairs of straps. The wall was finished with a granite coping 4 ft. by 1 ft. 9 in., the stones being jointed to allow a cement dowel 4 in. square, and the full depth being afterwards run in. Fender steps of ¾-in. square iron were fixed in the fenders and hand chains to the coping, and mooring rings of 2-in. diameter metal were fixed to the coping. The space behind the wall was filled with dry ashes and other suitable filling, and weep holes were left through the wall at intervals, rubble being built up at the inlet to each weep hole.

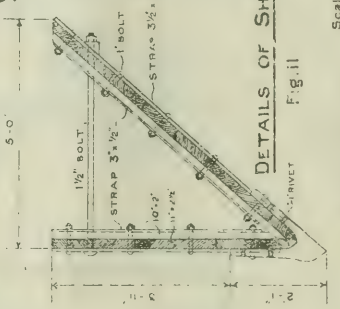
As the filling was put in the timbers of the back stagings were gradually removed, but it was found not to be economical to draw the long poles, the heads of which were sawn off below the surface.

on as the monoliths were completed. While this work was in progress the work of excavation and demolition of old buildings on the land behind, and the building of the heavy retaining wall and diversion

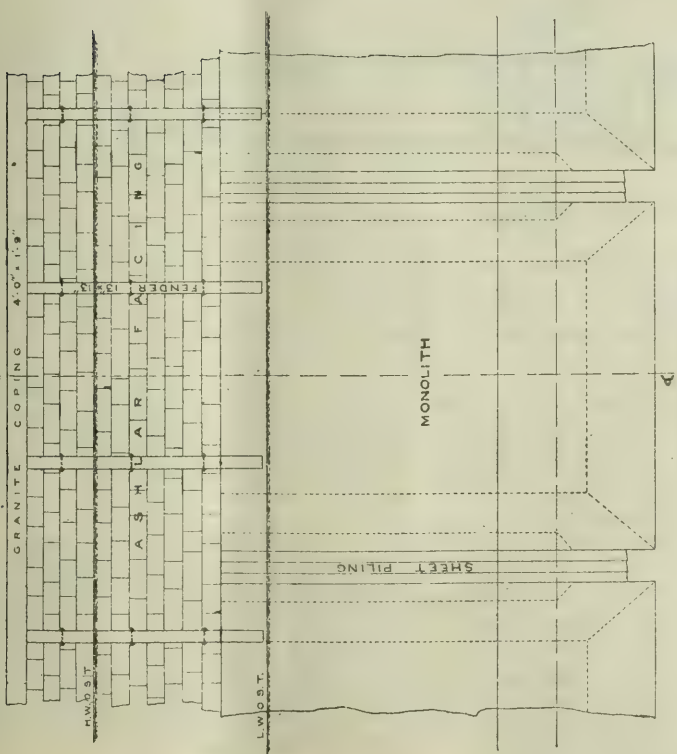


CROSS SECTION A-A
Fig. 10

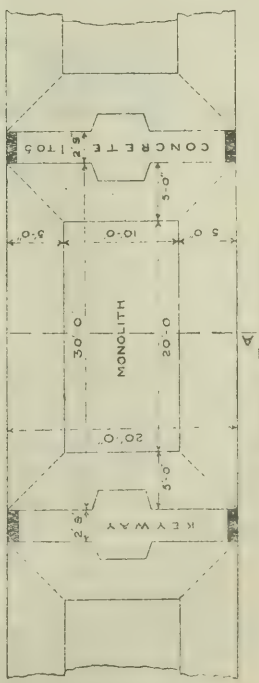




DETAILS OF SHOE
Fig. 11



ELEVATION OF QUAY
Fig. 8



PLAN OF FOUNDATIONS
Fig. 9

NEWCASTLE-UPON-TYNE QUAY EXTENSION, EAST OF OUSE BURN.
(Plate 3.)

These piles proved extremely useful in forming supports for the front of the shed which was afterwards erected.

DEMOLITION OF OLD BUILDINGS, ETC.

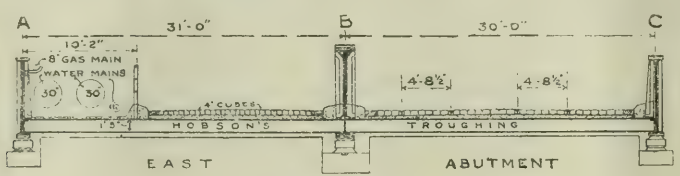
The monolith sinking and wall building were, of course, carried out simultaneously, the wall following

of the road connecting the quay and Burrell-road with the City-road, was also in progress.

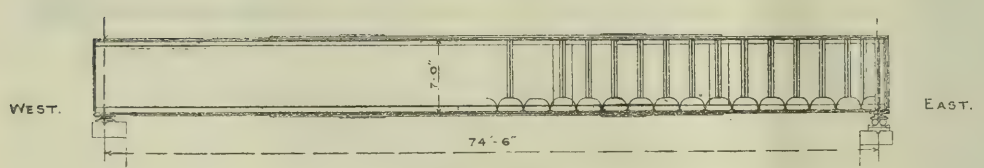
Interesting features in the removal of the old buildings, &c., were the removal of the old Glasshouse Bridge, which was blown down by gelignite, and a large chimney in the bottle works, about 85 ft. high

and very wide in the base, which was also removed by explosives. This chimney was in close proximity to the road and some works and offices in use, and it was therefore impossible to "fell" it in the usual manner. It was also considered unsafe to have men working on the chimney as it was very old; the base was founded on arches, and accidents might have occurred. It was therefore decided to "drop" the chimney direct, and for this purpose eight holes were drilled in the foundations of the arches, spaced equally distant, into each of which was inserted a charge of gelignite. These charges were furnished with electric detonators and fuses and electrically connected up, so that when the current was switched on the charges should explode simultaneously. This was done; the foundations were shattered, and the chimney dropped nearly vertically, no single brick falling without the boundary. The bricks were then removed from the works and excavation proceeded with.

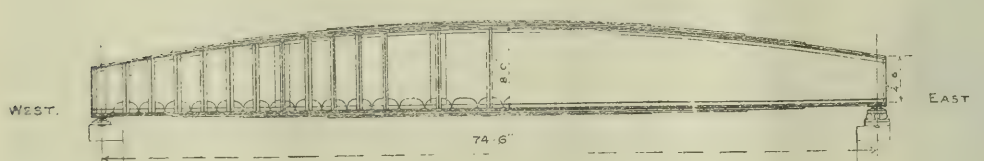
A steel girder bridge, about 60-ft. span and carrying two 30-in. water mains across the Ouse Burn, had also to be removed, and this was effected by erecting a staging on a barge, which was floated under the bridge and lifted by the rising tide until the superstructure of the bridge rested on the platform (the fastenings to the abutments having been removed), when the bridge was carried higher up the stream, where two temporary abutments had been prepared and, as the tide fell, deposited in its new position. It was there used as a temporary footbridge to replace the old Glasshouse Bridge.



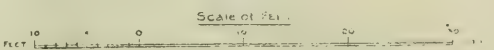
Cross Section.
Fig 12.



Elevation, Girder A
Fig. 13.



Elevation, Girder B.
Fig. 14.



NEWCASTLE-UPON-TYNE QUAY EXTENSION, EAST OF OUSE BURN.

(Plate 4.)

LOW-LEVEL BRIDGE OVER THE OUSE BURN.

(Figs. 4, 12, 13 and 14.)

As previously stated, the low-level bridge was carried on six monoliths, each 22 ft. by 15 ft. These monoliths were spaced 15 ft. apart, and their walls were 3 ft. 6 in. as against 5 ft. in the large monoliths. The shoes were of a lighter section than the large shoes, but of exactly similar pattern. After the monoliths were sunk and filled the abutments were built. The abutments were of dressed stone facework and concrete backing, as in the wall; but in this case the face had no batter. The spaces between the monoliths were arched over, the arches being semi-circular and built of brickwork, five rings thick, in cement mortar, with ashlar voussoirs on the face. Behind the arches concrete walls, 4 ft. 6 in. thick, were carried down to about 6 ft. below low water to retain the ground at the back and the filling. The bedstones for the girders were of granite, and were about 2 ft. deep. The superstructure (supplied and erected by the Cleveland Bridge and Engineering Company, Limited) consisted of three mild-steel plate girders, 76 ft. 6 in. long, with cross flooring of Hobson's patent troughing, 1 ft. 3 in. deep and ½ in. thick. The centre girder was arched, and 8 ft. 4 in. deep, and the side girders straight, and 7 ft. 2¼ in. deep. The bearing plates were of cast steel, those on the west abutment being fixed, and on the east free to move on 8-in. diameter steel rollers. The troughing was filled and covered with concrete, and a dampcourse of rock asphalt mastic, ¾ in. thick, laid over the whole surface. On this the paving, consisting of 4-in. Aberdeen granite cubes, was laid. The southern half of the bridge carries a double railway track of standard gauge, and the northern half a 20-ft. roadway and a 10-ft. space, on which are carried two 30-in. diameter and one 12-in. diameter water pipes of the Newcastle and Gateshead Water Company, and one 7-in. gas pipe. The bridge was afterwards tested by means of four steam cranes travelling on the southern half and two steam rollers on the northern half. The total load was 132 tons 17 cwts., and the greatest deflection at the time of application of maximum load was ⅛ in., there being no permanent deflection.

RAILWAYS, ROADS AND PAVING.

Approach roads on a gradient of 1 in 40 were formed to the bridge on either side of the Ouse Burn, small retaining walls being built to hold up the raised ground. A double railway track was laid, extending the railway on the west side across the bridge and the full length of the new wharf. The rails were of tramway section, 5½ in. deep, with 7-in. flange, and weighed 99 lb. per yard. They were laid on pitch-pine longitudinal timbers, 11 in. wide by 5 in. deep, laid on a concrete bed. The railway and roadway were paved with 4-in. Aberdeen granite cubes, and a 3-ft. 6-in. footway behind was made of concrete *in situ*, with a 12-in. by 6-in. granite kerb.

SINGLE STOREY SHED.

(Figs. 4, 6 and 7.)

The erection of the single storey transit shed, 240 ft. in length by 70 ft. wide, completed the work. This shed, erected by F. W. Cross & Co., Limited, of Walsall, at a cost of £2,425 8s. 7d., was built of steel

The Surveyor
And Municipal and County Engineer.

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columns and roof principals with brick gables and panelling, and steel-framed sliding doors lined with corrugated-iron sheeting. The door openings were 30 ft. wide, three doors 14 ft. 3½ in. deep and 10 ft. wide to each opening, the doors being carried from above by means of 6-in. diameter steel wheels running on a half-round bar carried on steel channels. The roof was composed of galvanised corrugated iron, eighteen gauge, coated on the outside with two coats of bitumastic solution, and a glazed skylight extended along the centre of the roof. The floor was composed of 1½ in. of rock asphalt mastic, laid in two ¾-in. layers on a bed of concrete 8 in. thick. No grit was allowed in the lower layer, and about 20 per cent in the upper layer. The shed was afterwards lighted both internally and externally with electric lamps.

DREDGING AND REMOVAL OF STAGING.

On the completion of the works the temporary staging in front of the newly constructed wall was removed. The decking, beams, wallings, &c., were first removed, after which the piles were drawn by a floating pile-drawing craft, or jib keel, belonging to the Tyne Improvement Commission. So firmly were many of these piles embedded that they were torn in half in the endeavour to draw them, leaving the lower portion still fast in the ground. These broken piles were afterwards removed when a portion of the dredging had loosened the clay around them. The berth was dredged for the corporation by the Tyne Improvement Commission to a depth of 20 ft. below low water ordinary spring tides, 78,110 tons of material being dredged and sent to sea, the cost amounting to about 10¾d. per ton.

PLANT.

The principal plant employed on the works included one 7-ton crane (Smith, Rodley), two 5-ton and one 2½-ton cranes (Stothert & Pitt, Bath), all being capable of travelling, slewing and derricking; one 2½-ton fixed derrick crane, two pile frames with steam winches and boilers complete, three steam pumps, three 1-cub.-yd. grab dredgers, two ½-cub.-yd. grab dredgers, diving pump and complete outfit for two divers, 530 tons of kentledge blocks, two Taylor's patent concrete mixers, two 10-horse power motors, &c. A portion of this plant had been used on previous sections of quay works.

GENERAL.

The total amount of concrete in the monolith foundations amounted to 9,904 cub. yds. in the walls and keyways, and 5,183 cub. yds. in the wells. The concrete in walls cost about 11s. 9d. per cubic yard, and in wells 8s. 6d. per cubic yard. These low costs were much assisted by the low price of materials, cement costing from £1 0s. 9d. to £1 6s. 6d. per ton, and river gravel and sand 1s. 8d. per ton alongside the works. The cement was of good quality, each lot being carefully tested and conformed in all respects to the British Standard Specification. With the exception of the steelwork of the bridge and the transit shed, the whole of the work was carried out by the corporation direct. The work was in every way successful, and though the scheme was considerably enlarged from the original design, was carried out within the estimate. It was found advisable to buy a greater area of land than originally intended, to make provision for the future, and for this there was a supplementary grant. The cost of the land purchased varied from £2 3s. 1d. to £5 13s. 8d. per yard (the latter figure including compensation for trade and buildings). The works were commenced in October, 1906, but the whole of the land required was not obtained till July, 1908. The foundation work and walls were completed in April, 1910, and the transit shed, railways and paving in 1911. The works were carried out by the respective city engineers, Mr. C. R. S. Kirkpatrick, M.INST.C.E., and Mr. W. J. Steele, M.INST.C.E. The author of this paper was resident engineer during the whole of the construction.

APPENDIX I.

Costs of Materials used on Works.

	£ s. d.	£ s. d.	
Castings for monolith shoes	6 2 6	to 6 7 0	per ton
Wrought-iron straps for shoes	10 6	to 12 0	per cwt.
Bolts, nuts, and rivets for shoes	13 0	to 17 0	,,
Steelwork in bridge girders		12 5 0	per ton
Steelwork in Hobson's troughing		12 10 0	,,
Steelwork in columns of shed		11 0 0	,,
Steelwork in roof principals		12 0 0	,,
Kentledge blocks (cast-iron)		3 6 6	,,
Cement	1 0 9	to 1 6 6	,,
River gravel		1 8	,,
Sand		1 8	,,
Aberdeen granite cubes		1 8 4	,,
Pitch pine piles, 50 to 55 feet long	2 1½	to 2 4	per cub. ft.
Ashlar face-work for wall		1 [illegible]	,,
Norwegian granite coping		2 4½	,,
Norwegian granite bed stones		3 1	,,
Asphalt damp course ½ inch thick		3 6	per sq. yd.
Asphalt floor to shed, 1½ inch thick		4 4	,,
American oak fenders		4 5	per cub. ft.

APPENDIX II.

Costs of Completed Work.

	£ s. d.	£ s. d.	
Castings, straps, bolts, &c., for one monolith shoe, 30 ft. by 20 ft. complete	144 10 10	to 151 4 10	
Concrete in walls		11 9	per cub. yd.
Concrete in wells		8 6	,,
Sinking	4 6	to 5 0	,,
Dredging			10¾ per ton
Monolith foundation (complete)		1 14 0	per cub. yd.
Quay wall (complete)		1 12 0	,,
Quay wall and monolith foundation (complete) about		170 0 0	per lin. yd.

ROYAL INSTITUTE OF PUBLIC HEALTH.

PAPERS AT THE PARIS CONGRESS.

The following are among the papers which will be presented to the Municipal Hygiene Section of the congress of the Royal Institute of Public Health, which will be opened in Paris on Thursday next, the 15th inst.:—

"Town Planning in Relation to the Development of Colliery Districts," by A. B. Dunne, M.B., M.R.C.S., medical officer of health of the Rural District of Doncaster.

"Eighteen Months' Experience under Secs. 15, 17 and 18 of the Housing, Town Planning, &c., Act, 1909," by J. Dundas, M.D., D.P.H., medical officer of health for Ramsgate.

"Open Spaces," by Basil Holmes, secretary, the Metropolitan Public Gardens Association, London.

"The Housing of the Working Classes in Cities and Towns," by R. Finlay Heron, town clerk to the Urban District Council of Blackrock, Dublin.

New Baths for Liverpool.—The Liverpool Corporation on Wednesday resolved to erect swimming baths at the Pierhead, at an estimated cost of £70,000.

Leeds Corporation Scores.—At the meeting of the Leeds City Council on Wednesday it was announced that a plot of land near the Shadwell school had been purchased privately for the corporation for under £800, while when negotiating directly the corporation had always been asked £2,000. "It is a great pleasure," said Alderman Clarke, "that for once the corporation have scored."

Assistants' and Students' Section.

Conducted by SYDNEY G. TURNER, Assoc.M.Inst.C.E.

All communications in regard to this page must be addressed to The Editor, St. Bride's House, 24 Bride-lane, Fleet-street, E.C. *Envelopes must be marked "Assistants' Section" in the top left-hand corner. Correspondents are invited to submit questions for consideration and answers to the questions which appear. For the contributions considered to be the most meritorious, one or more premiums in books will be awarded monthly. Diagrams must be drawn to scale on separate sheets, ready for reproduction.*

QUESTIONS.

This week answers are invited to the following questions:—

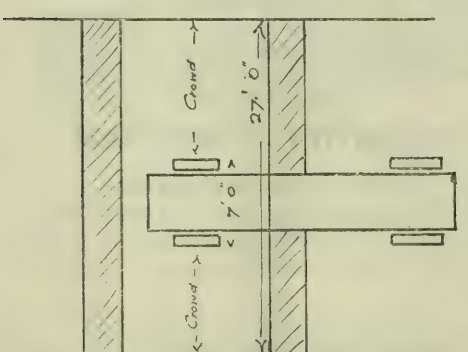
314. Concrete Roof.—It is desired to construct a semi-circular barrel roof in concrete of 50-ft. span, reinforced with expanded metal. Show the dimensions of the supporting walls, which are to be 15 ft. high from the top of the footings. The roof is to be ribbed with an extra thickness of concrete over the piers. (H. V. A., *Clapton.*)

317. Strength of Beam.—A rolled steel I beam of British Standard Section, 12 in. by 6 in., and weighing 54 lb. per foot, is capable of sustaining a load of 15 tons uniformly distributed over a span of 20 ft. What would be the safe load uniformly distributed which could be placed on either half of the lower flange? ("Pupil.")

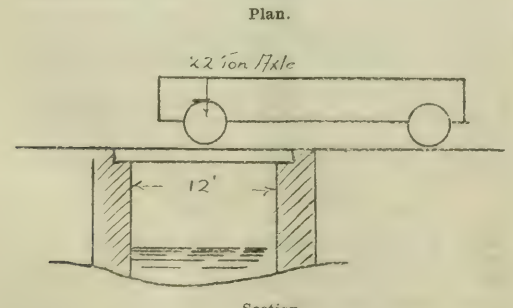
324. Oil Engines.—Assuming two engines of equal horse-power (4-h.p.), one an oil engine and the other a petrol, what would be the approximate cost for running each engine for fuel and repairs? How would the costs compare with each other, including first outlay and oil, repairs, &c.? In regard to efficiency, which engine would be the more efficient from an economic standpoint? ("Griffo.")

325. Air Compressors.—How is the size of an air receiver calculated in connection with an air compressor? Of what thickness of metal would it be made if (1) of cast iron, (2) wrought iron, assuming it had to withstand a pressure of from 15 lb. to 40 lb.? Give any further particulars regarding same. ("Griffo.")

326. Reinforced-Concrete Bridge Design.—Show a suitable design in reinforced concrete, either in a single slab or slab and beams, for a decking to carry a roadway over a bridge; span 12 ft., width



Plan.



Section.

27 ft., cover 9 in. macadam; brickwork abutments. Show the calculations by which the section, steelwork, &c., is arrived at. The maximum live load that can come on the bridge is a 22-ton axle, and the remainder of the bridge covered with a crowd. (G. B. S., *Hove.*)

327. Flow of Sewers.—State the advantages of egg-shaped and circular sewers, and give conditions under which such advantages would occur. Give proofs of velocities and discharge. (D. G. B., *Darlington.*)

[The Editor is at all times glad to hear from readers who desire to submit questions regarding matters of general interest, points of daily practice, &c., for insertion in the "Assistants' and Students' Section." Questions which are published are taken into consideration, as well as other matter, in awarding the Monthly Premium.]

REPLIES TO QUESTIONS.

321. Paving.—What is the correct method of setting out a paved road? Show how to work out the heights and cross-fall for a road 54 ft. wide, to be paved with a camber of 1 in 48 (channels each side are level). (P. G., *Chichester.*)

To set out the levels of a paved road the positions of the gullies and summits in the channels must first be decided upon. An assistant may follow one of two methods—*i.e.*, either make the calculations on the works during progress or prepare in the office beforehand a longitudinal section along each existing channel, showing also existing kerb and back line of footpaths and the heights of any thresholds above this back line. The latter method is the better one of the two because it provides definite information as to what portions of footway and kerbing it is possible to alter in order to give more satisfactory gradients along the channels. It sometimes happens that if the kerb can be altered an extra gulley which would otherwise have to be provided will be unnecessary. The question of altering the footways, however, must in each case be very carefully considered in order to determine whether the extent to which the roadway will be benefited is or is not outweighed by the expense and possible inconvenience of the footway alteration proposed. Another advantage gained by having working sections is that the assistant can in a very short time set up the levels of new gulleys and summits whenever required.

Assuming that sections are being prepared for a wood-paved road, it must be kept in mind while calculating the levels for the new work that the depth of kerb should be 4 in. minimum and 8½ in. maximum, and the channel gradients not less than 1 in 150 (asphalt 1 in 180).

An equation may be given here which will assist in making calculations. Suppose it is required to find the level of the summit S in the sketch, having the gulleys A and B:—

$$S = l + \frac{D + dg}{2g}$$

where l = lower reduced level

D = distance

d = difference between levels

g = gradient

$$\text{then } S = 7{\cdot}59 + \frac{120 + (7{\cdot}72 - 7{\cdot}59)\ 150}{2 \times 150}$$

$$= 7{\cdot}59 + {\cdot}46$$

$$= 8{\cdot}05$$

The distance of the summit, S_1 from B = (S—B) 150 that is 69 ft.

The same equation will hold good when calculating the level of a gulley which is to be placed between two summits whose levels and positions are known; but the plus signs must be changed to minus signs.

Dealing with cross-sections, these are set out where pegs have been fixed representing the new gulleys and summits. Any intermediate sections between these defined levels can be found by using boning sticks in the usual way. The querist refers to a cross-section of a road where the points in the channels are the same level. In this simple case, which, by the way, seldom occurs, the crown of the

road will be half-way between the channels and the height of the crown above the channels to give a cross fall of 1 in 48 will be $\frac{54}{48\times2}=\cdot56$ ft. If the cross fall be 1 in 33, as for wood paving, then $\frac{54}{33\times2}=\cdot82$ ft. For all other cases—*i.e.*, when the channel points are not the same level—the level of the crown can be found by the above equation, as shown when finding a summit.

To complete the cross-section place a peg on each side of the crown and midway between this point and the channels. Calculate the level by multiplying the difference between the channel and crown levels by ·65. Reference should be made by querist to an answer appearing in this column a few weeks ago for further information.

A word of caution is perhaps necessary; care should be taken that gullies are placed as near as possible opposite each other, and that the crown pegs in the cross-sections do not present an excessive zig-zag line on plan. A little adjustment when setting out will mean an improvement in the appearance of the finished surface of the road. (F. E. Y., *Richmond.*)

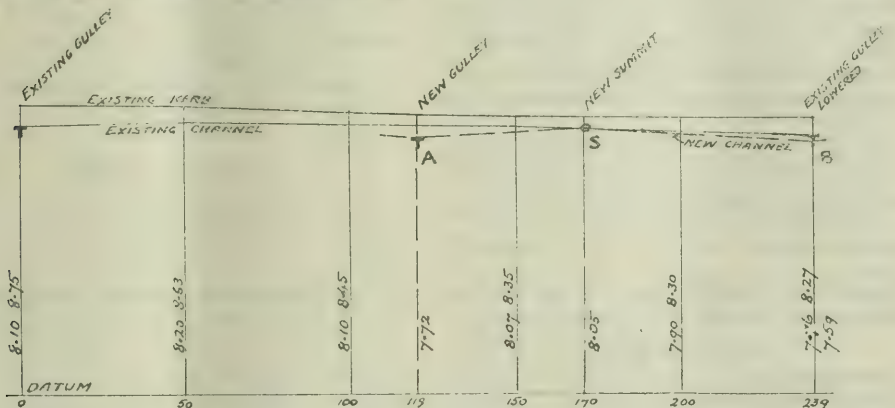


Diagram Accompanying Reply to Question on Paving—Assistants' and Students' Section.

Notes.

"G. W." writes:—In your issue of April 11, 1913, reply to question No. 319, the general expression for loss of head is taken as $\frac{4\,flv^2}{2\,dg}$ where $f = \cdot01$.

The expression is given in Merriman's Hydraulics, page 209, article 86 as $\frac{flv^2}{2\,dg}$ where $f = \cdot02$.

Would you be good enough to explain how the difference arises?

[The value of f in this formula varies with circumstances, and in determining it in any given case consideration must be given to the size of pipe and velocity of flow. According to Sanneson, it will vary between ·012 for a ½-in. pipe when $v=1$ ft. per second, and ·003 for a 3-ft. pipe when $v=15$ ft. per second. It appears, therefore, that a value of ·01 in the answer referred to is a reasonable one to assume.—Ed. Students' Section.]

Godalming Town Hall.—Godalming Town Council discussed on Tuesday rival petitions which have been presented to them, one asking for the demolition of the old town hall, and the other pleading for its preservation. After a long discussion the council resolved not to pull down the building. The town hall was built in 1814 on the site of an earlier building, and historical records show that a Hundred House existed on the spot in 1532.

Drainage Works and Sanitary Fittings.—A third edition, revised and brought up to date, particularly as regards the questions of concrete sewers, sewer ventilation and flushing, and the Public Health Acts Amendment Act of 1907, still further evidences the success of this little manual,* which manifestly deserves the attention and confidence of all concerned in the important subject with which it deals.—*The Bookseller.*

* "Drainage Work and Sanitary Fittings." By Wm. H. Maxwell, Price 2s. nett. London: St. Bride's Press, Ltd., 24 Bride-lane, E.C.

LOCAL GOVERNMENT BOARD INQUIRIES.

The Editor invites the co-operation of Surveyor *readers with a view to making the information given under this head as complete and accurate as possible.*

INQUIRIES HELD.

Cambridge T.C. (April 25th. Mr. Edgar Dudley).—£1,875 to acquire and lay out 5½ acres of land adjoining Vinery-road as a recreation ground for Romsey Town. The town clerk, Mr. J. E. L. Whitehead, stated that there was a provisional agreement for the council to purchase the land which was the subject of the present inquiry for £1,875, which was at the rate of £357 per acre. That was subject to no restriction. The land had been valued at £1,868.

Colchester T.C. (April 24th. Mr. M. K. North).—£1,000 for works of storm-water drainage in and near Maldon-road, £60 for works of sewerage in Mill-road, and £630 for the provision of a travelling crane and weighing machine at the wharf depot.—The borough surveyor, Mr. H. Goodyear, referring to the proposed storm-water drainage, said there had been numerous complaints from residents in the district with reference to flooding on the occasion of exceptionally heavy rains. The existing sewer had been in use for about twenty-one years, and he thought the sewer it was proposed to put in would be ample to prevent flooding, and that it would last for many years. With reference to the works of sewerage in Mill-road, the town clerk, Mr. H. C. Wanklyn, stated that there was a big asylum being built in the district, and the council had got the sanction of the Local Government Board to make new streets there. As to the expenditure of £630 for a travelling crane and weighing machine, Alderman Blaxill explained that a need had been felt for the provision of a more economical means of unloading materials at the Hythe. During five years 23,371 tons of material had been unloaded at the Hythe, an average of 4,674 tons a year. The cost for labour for the year was £175 5s. 6d., an average of 9d. per ton. Under the proposed scheme the cost would be 4d. per ton, and allowing for principal and interest, and basing the quantity of material on the same average, there would be a nett annual saving of £44. The council also thought that all material on delivery should be weighed.

Coventry T.C. (May 2nd. Mr. A. A. G. Malet).—£38,149 for sewage disposal works.—The borough engineer, Mr. J. E. Swindlehurst, told the inspector that no alteration in getting the sewage to the farm or method of treatment was proposed, but it was intended to provide a certain number of bacteria beds. In the loan was also included expenditure on new sewers at Radford and Foleshill. There had been an experimental bacteria bed in operation for a few years, under the supervision of Dr. Bostock Hill, and the results of the experiment were such that the corporation felt justified in making the system permanent as a means of dealing with the increased volume of sewage in consequence of the large addition of population in recent times.

Ledbury R.D.C. (April 30th. Mr. A. G. Drury).—£2,450 for works of sewerage and the construction of sewage purification works.—The sewage will be disposed of by the most modern type of purification works, involving the use of a hydrolytic tank and percolating filters. The engineers are Messrs. Taylor & Wallin, of Newcastle-on-Tyne and Birmingham.

Newport (Isle of Wight) R.D.C. (April 30th. Mr. M. K. North).—£455 and £104 for water supply schemes for Godshill and South Arreton.—It was explained that the application was in respect of the extension of a scheme already begun, and that the parishes concerned favoured the proposal.

Whitehaven R.D.C. (April 22nd. Mr. F. H. Tulloch). —£810 for a water supply for the parish of Gosforth.—The proposal was described as an extension of the Southern Water Scheme, which cost £14,000. The scheme was estimated to cost £620 in 1912, and it was explained that owing to the increased cost of materials since then a revised estimate of £810 had become necessary.

APPLICATIONS FOR LOANS.

Brighton T.C.—£1,600 for the widening of Grand-parade.

Birmingham T.C.—£19,578 for works of paving with granite setts and sewerage.

Coventry T.C. — £1,500 for furnishing the city hospital extension.

Doncaster R.D.C.—£7,535 for a water supply scheme.

Kent C.C.—£3,100 for a new school at Sutton Valence.

Hebden Bridge U.D.C.—£330 for laying sewers.

Hemel Hempstead Joint Hospital Board.—£5,496 for a new hospital.

Leeds T.C.—£4,150 for an infants' school at Beeston.

Leyton U.D.C.—£2,505 for the construction of a sewage tank.

Peterborough R.D.C.—£4,000 for fourteen workmen's cottages.

Shipston-on-Stour R.D.C.—£5,300 for a sewerage scheme.

Swansea T.C.—£2,050 for laying out the cemetery.

Wolstanton U.D.C.—£368 for a cookery centre.

LOANS SANCTIONED.

Ashby-de-la-Zouch.—£4,646 for works of sewerage.

Ashton-in-Makerfield U.D.C.—£19,606 for a sewage disposal scheme.

Battersea B.C. — £12,043 in connection with the electricity undertaking.

Bognor U.D.C.—£1,800 for the erection of twelve cottages.

Colne T.C.—£450 for installing Deacon meters for the detection of waste.

Droitwich T.C.—£1,200 for workmen's cottages.

Eastbourne T.C.—£1,200 for sanatorium extensions.

Maidstone T.C.—£2,000 (to be repaid in sixty years) for the purchase of the ancient tithe barn.

Worthing T.C.—£1,940 for the purchase of property for road widening.

Scarborough T.C. — £1,079 for the erection of bungalows in the South Cliff gardens.

Staffs C.C.—£5,160 for a new school at Leek.

Walmer U.D.C.—£2,330 for sewerage works.

FORTHCOMING INQUIRIES.

MAY.

	£
13.—**Llandrindod Wells.** For the provision of a recreation ground (Mr. Edgar Dudley)	425
13.—**Marston Sicca.** For works of water supply (Mr. W. O. E. Meade-King) ...	850
13.—**Scarborough.** For drainage purposes (Mr. R. H. Bicknell)	1,000
14.—**Abergavenny.** For street improvement works (Mr. Edgar Dudley)	1,260
14.—**Croydon.** For baths, bridge, and road purposes (Mr. A. A. G. Malet)	42,093
14.—**Darlington.** For depot purposes (Mr. R. H. Bicknell)	1,919
14.—**Evesham.** For works of water supply (Mr. W. O. E. Meade-King)	13,499
14.—**Middlesbrough.** For works of paving (Mr. R. H. Bicknell)	3,920
14.—**Peterborough.** For the electricity undertaking (Mr. T. C. Ekin)	7,000
14.—**Pontypridd.** For the provision of a mortuary (Mr. M. K. North)	—
14.—**Thurnscoe.** For works of water supply (Major C. E. Norton)	700
15.—**Blaydon.** For street improvement works (Mr. R. H. Bicknell)	1,450
15.—**Bristol.** For works of street widening (Mr. Edgar Dudley)	6,412
15.—**Calne.** For works of paving (Mr. M. K. North)	500
15.—**Great Yarmouth.** For the electricity undertaking (Mr. T. C. Ekin)	7,750
15.—**Hitchin.** For the purchase of land for an hospital (Mr. F. St. George Mivart)	1,050
15.—**Mansfield.** For sewage disposal purposes (Major C. E. Norton)	3,100
15.—**Upton-upon-Severn.** For a housing scheme (Mr. Courtenay Clifton)... ...	900
15.—**Wycombe.** For a housing scheme (Mr. W. H. Collin)	2,600
16.—**Chesham.** For a housing scheme (Mr. C. H. Eyles)	2,042
16.—**Horsham.** For the provision of a refuse destructor (Mr. T. C. Ekin)	2,000
16.—**Hartshorne and Seals.** For works of water supply (Major C. E. Norton) ...	2,200
16.—**Wells.** For works of water supply (Mr. W. O. E. Meade-King)	4,700
21.—**Stafford.** For the provision of working-class dwellings (Mr. E. Leonard) ...	12,200

CORRESPONDENCE.

For every ill beneath the sun
There is some remedy or none;
If there be one, resolve to find it;
If not, submit, and never mind it.
—ANON., *circa* 1843.

THE PROVISION OF WORKMEN'S DWELLINGS.

To the Editor of THE SURVEYOR.

SIR,—Having accepted the invitation of the president-elect of the Institution of Municipal and County Engineers to submit a paper on "The Housing Question and its Solution," and being desirous of illustrating as completely as possible the efforts of local authorities in various parts of the country in the erection of workmen's dwellings, I should esteem it a favour if my colleagues whose authorities have erected such buildings would loan me photo prints or other plans for exhibition at the coming annual meeting at Yarmouth. Such co-operation among members of the institution would, I feel sure, be greatly appreciated, and would form a very valuable record of work done. So as to reduce the cost of reproduction in the "Minutes of the Proceedings" it is also advisable, when loaning the plans, to state whether printing blocks have already been prepared of such plans, and, if so, where the blocks can be obtained.

As *actual* figures are of the greatest value, I shall be pleased to collate and tabulate information received on the following points: (1) Name of authority erecting houses; (2) number of houses in any scheme; (3) accommodation provided in each house, with size and height of rooms; (4) loan periods; (5) cost per house for building, fences, &c.; (6) cost of land per house; (7) cost of roads and sewers per house; (8) number of houses per acre; (9) details of cost of scheme; (10) expenditure per annum in detail; (11) receipts per annum in detail.—Yours, &c.,

REGINALD BROWN, M.INST.C.E., F.S.I., &C.

Town Hall,
Southall.
May 5, 1913.

London's Tramways. — More trailer tramway cars are to be bought, it was stated at the London County Council meeting on Tuesday, as the tramway system was benefiting greatly from them.

Greenwich Generating Station.—On Tuesday last the London County Council approved an estimate of expenditure on capital account of £82,100 in respect of the provision of two 8,000 k.w. steam turbo-generators, and the provision and laying of condensing water pipes, in connection with the extension of the plant at the Greenwich generating station. At the same time, subject to certain conditions, the tender of the British Westinghouse Electric and Manufacturing Company (Limited), to supply and erect the two generators and auxiliaries for £50,532, was accepted.

Municipal Work in Progress and Projected.

The Editor invites the co-operation of SURVEYOR *readers with a view to making information given under this head as complete and accurate as possible.*

The following are among the more important projected works of which particulars appear below: Buildings—Darwen, Glasgow, Taunton; housing and town planning—Dundalk; roads and materials—Birmingham £18,538, Holland (Lincs); sewerage and sewage disposal—Belper, Darlington £32,400, Trowbridge £16,500; water, gas and electricity—Belper, Bideford £20,000, Winchcomb £17,000.—Particulars of other works projected will be found on our "Local Government Board Inquiries" pages.

BUILDINGS.

Belper R.D.C.—Plans and estimates of a bridge, over the Derwent at Allestree, in iron or concrete, are to be prepared, and the surveyor, Mr. R. C. Cordon, has received instructions to make a survey of the site, take levels and soundings, and invite designs from constructional engineers. The span will be 100 ft., with a width of roadway of 15 ft.

Blackpool T.C.—The tender of Messrs. W. Eaves & Co. has been accepted for the erection of a tramway shelter opposite the Hippodrome, and it has been agreed to erect another shelter at the corner of Devonshire-road and New-road. The estimated cost of both structures is £130.

Bradford T.C.—The scheme for crossing the Aire Valley at Esholt in connection with the Bradford sewage works, and adopted at the last meeting of the council, when additional arches were added, having received the approval of the Local Government Board, it has been decided to instruct the joint engineers (Messrs. James Watson and Garfield) to prepare the necessary contract drawings, plans, and specifications.

Darwen T.C.—A committee have been appointed to inspect public baths in various towns with a view to the adoption of the Baths and Washhouses Acts in Darwen.

Glasgow T.C.—The Municipal Buildings Committee recommend that the author of No. 3 design for the extension of the municipal buildings be appointed architect and entrusted with the carrying out of the work.

Ivybridge U.D.C.—The plans of the proposed new water supply, prepared by Mr. H. Francis, of Plymouth, have been approved, and tenders are to be obtained as soon as arrangements have been made for obtaining possession of the land. It is expected that the works, which include the construction of a reservoir on Harford Moor, will take about two years to carry out.

Middlesbrough T.C. — The new Archibald council schools were opened last week. The schools will accommodate 1,400 children, and have cost approximately £15,000.

Penge U.D.C. — The Education Committee have decided to use Konis for dust prevention in their schools.

Portadown U.D.C.—An appeal has been made to the Road Board for a grant in aid of the widening of Portadown bridge.

Rawtenstall T.C.—Extensions to the public library are to be carried out at a cost of £1,000.

Shropshire C.C.—The Road Board have made a grant of £1,350 towards the cost of the new bridge over the Severn at Cressage.

Southampton T.C.—The provision of a coroner's court and the necessary offices, including a post-mortem room, has been referred back to the Health Committee.

Taunton T.C.—The council have generally accepted the proposal for the provision of a town hall by combination with the Market Trustees, and left the details to be worked out by a joint committee of the council and the trustees.

West Hartlepool T.C.—The tender of Mr. R. J. Marshall, of Hartlepool and West Hartlepool, at £4,333, has been accepted for the erection of a swimming bath on the sea banks between the town and Seaton Carew. The building will be 144 ft. long and 67 ft. wide. The actual bath will be 100 ft. long and 40 ft. wide. On one side will be thirty-three dressing-boxes, while the other side will be arranged to accommodate spectators at swimming galas, &c. The water will be pumped from the sea and heated.

Woolwich B.C.—The surveyor, Mr. J. Rush Dixon, M.INST.C.E., has received instructions to carry out alterations, repairs and painting at the Woolwich and Plumstead baths, at a cost of £281.

HOUSING AND TOWN PLANNING.

Birmingham T.C.—A motion has been adopted in favour of an inquiry "into the housing conditions in the poorer parts of the city, and the way in which they can best be improved."

Coleraine U.D.C. — A tender at £2,441 has been accepted for the erection of workmen's houses.

Coventry T.C.—The Local Government Board have written to the council stating that housing accommodation for some 500 persons should be provided in Coventry, apart from the Narrow-lane housing scheme. They accordingly suggest that the council should draw up a housing scheme making provision for the erection of 100 working-class dwellings, or of a number of cottage flats providing suitable accommodation for an equivalent number of persons, the site or sites of the dwellings to be approved by the board, and, if possible, to be within 1 mile of the area affected by the improvement.

Dundalk R.D.C. — A housing and improvement scheme estimated to cost £28,700 has been adopted.

Lurgan U.D.C. — The tender of Mr. William McKinney, at £8,775, has been accepted for the erection of fifty-four workmen's houses.

Padstow U.D.C.—The investigation made by Mr. C. H. Eyles, Local Government Board inspector, into the local housing conditions, has resulted in the sending of a letter by the board informing the council that it will be desirable to start a housing scheme with the provision of eight cottages. The council have appointed a sub-committee to go into the matter.

Southwick U.D.C.—Amended plans for a town-planning scheme have been prepared by the surveyor, Mr. George W. Warr, and are under the consideration of the Sanitary Committee.

PARKS AND OPEN SPACES.

Eastbourne T.C.—It has been agreed to purchase for £2,638 land to be utilised as a playground for children in the Old Town.

Godalming T.C.—Mr. C. H. Master, a former high sheriff of Surrey, has offered £2,000 to the council for laying out Ram Corner as a garden. The site was until recently occupied by business premises, and had for many years been the narrowest point on the main road between London and Portsmouth, and was well known as a danger-spot for traffic.

Harrogate T.C.—Station-square is to be laid out ornamentally at a cost not exceeding £100, and used exclusively as an open space.

REFUSE COLLECTION AND DISPOSAL.

Chorley T.C. — The annual report respecting the destructor shows that 7,307 tons of refuse have been dealt with, an increase of 391 tons. There were 7,624 lb. condemned meat and offal dealt with, and 201 dogs and 101 cats cremated. The total cost per ton for destroying the refuse for furnace and feed men's wages only was 13·33d. Some 653 tons of mortar were sold, yielding £115 nett, broken clinker had realised £79, scrap tin and light scrap iron £62, fish guano £280. The total sales of by-products amounted to £692, an increase of £125.

ROADS AND MATERIALS.

Birmingham T.C.—The Public Works Committee have been authorised to pave a number of streets with granite at a cost of £18,538.

Cardiff T.C.—The relaying certain thoroughfares with wood blocks has raised the issue of direct *versus* contract labour, and on Monday last the council ap-

pointed a committee to make inquiry in other towns on the subject.

Devonport T.C.—A widening scheme for Tavistock-road is to be carried out at an estimated cost of £5,500.

Droitwich T.C.—In order to obviate the danger of flooding it has been agreed to raise the level of the High-street to its original height. The work will also entail the raising of the sewer and the gas and water mains.

Eastbourne T.C.—The council have decided to persist in their refusal to allow the postal authorities to erect wooden telephone poles in the principal streets. They express regret that this attitude has been made a pretext for delaying the installation of telephones to private houses, and call upon the authorities either to lay underground cables or erect ornamental steel poles.

Edinburgh T.C.—The Streets Committee recommend the widening of Broughton-road on the north side, at an estimated cost of £800.

Exeter T.C.—The city surveyor, Mr. T. Moulding, has been instructed to proceed as soon as practicable with the demolition of the unoccupied properties in Bartholomew-street West and Blackboy-road, and the widening of the street adjoining the sites.

Hackney B.C.—The council have accepted the tender of the Acme Flooring and Paving Company, at £10,445, for the carriageway wood paving at Upper Clapton-road and Clapton Common (from Mount Pleasant-lane to near Braydon-road), Amhurst-road (from Brett-road to Dalston-lane) and Dalston-lane (from Pembury-road to Mare-street). The tender of Mr. George J. Anderson, of Poplar, amounting to £2,000, has also been accepted for excavation and supply of hard-core foundation to the carriageway in Amhurst Park, and that of Mr. George Porter, Clapton, for £490, for excavation and hardcore foundation to the carriageway in Ridley-road, from Birkbeck-road to Dalston-lane. For the resurfacing of the carriageway with Trinidad asphalt macadam at Amhurst Park and Ridley-road the tender of Mr. H. V. Smith & Co., Limited, Westminster, was accepted at 5s. 6d. per yard super.

Hebden Bridge U.D.C.—The surveyor, Mr. T. Waddingham, has been instructed to report upon the condition of certain streets to the Highways Committee.

Henley T.C.—It has been decided to relay Reading-road with Tarmac.

Holland (Lincs) C.C.—It has been agreed to spend £2,725 on the Fleet, Gedney and Moulton main road, provided a grant is received from the Road Board, and, failing that, that £1,000 be spent on strengthening the road from Granite House, Gedney, to Long Sutton boundary.

Kanturk (co. Cork) R.D.C.—A resolution in favour of a scheme of road improvement has been passed by the council. It refers to the steam rolling of the Lismore to Killarney road for a length of 11 miles. The estimated cost is £5,127, half of which will be contributed as a free grant by the Road Board, quarter by the county at large, and quarter by the Kanturk Council.

Lewisham B.C.—The General Purposes Committee recommend the council to contribute a further sum of £3,083 for the widening of Bromley-road, the work in connection with which is to be carried out by the London County Council for tramway purposes.—The surveyor, Mr. E. van Putten, has been authorised to proceed with the work of paving Sydenham-road from Bell Green to Kent House-road with slag tar-macadam.

The Works and Highways Committee have accepted an offer of Tarred Granites, Limited, to supply the necessary tar-carpeting material for paving an area of about 1,550 yds. on Blackheath at 1s. 5½d. per yard super., the council supplying the necessary labour and giving the whole a coat of tar and granite chippings late in the summer. The company state that this offer is made solely with the object of demonstrating the efficiency of their material. It is agreed that the payment for the material shall be deferred for twelve months, and that it shall be conditional upon the work wearing to the satisfaction of the borough surveyor.

Norfolk C.C.—The Road Tarring Joint Committee appointed by the Eastern and Western Highways Committee having considered schedules of roads in the Eastern and Western Divisions of the county, which the county surveyor, Mr. T. H. B. Heslop, proposes should be tar-painted during the season 1913—viz., 100 miles 3 fur. 157 yds. of roads—recommended that the work, the cost of which amounts to £4,419, be carried out. This estimate did not include the council's proportion of the cost of tarring those sections of road dealt with under the Road Board grants.

Northumberland C.C.—Alderman Bainbridge, on behalf of the Highways Committee, stated at a council meeting last week that they were anticipating a contribution from the Road Board at the rate of 3d. per square yard—namely, £6,500. In addition, an application had been made in respect of the improvement of roads and dangerous corners. They asked £4,607. The Road Board had promised exactly half. In regard to the question of traffic, the experience of Northumberland was similar to that of Hampshire. The increase in the cost of upkeep was exactly in ratio to the Acts of Parliament that had been passed. The coming into force of the Locomotives Act meant, in Hampshire, that the expenditure went up from £40,000 to £69,000, and in Northumberland from £39,000 to £63,000. When the Motor Car Acts came into operation the cost went up to £91,000, while in Hampshire it went up to £101,000. £10 per mile was the assistance they got from the Road Board at the present moment. In thirty-eight different districts the traffic had been taken in two different weeks, and in a year or two they would be able to locate, to a certain extent, the heavier traffic of the county.

South Shields R.D.C.—It is proposed to construct a new road from Hedworth to the Newcastle and Shields turnpike at the foot of Primrose-hill and opposite to the existing road to Monkton and Jarrow.

Worcester T.C.—Repairs and widenings are to be carried out in several streets, and the Road Board have promised a grant of £1,000 towards the cost of tarred-macadam surfacing.

SEWERAGE AND SEWAGE DISPOSAL.

Barnard Castle U.D.C.—Arrangements have been completed for the construction of a new sewer, and also a new water main.

Belper R.D.C.—The surveyor, Mr. R. C. Cordon, has received instructions to prepare plans and estimates for sewerage and sewage disposal works, for part of the parishes of Smalley and Denby.

Birmingham T.C.—The Public Works Committee have been authorised to extend the sewers from Blakesley-road, along Clement's-road, Yardley, at an estimated cost of £1,040.

Chelsea B.C.—In view of the fatal accident which recently happened in a sewer, and of the increasing danger to sewermen from petrol and other gases in sewers, the borough surveyor, Mr. T. W. E. Higgens, ASSOC.M.INST.C.E., recently suggested that it was desirable to obtain a self-contained breathing apparatus for use in emergencies. The council agreed with the suggestion, and the necessary apparatus is to be obtained at an estimated cost of £19.

Darlington T.C.—The borough surveyor, Mr. T. Winter, has prepared a sewerage scheme which is estimated to cost £32,400.

Hereford T.C.—It has been decided to allow the Hay Urban District Council three months' grace before applying for an injunction in regard to the disposal of Hay sewage, which, it is alleged, is now entering and polluting the river Wye.

Kidderminster T.C.—A letter has been received from the Local Government Board relative to the recent inquiry held at Kidderminster concerning the proposal of the council to borrow £13,500 for extensions of its sewage farm. The letter stated that the Local Government Board learned from the report of the inspectors who held the inquiry that the land proposed to be purchased—two farms from the Earl of Dudley—together with the farms already held by the council for the purposes of sewage disposal, comprised an area of 868¼ acres, but that under arrangements which had been made with Worcestershire County Council and Bewdley Town Council less than half the land was proposed to be used for the purposes of irrigation. The scheme was therefore open to criticism, not only on account of the heavy expenses involved, but also because a very large area of surplus land would be left on the Kidderminster Council's hands. The council are advised to consult engineers as to the practicability of an alternative scheme, and also as to the provisional arrangements already made with respect to the best means of preventing the works from being a nuisance.

Leyton U.D.C.—The surveyor, Mr. E. H. Essex, has prepared drawings for an additional tank at the sewage disposal works, and it has been decided to carry the work out at an estimated cost of £2,505 including royalties.

St. Columb R.D.C. — Improvements estimated to cost £300 are to be carried out at the sewage farm.

Stirling C.C.—A drainage scheme for the special Cowie district, estimated to cost £2,350, has been approved.

Trowbridge U.D.C. — It is proposed to make provision at the sewage disposal works for dealing with five times the average dry-weather flow, this average being 500,000 gallons in twenty-four hours. The estimated cost of the scheme is £16,500.

Uckfield U.D.C.—The tender of Mr. T. Parker has been accepted for work of sewer extension at Crowborough.

WATER, GAS, AND ELECTRICITY.

Banffshire C.C.—Gaugings of the proposed new water supply for Findochty from the Hill of Maud have proved satisfactory, and application for a wayleave is to be made to the Seafield Trustees.

Barrow-in-Furness T.C.—The council have approved of a scheme to build supplementary gasworks at a cost of £65,000. This will include the purchase from the Furness Railway Company of 5¼ acres of land, costing £2,500.

Belper R.D.C. — Tenders are to be advertised for for the Mapperley water supply scheme.

Bideford U.D.C.—The waterworks are to be enlarged at an estimated cost of £20,000.

Birmingham T.C. — A report has been adopted authorising the Electric Supply Committee to proceed with the erection and equipment of a new power house at Nechells, the equipment of sub-stations, and the provision of underground mains, the total cost of which will ultimately amount to half a million of money.

Blackburn T.C. — The council have voted £7,000 from the gas and tramway profits to relieve the rates.

Cirencester U.D.C. — It has been agreed to instal an electrical recorder at the pumping station for ascertaining the depth of water in the reservoir. The estimated cost, including poles and wires, is £157.

Falkirk T.C.—The electric generating station has been enlarged, and new plant purchased at a cost of £6,000.

Kelso T.C. — The Duke of Roxburgh has agreed to allow water for the supply of the town being taken from the Heatherhope Burn before the completion of the reservoir now being constructed there. Under this arrangement the water supply will be available within the next fortnight.

Kilsyth T.C.—The council having decided to construct a tank near Allanfauld to hold 170,000 gallons of water, Sir Archibald Edmonstone, Bart., of Duntreath and Kilsyth, has intimated that he will give the ground and necessary wayleaves free of charge.

Lanark C.C.—The Middle Ward District Committee have obtained powers for the construction of new waterworks. The area of the ward is about 260 square miles, and according to the plans submitted there will be a pipe line about 26 miles long.

Nottingham T.C.—The corporation gas undertaking shows a profit of £72,500 for the past year, and £39,000 of that amount is to be used for the relief of rates. The tramway profits permit the allocation of £19,000 to the rates, and those of the electricity department £8,000.

Oswestry T.C.—It has been decided to lay a new water main connecting with the reservoirs at an estimated cost of £1,425. The question of effecting improvements to the present reservoirs has been referred back to the Water Committee.

Winchcomb R.D.C.—Plans and specifications have been approved for a water scheme from Lidcombe Wood, on the estate of Lord Elcho, to supply several parishes. The estimated cost is £17,000.

MISCELLANEOUS.

Scarborough T.C.—The Board of Trade have given their sanction for the construction of a bathing shelter, a sea wall, promenade, and two slipways, and to the formation of a bathing pool or open-air swimming bath, in the South Bay, at Scarborough, subject to the work being carried out within five years. The borough engineer, Mr. H. W. Smith, has prepared plans of the proposed open-air swimming bath, but for the moment the corporation are staying their hands.

PERSONAL.

Mr. F. Feather, surveyor and inspector to the Shoeburyness Urban District Council, has resigned.

Mr. George Puddephatt has been appointed surveyor to the Clayton West (Yorks) Urban District Council.

Mr. J. Baldry, surveyor and inspector to the Leiston (Suffolk) Urban District Council, has sent in his resignation.

Mr. Frank Horbury, of Burnley, has been appointed surveyor of highways to the Ashby-de-la-Zouch Rural District Council.

Mr. W. H. Makepeace, sewage engineer to the Stoke-on-Trent Town Council, has had his salary increased to £350 per annum.

Mr. H. J. Jackson, inspector and surveyor to the Ware Rural District Council, has had his salary increased by £50 a year.

Mr. S. P. Andrews, borough surveyor of Faversham, has been voted an increased salary of £50 a year for the ensuing two years.

Mr. John Ashurst, assistant borough engineer and surveyor of Luton, has been appointed city surveyor of St. Albans at a salary of £300.

Mr. T. Charles, formerly engineer and surveyor to Harrow-on-the-Hill Urban District Council, has been elected chairman of that authority.

Mr. H. J. Parker, assistant road surveyor to the Settle Rural District Council, has been appointed road surveyor to the Kettering Rural District Council.

Mr. Herbert Crabtree, second assistant in the office of the borough engineer of Colne, has been appointed surveyor to the Llandrindod Wells Urban District Council.

The late Mr. William Weaver, for over forty years borough engineer of Kensington, and a past-president of the Institution of Municipal and County Engineers, left property valued at £8,330.

CENTRAL COMMITTEE ON ROADS AND ROAD TRAFFIC.

A meeting of the Central Committee on Roads and Road Traffic was held at Caxton House, Westminster, on Wednesday. Lord Belper (County Councils' Association) was in the chair, and the following were present: Colonel R. E. Crompton, C.B. (Royal Automobile Club), Mr. A. T. Davis (County Surveyors' Society), the Right Hon. R. C. Munro Ferguson, M.P. (Convention of Royal Burghs), Mr. W. Rees Jeffreys (Road Board), Mr. Wallace E. Riche (Roads Improvement Association), Mr. E. Shrapnell-Smith (Commercial Motor Users' Association), Mr. A. Spurrier (Society of Motor Manufacturers and Traders), Mr. F. Wilde (Automobile Association and Motor Union) and Mr. G. Montagu Harris (hon. secretary).

The committee approved the following resolutions, passed by the Highways Committee of the County Councils' Association:—

"(1) *Classification.*—The Road Board should be responsible, after consultation with the local highway authorities, for making a classification of roads on a scheme to be laid from time to time before Parliament, and such classification should include (*a*) trunk roads, (*b*) main or primary roads, (*c*) other roads which might, if thought fit, be further sub-divided."

"(2) *Cost.*—Government grants should be given in respect of classes (*a*) and (*b*); such grants should amount to at least one-half the cost of maintenance in the case of class (*b*), and a larger proportion in the case of class (*a*) on a certificate being given by a Government superintendent that the roads have been properly maintained by the local authorities."

The committee decided to collect information which would assist the Road Board in drawing up a scheme of classification of roads, and for this purpose appointed a sub-committee consisting of Colonel Crompton, Mr. A. T. Davis, Mr. Munro Ferguson, Mr. Shrapnell-Smith and Mr. Wallace E. Riche.

FOR OTHER ADVERTISEMENTS

See End of Paper.

TOWN PLANNING ASSISTANTS.—Required a Junior Assistant, who must be a neat draughtsman, in the Town Planning Department of the City Engineer and Surveyor's Office, Sheffield. Salary £90 per annum.

Also an Assistant, who must be a neat draughtsman, good surveyor and leveller, at a salary of £120 per annum.

Applications to be sent in not later than May 20th, together with copies of not more than three testimonials, on Forms to be obtained from the City Engineer and Surveyor, Town Hall, Sheffield.

(434)

BURNLEY RURAL DISTRICT COUNCIL.
SECOND ASSISTANT SURVEYOR.

The above-named Council invite applications for the appointment of Second Assistant in the Engineer's and Surveyor's Department. The person appointed must be a good draughtsman and have had practical experience under the Private Street Works Act, 1892.

Age between 21 and 24 years. Salary £70 per annum.

Applications, together with copies of two recent testimonials, to be sent to the undersigned not later than 9 a.m. Monday, 2nd June, 1913, endorsed "Second Assistant Surveyor."

Canvassing will be deemed a disqualification.

(Signed) J. S. HORN,
Clerk to the Council.

Council Offices,
18 Nicholas-street,
Burnley.
May 7, 1913. (435)

NEWMARKET URBAN DISTRICT COUNCIL.
SURVEYOR'S CLERK.

The above Council invite applications for the Appointment of Surveyor's Clerk. Applicants must have had previous experience in a Municipal Surveyor's Office, and must be capable of tracing plans and keeping all the various books, and be an efficient shorthand writer.

The salary will be at the rate of £78 per annum.

Applications, in the candidate's own handwriting, endorsed "Surveyor's Clerk," to be sent to the undersigned, accompanied by copies of three recent testimonials, not later than 10 a.m. on Friday, the 16th instant. Canvassing is prohibited.

(By order)
S. J. ENNION,
Clerk.

Deva Chambers,
Newmarket.
May 7, 1913. (436)

BOROUGH OF LUTON.

The Corporation of Luton invite applications for the Appointment of Chief Assistant to the Borough Engineer and Surveyor.

Salary £150 per annum.

Candidates must be thoroughly qualified, and have had good Municipal experience.

Applications, in candidate's own handwriting, accompanied by copies of not more than three recent testimonials, endorsed "Assistant," to be delivered to the undersigned not later than 10 a.m. on Tuesday, the 20th inst.

Canvassing will disqualify.

W. SMITH,
Town Clerk.

Town Hall,
Luton. (439)

WELLINGBOROUGH URBAN DISTRICT COUNCIL.

The above Council invite applications for the Appointment of Second Assistant in the Office of the Engineer and Surveyor.

Candidates must have been articled and had experience in the Office of a Municipal Engineer and Surveyor.

Preference will be given to candidates who are Students of the Institution of Civil Engineers.

Salary £65 per annum.

Applications to be made in candidate's own handwriting, stating age and experience, accompanied by copies of three recent testimonials, endorsed "Second Assistant," to be addressed and delivered to the undersigned on or before Monday, the 19th May, 1913.

No canvassing.

E. Y. HARRISON, A.M.I.C.E., A.M.I.M.E.,
Surveyor and Water Engineer.

Council Offices,
Market-square,
Wellingborough.
May 7, 1913. (438)

YEOVIL RURAL DISTRICT COUNCIL.
WORKS OF SEWERAGE AND SEWAGE DISPOSAL FOR THE PARISH OF STOKE-UNDER-HAM.

The above Council invite Tenders for the Construction of Sewerage and Sewage Disposal Works, consisting of about 4,000 yds. of 9-in. and 6-in. Sewers, with Manholes, Ventilators, &c., Septic Tanks, Trickling Filters and Appurtenances, in accordance with Plans and Specifications prepared by Mr. Arthur J. Martin, M.INST.C.E., of 7 Victoria-street, Westminster, S.W., the Engineer appointed by the Council for the carrying out of the Works.

The Drawings and Specifications may be inspected on and after the 9th day of May, 1913, at the Office of the Engineer (as above), or at my Office, and copies of the Specification and Bills of Quantities may be obtained from the said Engineer upon payment to him of the sum of Three Guineas, which will be refunded on receipt of a *bonâ-fide* Tender and the return of all documents, and after the signing of the Contract. Such Contract will include the Government Fair Wages Clauses, modified as may be necessary to make same applicable to the works in question.

Sealed Tenders, in envelopes endorsed "Stoke-under-Ham Sewerage," to be delivered to me, the undersigned, not later than the twenty-ninth day of May, 1913.

The Council do not bind themselves to accept the lowest or any Tender.

(By order of the Council)
J. E. RODBER,
Clerk.

30 Kingston,
Yeovil, Somerset. (437)

COUNTY BOROUGH OF WEST HAM.
TO CONTRACTORS.

The Council hereby invite Tenders for the following Works:—

(1) Extension of Technical Institute, Romford-road, Stratford.
(2) Underground Conveniences, Queen's-square, Green-street, Upton Park.
(3) Private Street Works, Sugar House-lane, Stratford.

Plans and Specifications may be seen, and Forms of Tender, Bills of Quantities, and further particulars obtained at the Office of the Borough Engineer, Town Hall, West Ham, E., upon payment of One Pound in respect of each Form of Tender, which amounts will be returned upon receipt of *bonâ-fide* Tenders.

NOTE.—No Tender will be considered unless the same is delivered at the Office of the Town Clerk, Town Hall, West Ham, E., in the envelope supplied, by registered post, not later than 4 o'clock p.m. on Tuesday, 27th May, 1913.

The Council do not bind themselves to accept the lowest or any Tender. The Contractor will be required to enter into a bond, with one surety, for the due performance of the Contract, and no work will be ordered under the Contract until such bond has been duly executed.

The Contractor whose Tender is accepted, and with whom a Contract is entered into, will be required to pay the whole of his workmen such rate of wages, and observe such hours of labour, as are recognised by the Workmen's Trade Unions, and shall not assign, nor under-let, or make a sub-contract with any person or persons for the execution of any part of such work. In the event of any breach of such agreement the Council will enforce the penalty clause in its entirety.

(By order of the Council)
FRED. E. HILLEARY,
Town Clerk.

Town Hall,
West Ham, E.
May 9, 1913. (440)

Sewage Treatment.*

By R. J. McKENN.

When I was asked, and agreed, to read a paper on sewage treatment I was fully alive to the fact that I was taking up a subject of great importance from many standpoints. It is one which, to be thoroughly applied, calls for the assistance of many departments of science -engineering (civil and mechanical), chemical, bacteriological, biological and botanical, to mention no more. These departments, although apparently separate, have to and do unite when dealing with the science of sewage treatment.

To the average lay mind a sewage works implies the somewhat vague idea of a department which is of little importance, plays but a very small part in the daily routine of civic life, and is generally looked upon as a necessary evil. While it is true that this condition exists it is unfortunate, for if the man in the street could but realise the importance of a sewage works, even without attempting to understand the scientific plane on which it stands, it would be a healthy sign of the times. It would be significant that the individual had realised that the greatest asset to a community was the health of its members, that health was the truest and fullest form of wealth, and that the engineering and sanitary departments of a corporation, while not returning to the latter's pockets revenue in the form of hard cash, return that which hard cash cannot purchase health.

The question of sewage treatment in its various ways is an old one, and has occupied in the past and is occupying to-day some of the highest minds in the scientific world. So my subject is not a new one, and I am not pretending to advance to-night anything which has not already been advanced many times before. It is possible, though, that I may present a different aspect of the question than may have appealed to you hitherto, and which may be the base for an instructive discussion. I am not specialising on any one part of sewage treatment, but am going through the various parts of a sewage works, commencing with the detritus tanks and dealing with each part in sequence, and concluding with the methods of treating sewage.

I am safe in saying that the sewerage and drainage system of our cities and towns is carried out on the combined system, which means that the sewage of such places is of a complicated character, whose condition varies according to the industries of the district. For instance, the sewage from such towns as Bradford, where the woollen industry is prominent, is different from the sewage from a town like Heywood, where the woollen industry is absent; and again, the sewage from these towns differs from the sewage of towns like Harrogate and Buxton, which are residential. Therefore no fixed law can be laid down for a common treatment of sewage; and this variation in character, together with the general physical condition of the district, makes the question of sewage treatment a difficult one when the construction of a works is being considered, and calls for the assistance of the chemist as well as the engineer. Where the sewage can reach the works by gravity a difficulty in construction and a saving in cost can be overcome, but where pumping has to be resorted to further work is put on the engineer in designing, and extra work on the corporation.

MINIMUM CAPACITY.

Before proceeding further I wish to state that where I refer to the capacities of tanks and filters the reference will be to the capacities required by the Local Government Board, and here would point out that these capacities are given as a minimum. This is an interesting point and is worth a little consideration. In designing a sewage works I am well aware that the engineer has to keep the cost as low as possible, but I raise the question, is it a wise procedure to construct a works on a minimum capacity? If a works has to be thus constructed I am sure it is no wish of the engineer. I maintain that a margin should be allowed over and above the minimum to allow for any variations in flow due to increase in population or industry, and especially for times when the works is called on to deal with three times the dry-weather flow. How much of a margin should be allowed depends on the general conditions of the district for which the works are being designed.

DETRITUS TANKS.

We will follow out the course of sewage treatment, dealing with the general constructional part of the works first. After screening (and all sewage must be screened, including storm water) the sewage should pass through detritus tanks, so that grit, &c., will settle, while the organic matter in suspension is carried forward for further treatment. These tanks are very essential, and their capacity as laid down in the Local Government Board's requirements, where there are two or more in number, should each be not less than $\frac{1}{100}$ part of the dry-weather flow. It is generally stated that these tanks should be shallow, the latter term being somewhat indefinite. I consider the minimum depth of a detritus tank should be 2 ft. 6 in. Of course, the depth will be governed by conditions of the fall available in a gravity scheme. Assuming shallow tanks to be 18 in. to 2 ft. deep, they quickly fill with grit, &c., and in times of storm will soon be thrown out of use. By being thrown out of use I mean that by quickly filling the grit, &c., will soon find its way elsewhere, which is not desirable, and this condition is aggravated owing to the fact that during such a time, unless there is reserve, the working tanks cannot be cleared.

TANK TREATMENT.

Passing from the detritus tanks the sewage undergoes what is generally termed tank treatment. This question of tank treatment is a much debated one from the point of view of construction. Various designs have been claimed to meet the desired end, but have not met with the success anticipated; and to-day the engineer designing a works cannot complain of lack of variation, chief among them being the Fieldhouse tank and Emscher tank, besides the septic tank and the continuous and quiescent precipitation and sedimentation tanks. I am not going to discuss the relative advantages and disadvantages of any of the foregoing, such having been done by the designers and engineers many times.

In the Fifth Report of the Royal Commission, and after exhaustive inquiries, they arrived at the following as being the minimum capacities of tanks to be used for the preliminary treatment of sewage: *Septic tank*—where there are two or more in number, the total capacity to be equal to day's dry-weather flow; *Settling tank*—worked on the continuous flow, where there are two or more in number, the total capacity to be equal to ten to fifteen hours the dry-weather flow; *Settling tank*—worked on the quiescent system, where there are eight or more, *each* to be equal to two hours the dry-weather flow; *Precipitation tank*—worked on the continuous flow, where there are two or more, the total capacity to equal eight hours the dry-weather flow; *Precipitation tank*—worked on the quiescent system, where there are eight or more, *each* to be equal to two hours the dry-weather flow. While dealing with the capacities of tanks I must refer to the storm and humus tanks: *Storm tanks*, where all over three and up to six times the dry-weather flow should be treated prior to further treatment on beds, or being discharged into a river, as the case may be, should not be less in capacity, where there are two or more in number, than one-quarter of the day's dry-weather flow; *Humus tanks*, or shallow straining filters -the minimum capacity must be equal to two hours the day's dry-weather flow.

Coming back to the question of tanks. I am correct in saying that a tank is a chamber in which sewage undergoes its preliminary treatment by settling out as much of the suspended matter as is possible, allowing of a breaking up or dissolution of the heavier organic matter which the sewage may contain, and by allowing of the equalisation of the strength of the sewage prior to undergoing further treatment.

All tanks should be designed so that the sewage on entering does not come in contact with the deposited sludge, for by so doing the sludge is disturbed and thrown into suspension, and besides helping to reduce the purity of the tank effluent, there is always the danger of such matter being carried on to the filter-beds, which would help to

* Paper read at a district meeting of the Institution of Municipal Engineers held at Manchester on April 16th.

choke them. For my own part I favour the rectangular tank, constructed with the base sloping towards the point where the sludge discharges: for in such tanks it is an easy matter so to design the inlet that the sewage will be equally distributed the full width of the tank. This is an important point, for then an even flow through the tank is encouraged at the start, and this allows of an equal settling, and a more efficient breaking down of the heavier organic matter. The outlet sill extending also the full width of the tank makes up conditions which allow of an effluent being discharged of equal strength. This is a superior method to the case where the sewage enters the tank by several pipes, each having a separate discharge, for in this case it is easy to see that the sewage will travel some distance in the tank before there is what, for want of a better term, I describe as a combination. Another point of importance is that where there is more than one tank and a sewage works require at least two arrangements should be allowed in the design so that each tank will receive an equal quantity of sewage under all conditions, from one to three times the dry-weather flow. If this is not done, no matter how equal the flow may be through any one tank, there will be some tanks dealing with a greater volume of sewage than another, with the result that the beds will be called upon to deal with a tank effluent of fluctuating degrees of purity.

No matter how carefully the tanks may be managed, there are times when they discharge suspended matter of a low specific gravity, and if no arrangements are made for arresting this matter it is discharged on the filter-beds. This brings me to the question of the tanks being worked in parallel or in series—in other words, primary and secondary tanks. As I have just stated, this suspended matter is of low specific gravity, and to have secondary tanks of sufficient capacity to arrest this matter, either on the continuous flow or the quiescent system, would greatly increase the capital cost of the works. This suspended matter should be prevented as much as possible from gaining access to the filters, and in lieu of secondary tanks I would suggest roughing filters (although I know they are generally adopted) as an intermediary between tanks and final filters. This would apply more especially where percolating filters are used. Where there is fall available I suggest it is better to use the roughing filters on the downward filtration method. This method allows of a better aëration of the tank effluent, besides a better chance of the suspended matter being arrested, than if upward filtration is adopted. This latter method should only be adopted when the fall is limited. Time will not allow me to go further into this important question of tanks. Before leaving though I wish to suggest that I consider it essential that a margin should be allowed over and above the minimum capacity required by the Local Government Board. This would allow for any sudden increase in flow, and would allow of the composition of the liquid leaving the tanks being more gradually equalised, thus preventing extra work being suddenly put on the filter-beds.

SLATE BEDS.

While dealing with this question of tanks, there is another method to which I desire to draw your attention—viz., the Dibdin slate beds. Mr. Dibdin has very kindly forwarded me several photographs of works being fitted with slate beds, and a few words on their construction and use will be of interest. These beds are built up of slates laid horizontally, with about 2in. of space between the top surface of one and the under surface of the next. Mr. Dibdin thus briefly described the action of the slate beds in a lecture given last December: "The solid matters in the sewage are allowed to settle on shelves of slate supported by slate blocks at a distance of about 2in., these being superposed to a depth of 1ft. to 5ft. or 6ft., as required. In consequence of the alternate filling and emptying, and resting empty, the deposit becomes the home of many types of organism that digest the matters and render them inoffensive, in like manner to the action by which earth-worms produce a humus from organic debris and throw it to the surface in the form of worm casts. In the slate bed the deposit of earthy matter thus formed on the surface of the layer of mud on the slates is washed off by the receding effluent when the bed is emptying, and forms a black slurry consisting of mineral and indigestible matter with numerous organisms from the bed. This slurry is then placed on a suitable drainage bed for the water to drain off and allow time for the full digestion of any crude material that may have come from the bed, and finally to allow the host of infusoria gradually to extinguish themselves by the natural process of the 'survival of the fittest,' the organisms taking part in the action including such red worms as are possible under the conditions, infusoria and ærobic bacteria."

The following extract from the report of the Bureau of Survey on the purification of the sewage of Philadelphia can be usefully referred to with reference to slate beds: "The best results were accomplished when the bed was filled twice a day, or at the rate of 2,000,000 gallons per acre per day. Crude sewage applied deposited three-fourths of the suspended solids; the effluent was slightly nitrified, and rendered partially stable. The result was obtained ærobically, and the bacterial work is undoubtedly largely supplemented by worms and other lower forms of animal life. As the results accomplished by the bed are more than mere sedimentation, including oxidation of the applied sewage, it has been considered in two ways: First, as a sedimentation tank in which the resulting sludge has been digested and concentrated; second, as a contact bed producing partially a stable effluent. If looked upon as a sedimentation process it would consist of nineteen superposed quiescent basins, each about 3in. deep. The bed should be filled at such a rate that the velocity is not high enough to disturb the deposit on the slates, and then the bed be allowed to remain quiescent for, say, one hour. Before the bed is again filled the worms and other animals and the bacteria have attacked the organic matter of this deposit, and are ready for the next thin layer of food when the bed is subsequently filled. If considered as a contact bed its large void space, as compared with a contact bed filled with ordinary media, is of great aërating value, also due to the construction in horizontal layers, one slate resting upon another; on the underside of many of the slates a large flat bubble of air must be entrained, which would tend to oxygenate the sewage while in the bed."

The slate bed, it will be seen from the foregoing, is not claimed to be a filter, but a bed where sewage undergoes a treatment prior to bed filtration which, while allowing of a dissolution of the organic matter, leaves a minimum of sludge which is of an inoffensive character and can be disposed of by drying or lagooning. The working capacity of a slate bed with slates 2in. apart is estimated at 66 per cent of the whole tank. I think there is a future for this preliminary treatment of sewage, and it would appear unfortunate that extensive experiments cannot be made to discover the true efficiency of the Dibdin slate beds.

(To be concluded.)

"Akonia."—The Crown Commissioners have decided to treat the thoroughfares in Regent's Park with "Akonia" throughout the season. "Akonia" is also to be used at Aldershot on the occasion of the King's visit this week.

Central Lighting in Birmingham.—With the object of illustrating the advantages of the central lighting of the principal thoroughfares of the city, the Birmingham Corporation gas department are (the *Birmingham Post* states) engaged in carrying out a considerable improvement in the method of lighting Paradise-street. The scheme provides for the erection of four high-pressure gas lamps, each of 4,500-candle power, suspended in the centre of the roadway from wire ropes carried across the thoroughfare. Two are already in position, and the others will be completed within a fortnight. There are some novel features in connection with this installation, inasmuch as no flexible tube is used at any point, the gas being conveyed to the lamps by means of ordinary gas pipes. The lamps may be raised and lowered while alight, so that a lamp may be lowered to the level of the street for cleaning or remantling, and then raised into position again 26ft. above the road level without the light being wholly extinguished. The wire ropes across the roadway are capable of bearing a strain equal to 10 tons. The apparatus for manipulating them is somewhat ingenious, and so arranged that the movement is simply and easily effected. Each lamp carries three burners, and in the daytime, when the illumination is not required, the gas is maintained alight by means of a by-pass.

ROAD BOARD GRANTS TO IRELAND.

QUESTIONS IN THE HOUSE OF COMMONS.

In the House of Commons on the 1st inst. Mr. Patrick White asked whether, at a meeting held in Dublin after the Road Board came into existence, Sir G. Gibb announced that £170,000 would be Ireland's share for the first year; having regard to the fact that the revenue of the board has exceeded the amount anticipated, what Ireland's share per annum is at present, what was the actual amount paid to Irish authorities in each of the years since the board was established, and what amount to Great Britain for a corresponding period; at what date was money available for distribution in the first instance, and the dates and amounts first paid to Great Britain and Ireland respectively?

Mr. Masterman said he understood that at a general conference between the Road Board and representatives of Irish county and county borough councils held in Dublin on March 7, 1911, the chairman of the Road Board stated that the amount proposed to be allocated to Ireland out of the Road Improvement Fund up to March 31, 1912, was approximately £150,000. The sum of £144,236 had already been indicated to individual highway authorities. The board were now engaged in selecting other works to which approximately £100,000 would be granted.

Mr. White asked upon what principle the Road Board allocated Ireland's share of the money as between the different counties in Ireland, whether upon the basis of population, annual road expenditure, or the outlay consequent on the county being an avenue for tourist traffic; what conditions were attached to the grant; how many Irish counties failed to comply with the conditions and thereby forfeited their right to a grant; whether the aggregate sum not drawn by such counties was at the disposal of other counties; whether the Road Board was aware that the county of Meath, through its representatives, had unanimously voted £1 for every £1 the Road Board had granted or will grant; and whether, having regard to the fact that three main trunk roads ran through the county diverging from Dublin, and were largely used by tourists visiting places of historic interest, the board would consider the advisability of increasing their grant to an amount equal to what the county itself will contribute?

Mr. Masterman said the amount distributed in Ireland out of the Road Improvement Fund had hitherto been allocated by the Road Board to works of road improvement in the various counties approximately upon the basis of population, but in considering each case the board had regard to the circumstances of each county and to the relative public importance of the improvements required in the various parts of the country. No conditions were attached to grants except that the work towards which grants were made would be carried out in accordance with the approved specifications, and no Irish county had forfeited its right to payment of the amount payable under any grant made. The board were aware that the county of Meath were prepared to provide £1 for every £1 of grant from the Road Board, and the claims and requirements of the county of Meath would receive from the board the same consideration as was given to the relative claims and requirements of other counties in Ireland.

In a written answer to Mr. White, Mr. Masterman stated that the first payment in respect of income was paid to the credit of the Road Improvement Fund on November 5, 1910. The first grant in Ireland was indicated on January 19, 1911; the first payment under it was requisitioned and made in August, 1911. The first substantial grant in Great Britain was indicated in December, 1910; the first payment under it was requisitioned and made in May, 1911. No moneys were paid to Irish authorities in the financial year ending March 31, 1911. In the year ending March 31, 1912, £18,848 was paid, and in the year ending March 31, 1913, £27,986. The corresponding figures for Great Britain were £8,420, £251,813, and £431,943.

Manchester's New Baths.—New baths at Burton-road, Withington, built at a cost of £15,500, have been formally opened.

SOME RECENT PUBLICATIONS.*

Our Village Homes: Present Conditions and Remedies. By Hugh Aronson, M.A., Barrister-at-Law. Price 2s. 6d. nett. London: Thomas Murby & Co.

No one can read this little work without feeling that the author is an earnest reformer in regard to the housing of our rural population. Speaking from practical knowledge and experience, the author, after depicting the village as seen "from within" and "from without," shows the effect of bad housing conditions on rural depopulation, health and morals. The pressing nature of the problem of rural housing is shown by the fact that each of the great parties in the State has recognised the evil, although little has been done as yet effectively to mitigate it. Mr. Aronson offers some strong criticism of existing legislation, and shows the utter inadequacy of the present Housing Acts for dealing with rural conditions. He advocates the policy of State grants, not indeed as a wholly economic solution of the housing problem, but as a palliative or temporary measure until the agricultural labourer shall receive an economic wage. In the chapter on Administrative Action there is some vigorous criticism of the Local Government Board and their staff. The book is an earnest contribution to a discussion which at the present juncture is of paramount national importance.

Paint and Painting Defects: Their Detection, Cause, and Cure. By J. Cruickshank Smith, B.Sc., F.C.S. Price 3s. 6d. London: The Trade Papers Publishing Company, Limited.

This is an exceedingly useful and essentially practical handbook, in which the author presents in a simple manner, freed as much as possible from technical terms and scientific language, the nature and chief causes of commonly occurring defects in work finished with paint, enamel or varnish. For the practical man who desires to take an intelligent interest in the nature and properties of the materials which he uses, and the methods and processes used in their manufacture and preparation, this volume will prove specially valuable. At the same time, the architect and engineer, with whom rests the ultimate responsibility for the excellence of the finished work, will find much very useful information. The book is divided into two parts, the first of which treats generally of the investigation of defects, while the second consists of an exhaustive alphabetical list of faults and defects, with notes on materials and processes.

Heat: A Manual for Technical and Industrial Students. By J. A. Randall. Price 6s. 6d. nett. London: Chapman & Hall, Limited.

This manual will be found specially useful to students taking elementary courses in heat, and particularly to those who have in view ultimately the study of power engineering. The author, while dealing with elementary and fundamental principles, makes a special point throughout of emphasising their application to the various commercial and engineering processes in which they are the controlling factor. Thus, for example, considerable care has been devoted to the relationships between the temperature, pressure, volume and energy of gases which have a technical application. Again, such matters as steam-power plants, gas-power plants, and refrigeration are discussed, not indeed exhaustively, but as a medium for the presentation of fundamental facts and laws. Each chapter concludes with a series of problems for solution, and a very useful summary of the ground covered. The book is an excellent introduction to the study of applied heat.

Society of Engineers.—The Society of Engineers held a Bohemian concert at the Holborn Restaurant on Saturday, May 3rd, when a varied musical programme, arranged by Mr. Charles Capper, was listened to with much pleasure by the large audience of members of the society and their friends. In the unavoidable absence of the president, Mr. Arthur Valon, M.Inst.C.E., the chair was taken by Mr. H. C. H. Shenton, the senior vice-president, and among the guests were Dr. Hele-Shaw, F.R.S., president of the Association of Engineers-in-Charge, Mr. J. W. Wilson, M.Inst.C.E., principal of the Crystal Palace School of Engineering, and others.

* Any of the publications reviewed, or referred to as received, will be forwarded by the St. Bride's Press, Limited, on receipt of published price.

Law Notes.

Edited by J. B. REIGNIER CONDER, 11 Old Jewry Chambers, E.C., Solicitor of the Supreme Court.

The Editor will be pleased to answer any questions affecting the practice of engineers and surveyors to local authorities. Queries (which should be written legibly on foolscap paper, one side only) should be addressed to "The Law Editor," at the office of The Surveyor, *accompanied by the writer's name and address, but correspondents who do not wish their names to be published should also furnish a "nom de plume." Where necessary, copies of local Acts or documents referred to should be enclosed.* **All explanatory diagrams must be drawn and lettered in BLACK ink only, and in such style as to be fit for direct reproduction—i.e., without re-drawing or amendment.** *Unless these conditions are complied with we cannot undertake to reply to queries.*

QUERIES AND REPLIES.

In order to avoid confusion querists are requested to use distinctive words as noms de plume. *The letter X, combinations such as X.Y.Z., and words such as "engineer" and "surveyor," should never be used.*

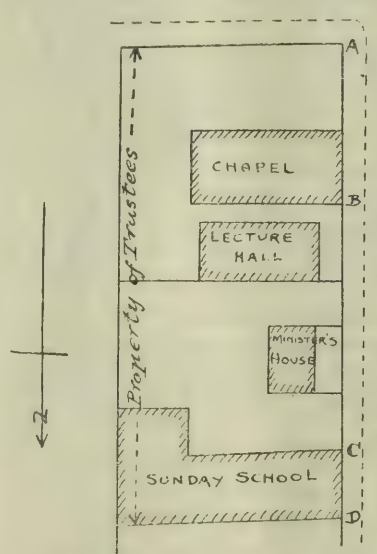
Slaughterhouses.—"Slaughterhouses" writes: This district is a rural one, and we have no Act in force for these matters except the Public Health Act, 1875, and in most of our villages we have slaughterhouses which existed prior to 1875, but which have never been "registered." (1) Being a rural district, does the Towns Improvement Act, 1847, apply for "Registration or Licensing"? (2) If so, have these slaughterhouses, by the default of the occupiers in not giving notice of registration, a right to remain in use? (3) In failing to "register" did their existence legally lapse as slaughterhouses? (4) Having remained in use "unregistered" since the passing of the 1875 Act, and no by-laws in force, can the rural district council require the occupier to be "registered or licensed"? If so, how? Or can they still go on unregistered or unlicensed? (5) In a few parishes we have had the Local Government Board Urban Model Series of By-laws in force since 1888 with reference to slaughterhouses, and in the case of the slaughterhouses which existed prior to 1875, and for which no application for "registration" has ever been made. Where these by-laws are in force are they deemed to be licensed, or are they in default and liable to be "licensed" as a new slaughterhouse, or what is the position? (6) In respect of the rural district council granting a slaughterhouse a licence where no by-laws exist, if necessary or compulsorily, if at all, is the licence a personal one to the tenant of the slaughterhouse, or is it a licence for the building indefinitely? (7) In respect of the rural district council granting a new slaughterhouse licence where the by-laws are in force, is the licence again a personal one or one for the building "indefinitely"? In any event, may I point out to you the case of *Goodwin* v. *Sale*, King's Bench Division, of April 16, 1907, and would this judgment apply to my district where no by-laws exist, or where by-laws do exist? If none of the above circumstances apply, it would appear that a rural district council, where no by-laws are in force, have very little jurisdiction over slaughterhouses at all.

(1) No, unless an Order of the Local Government Board has been made investing the rural district council with urban powers with respect to slaughterhouses. (2 and 3) Under sec. 127 of the Act of 1847 failure to register subjects the offender to a penalty, and to continuing daily penalties so long as the premises are used as a slaughterhouse without having been registered. (4) If and when urban powers are obtained the registration can be enforced under the foregoing section. (5) From the existence of these by-laws it would appear that the council has been invested with urban powers, so far as these parishes are concerned. Now the effect of the 1847 Act is *(a)* that all slaughterhouses, old or new, must be registered, and *(b)* that new slaughterhouses must be licensed. "New" means not in use before the passing of "the special Act." In the case of urban authorities the special Act usually means the Public Health Act, 1875. But in the case of rural authorities it appears to mean the date of the Order giving urban powers (see Lumley's "Public Health Acts," 7th edition, p. 331). A slaughterhouse, therefore, which was in use at the date of the Order need not be licensed, but must be registered. (6 and 7) The licence is a personal one, and not one for the building indefinitely (*Goodwin* v. *Sale*, 1907, 2 K.B., 278). Where no by-laws exist it is probably because urban powers have not been obtained, and where such is the case there is no power either to license or register.

Closet Accommodation: Insufficiency.—"W. H." writes: A owns two privies with a dilapidated open ashpit, which are reported by the inspector of nuisances for the district to be a nuisance and insufficient for the five cottages they serve. The district council endorse this view. Would you, therefore, please state whether notices to the owner should be served, and subsequent proceedings taken under sec. 36 of the Public Health Act, 1875? (1) Do the words "without sufficient water-closet, earth-closet or privy, and an ashpit furnished with proper doors and coverings," in this section apply only to numbers (quantity), or (2) do they apply to insufficiency in structure, viz., open ashpits being without doors and coverings, (3) or insufficient through dilapidations? (4) Do the words "water-closet, earth-closet or privy and ashpit" in the singular number also bear a plural signification? Numbers of authorities, I know, act under this section both for increasing the number of conveniences and for reconstructional or conversion purposes. I have, however, found one case where, on appeal being made to the Local Government Board, the action of the council was not upheld.

It is for the local authority to decide, upon the report of their surveyor, whether or not the existing accommodation is "sufficient." If, after deciding that it is not sufficient, they give notice to the owner to provide sufficient accommodation, and on his failing to do so execute the necessary works, and take proceedings to recover the cost from the owner, the magistrates cannot go into the question of sufficiency (*Boyle* v. *Sherborne Local Board*, 46 J.P., 675). It would appear, therefore, that it is open to the authority, after properly considering the matter, to come to the conclusion that the accommodation is insufficient in any one or more of the senses suggested in the query, subject to an appeal to the Local Government Board.

Private Street Works Act, 1892: Chapel.—"T. U. O." writes: I should be pleased to have your valuable opinion on the following matter: The Private Street Works Act, 1892, is in force in this district, and the council are proposing to make up a private street upon one side of which abuts property belonging to chapel trustees. (1) Under sec. 13 of the above Act can the trustees claim exemption from private street works expenses for frontage marked AB, comprising the chapel X, land on the south side of it,



and also for that part of the Sunday school marked CD, which abuts on to the street? (2) Will the trustees have to pay their share of the cost of making up the street between B and C, which includes lecture hall and minister's house? (3) The chapel and Sunday school are used for public religious worship only. If they were used for other than religious purposes would this affect the case, and have any recent decisions been given bearing on this point?

(1) The exemption provided for by sec. 16 (not sec. 13) extends only to a church, chapel, or place appropriated to religious worship, which is, for the time being, by law exempt from poor rate. Churches, district churches, chapels, meeting houses or premises, or such part thereof as shall be exclusively appropriated to religious worship are exempt from poor rate by the Poor Rate Exemption Act, 1833, secs. 1 and 2. In my opinion, therefore, only so much of the frontage A B as is co-extensive with the chapel itself is exempt from private street works expenses, and the Sunday-school is not exempt unless it is *exclusively* appropriated to religious worship. (2) Yes. (3) Unless used *exclusively* for religious worship they would not be exempt. I do not know of any recent cases, but the law is clear.

By-laws: "Room Used for Human Habitation."—"Doubtful" writes: In this district the by-law with

regard to the height of rooms is as follows: "Every person who shall erect a new building, and shall construct any room therein so that it may be used for human habitation, shall comply with the following requirements—if such room is not intended to be used as a sleeping-room he shall construct such room so that it shall be not less, in any part thereof, than 9 ft. in height. If such room is intended to be used as a sleeping-room, and is not an attic or a room in the roof of such building, he shall construct such room so that it shall be not less, in any part thereof, than 9 ft. in height. If such room is intended to be used as a sleeping-room, and is an attic or room in the roof of such building, he shall construct such room so that it shall be not less, in any part, than 5 ft. in height, and so that it shall, to the extent of two-thirds of the superficial area of the floor, be of a height of not less than 9 ft." A gentleman in this town is desirous of building a bathroom attached to his house, but only wishes to make the height of the room 8 ft. I contend that the height should be 9 ft. I shall be glad of your opinion on the subject.

I think it would be a question of fact whether the bath-room was constructed so that it might be used for human habitation. As a rule a bath-room is not so constructed, but there may be exceptions.

Bridge over Railway.—"Ford" writes: A certain railway runs through my district, and I have requested the railway company to metal the approaches and roadway over one of the bridges spanning the railway, but the engineer to the company writes denying any liability to repair the road over the bridge and its approaches, saying that the Act granting permission to the company to construct the railway was passed in the year 1844—a year before the passing of the Land Clauses Act of 1845—and that they will only carry out such small repairs as to protect the bridge from damage. I presume the Act they refer to is the Railway Clauses Consolidation Act of 1845. Your opinion as to whether their contention is right, and if so, is there any other Act of Parliament that we can proceed under, will be of great assistance to me. I presume we could ask them for proof that the power to construct such railway was given in the year mentioned, if it is material to the case?

No doubt the Act referred to is the Railways Clauses Consolidation Act, 1845. See sec. 46. That Act, however, only applies to railways authorised by subsequent Acts. The Railway Regulation Act, 1842, sec. 13, empowers (but does not compel) railway companies to carry highways under or over their railways by means of a bridge, but it does not state by whom such bridge is to be repairable. There does not appear to be any other public Act bearing on the question. The company can certainly be asked to produce a copy of their special Act.

By-laws: Plans: Failure to Approve or Disapprove within a Month.—"M. E." writes: If an urban authority fails to approve or disapprove of plans submitted to them under their by-laws within one month in accordance with the provisions of sec. 158 of the Public Health Act, 1875, can the plan of the intended work be taken as approved? If not, what remedy has the person submitting the plan against the urban authority? And also can he proceed with the intended works forthwith as if the plan has been approved?

If the plans and the intended building are in accordance with the by-laws the person submitting the plans can either proceed with his building or apply for a *mandamus* to the council to approve the plans. But the omission to approve or disapprove will not protect him in the event of his building in contravention of the by-laws.

Private Street Works Act, 1892: Lighting.—"J. G." writes: Where a private street has been made up by the owners, can an urban council, under sec. 20 of the Private Street Works Act, require the provision of means for lighting before declaring it a public highway?

If (*a*) the street is sewered, levelled, paved, metalled, flagged, channelled, and made good to the satisfaction of the urban authority; and if (*b*) the greater part in value of the owners of the houses and land in such street make application in writing, the authority is bound, within three months, to declare the street to be a highway repairable by the inhabitants at large. They cannot first require the provision of means of lighting.

We have to draw the attention of querists to the directions laid down for their guidance in regard to the preparation of diagrams. Rough sketches obviously cannot be made use of, and we should be obliged if correspondents would therefore send only carefully-prepared drawings, preferably about 6 in. in width, and without colouring or wash of any description. Failure to observe these rules will involve the risk of queries remaining unanswered.

TIDAL WATERS AS A SOURCE OF POWER.

PAPER AT THE SOCIETY OF ENGINEERS.

At a meeting of the Society of Engineers, held on Monday last, a paper on "Tidal Waters as a Source of Power" was read by Mr. C. A. Battiscombe, the object of the paper being to draw attention generally to the commercial possibilities of hydro-electric installations in the British Isles, more particularly with regard to the use of the tides.

After some introductory remarks in reference to tidal intervals and the range of neap tides, the author pointed out that in this connection the head of water available for actuating turbines could not exceed one-third of the range of minimum tides. The form of installation required for a continuous output of power was then discussed, the chief objections to twin installations, so placed that the tidal interval at the one would not synchronise with the tidal interval at the other, being pointed out. An outline was given of the arrangements proposed for the constant maintenance of a working head, by means of a chamber for the turbines, connected by valves to the tidal way and to three reservoirs in which the tidal water might be impounded; and to this was added a description of the proposal of sequence of flow between the tidal way and the reservoirs.

It was claimed that the utilisation of the tides for power purposes presented few engineering difficulties as far as principles were concerned, but that the real difficulty lay in the question of cost, and therefore in the choice of the site and in the design of the structural details.

The expenditure on commercial works that an engineer was justified in recommending was suggested, and some explanatory remarks were offered in respect to various items given in the rough estimate and to the principles governing the economical capacity of a proposed installation for any range of tide. The rough estimate followed next and the cost of the Board of Trade unit, obtained from the proposed installation, was then considered from the point of view of supply and demand, both from a commercial and a municipal standpoint, on the basis of annual expenditure over a period of fifty years. The paper concluded by insisting on the importance of regarding the supply of fuel as a matter that concerned the whole nation; that the demand for combustible fuel was continually increasing, and that, coal being practically the only fuel found in England, it would be mere folly to neglect any other available source of energy by which the present rate of consumption of coal might be sensibly reduced. It was submitted that not only could the tides be utilised as a constant source of power, but that, taken in conjunction with the power that could be derived from fresh-water rivers, their utilisation would be a great gain to the commercial and industrial interests of the United Kingdom.

Sheffield Society of Architects and Surveyors.—At the annual meeting of this body, held at Sheffield University on the 1st inst., the election of officers resulted as follows: President, Mr. A. F. Watson; vice-president, Mr. C. B. Flockton; hon. treasurer, Mr. R. W. Fowler; hon. secretary, Mr. James R. Wigfull. It was decided that the following should constitute the council: Messrs. W. G. Buck, F. E. P. Edwards, J. R. Hall, C. F. Innocent, H. L. Paterson, H. I. Potter, C. S. Sandford, E. Winder, and F. H. Wrench. A vote of thanks was accorded the outgoing president (Mr. J. B. Mitchell-Withers) for his services during the past year. The total membership of the society is now 117, as compared with 115 last year.

SEA-COAST EROSION.—For a very complete and inexpensive library on the cause, prevention and repair of coast erosion the following three works are recommended: "Coast Erosion and Foreshore Protection," by John S. Owens, M.D., Assoc.M.Inst.C.E., F.R.C.S., and Gerald O. Case (price 7s. 6d., post free 7s. 10d.), with numerous illustrations and diagrams; "Sea-Coast Erosion and Remedial Works," by R. C. Allanson-Winn, M.Inst.C.E.I. (price 1s., post free 1s. 1d.); and "Erosion of the Coast and its Prevention," by F. W. S. Stanton, Assoc.M.Inst.C.E., F.S.I. (price 3s., post free 3s. 2d.), with numerous maps and other illustrations. The publishers are the St. Bride's Press, Limited, 24 Bride-lane, Fleet-street, London, E.C.

ROSYTH AND ADJACENT TOWN PLANNING SCHEMES.

A brief, informal description has been prepared by Mr. J. E. Wilkes, ASSOC.M.INST.C.E., the engineer, in response to several requests for information regarding the above schemes.

The Rosyth area is planned chiefly to accommodate the population coming to the district as a result of the establishment of a dockyard and naval base. The incoming population is estimated at 35,000, and, in addition, 25,000 men are to be based on the port.

As the land is very undulating, it was decided to make an altitude survey of the entire district, showing differences of level of 5 ft. by contour lines; this survey was made entirely by means of the tacheometer to ensure exactitude. On the survey all streets, sewers, stream regulations, &c., were designed.

At the outset negotiations with landowners were entered into, with a view to arranging the price of building land; also with a view to securing the necessary land for road widenings, and for contributions towards the requisite works. These have terminated very satisfactorily.

Mr. Wilkes points out that for Rosyth proper a somewhat formal design has been adopted, the ground here permitting this, adding, however, that he prefers, where possible, to follow the direct methods of the formal school.

The tramways to be provided are to be double track, with pressed steel sleepers laid on ballast. No cast-iron sewer manhole or other covers are to be placed in the carriageways, which will be for the most part of tarred stone, and subsidiary sewers will be behind the houses where possible.

Each building in the sub-centres is to form part of a uniform design, while elevations of all buildings are to be controlled.

The cottages in the workmen's districts will be suitably grouped, and must conform generally to type designs. The present building and road-making regulations are to be much modified, so as to permit of more economical construction.

The Rosyth area is very fertile and well wooded. It is also well sheltered from the prevailing south-westerly winds

Subsidiary roads have been planned in detail in the Dunfermline area, north of St. Margaret's, in order to settle properly the main roads and sewers, which alone will be included in the town plan.

The passenger station occupies a position well between the business and residential areas, and the goods station has been kept well away for the sake of amenity. The railway company's estimated cost of these stations is £42,000, and they are the subject of a Bill now before Parliament.

Street terminals have been arranged so that each serves as many streets as possible, some doing duty in nine directions; but as regards the amenity of the new town, it is sufficient, Mr. Wilkes thinks, to point out that Rosyth is in the Royal burgh of Dunfermline, the birthplace of Mr. Carnegie, who has endowed it with an income of £40,000 per annum, to be spent in public work of utility and beauty.

The whole of the roads in North Queensferry are perforce on land very hilly and broken up, but they will command beautiful views of the estuary of the Forth. A new access to North Queensferry, to avoid the somewhat squalid district of Jamestown, is to be provided by spanning the Great North-road, the low-level railway and the Admiralty railway by a bridge of 100 ft. span, which will carry a road under an existing arch of the high-level railway.

The altitude survey of 4,600 acres was commenced in July, 1912, and finished in three months, in spite of delays caused by crops and an abnormally wet season, and the technical part of the schemes, including estimates and principal negotiations, was finished by February, 1913. This, Mr. Wilkes states, was possible only on account of the zealous work of his assistants, Messrs. J. W. Bennett, C. W. N. Jack, W. J. L. O'Connell, and Wm. L. Tod, ASSOC.M. INST.C.E.

Building By-laws.—Mr. G. Belson Chilvers, engineer and surveyor to the Oundle, Northants, Urban District Council, will be glad to receive copies of by-laws as to new buildings which have recently received the sanction of the Local Government Board.

HOUSING CONFERENCE AT NEWCASTLE.

Under the auspices of the National Housing and Town Planning Council a conference was held in Newcastle-on-Tyne last week to consider the administration of the Housing and Town Planning Act, 1909.

Mr. Henry R. Aldridge, secretary of the National Housing and Town Planning Council, opened a discussion on "The Practical Administration of the Town Planning Powers of the 1909 Act, and the Preparation of General Town Planning Schemes." He explained the scheme of town planning adopted by the Birmingham City Council in the Quinton area. Other local authorities were coming forward, and he thought that in the next four or five years they would have 150 of the leading local authorities preparing town planning schemes. Birmingham Council had laid down that the number of houses should not exceed twelve per acre.

Councillor David Adams, Newcastle, dealt with the "Rehousing of the Dispossessed and the Housing of the Poorest," and in doing so read a report by Mr. Fletcher T. Turton, deputy surveyor, Liverpool, on the experience of that city in this matter. Liverpool began its operations in 1864. They in Liverpool realised that it was a question of poverty, and in 1896 they decided to build for the identical people turned out on the spot where they had been previously living, and at rents approximating to the rents paid for their former insanitary houses, which averaged from 3s. to 4s. per week. The result of that policy was that they had 2,174 dwellings containing a population of 8 000 odd people, every one of whom had been turned out of an insanitary house, a cellar or an overcrowded house, and it was chiefly because they charged rents approximating to what these people paid before they were turned out that the corporation was losing £22,000 per annum.

Mr. John H. Barlow, secretary of the Bournville Village Trust, opened a discussion on "The Development of New Housing Areas on Town Planning Lines, with limitation of the number of houses per acre and with especial reference to the provision of cottages with gardens, to be let at rents within the means of workmen," and Alderman D. H. W. Askew introduced the subject of the housing question in mining villages and towns.

It was urged by Mr. Davey, of the Northumberland Miners' Association, that what miners wanted were self-contained houses, not flats. If they had a large room and scullery downstairs, they wanted the latter made so that the people could not utilise it for living in. If the rents exceeded 5s. a week, it would be putting the screw on. There were few houses for miners that contained baths.

INSTITUTION OF CIVIL ENGINEERS.

ELECTION OF OFFICERS.

At the annual general meeting of the Institution of Civil Engineers held on Tuesday, April 29th, the result of the ballot for the election of officers was declared as follows:—

President: Mr. Anthony George Lyster, M.ENG. (London).

Vice-presidents: Mr. Benjamin Hall Blyth, M.A. (Edinburgh), Mr. John Strain (Glasgow), Mr. George Robert Jebb (Birmingham), Mr. Alexander Ross (London).

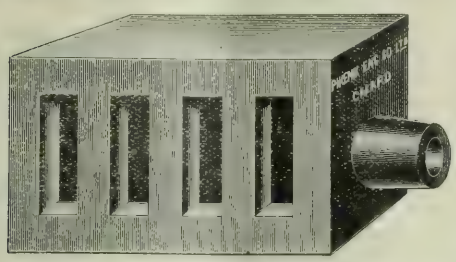
Other members of council: Mr. John A. F. Aspinall, M.ENG. (Liverpool), Mr. John A. Brodie, M.ENG. (Liverpool), Mr. William B. Bryan (London), Colonel R. E. B. Crompton, C.B. (London), Mr. J. M. Dobson (London), Sir Hay Frederick Donaldson, K.C.B. (London), Mr. E. B. Ellington (London), Mr. W. H. Ellis (Sheffield), Mr. W. Ferguson, M.A., B.A.I. (Australasia), Sir Maurice Fitzmaurice, C.M.G. (London), Sir John Purser Griffith (Dublin), Mr. C. A. Harrison D.SC. (Newcastle-upon-Tyne), Mr. Walter Hunter (London), Mr. Harry E. Jones (London), Sir Thomas Matthews (London), Mr. W. H. Maw, LL.D. (London), Mr. C. L. Morgan (London), Mr. Basil Mott (London), Mr. A. M. Tippett (South Africa), Sir Philip Watts, K.C.B. (London), Mr. W. B. Worthington, B.SC. (Derby), Mr. Dugald Clerk, F.R.S. (London), Mr. Robert S. Highet (India), Mr. Edward Hopkinson, M.A., D.SC. (Manchester), Mr. Frederick Palmer, C.I.E. (London), Mr. H. N. Ruttan (Canada).

This council will take office on the first Tuesday in November next.

ROAD SPRING WATER COLLECTING BOX.

The value of "The Durie" road spring water collecting box in situations where trouble is caused by springs of water rising in the middle of roads is pointed out in a pamphlet issued by the Phœnix Engineering Company, Chard. We are given to understand that these boxes have been used with most satisfactory results on roads where there is a large amount of heavy traffic.

When the spring is located a hole is dug in the



"The Durie" Road Spring Water Collecting Box.

road and one of the boxes, which is perforated on four sides, is placed in the hole and connected to the gutter at the side of the road by means of a pipe. Stones are placed round the box to act as a filter, to prevent dirt getting into it. These stones are reduced in size as they are placed further away from the box. The road is then made up as usual, after which it will be found that it will keep dry, and that the water will be carried into the gutter.

Studentships for Heating Engineers.—The Institution of Heating and Ventilating Engineers have founded two studentships tenable in the Faculty of Engineering at University College, London, and an award in connection with these will be made in June next. Each studentship is of the annual value of £50, in addition to the college fees, and is tenable in the first instance for one year, being renewable for a second, and under exceptional circumstances to a third year, subject to satisfactory work. Full particulars of the method of election and conditions of tenure may be obtained on application to the secretary of the college, Mr. Walter W. Seton.

ROYAL SANITARY INSTITUTE.

A sessional meeting of the institute will be held at 90 Buckingham Palace-road on Tuesday, May 20th, when an address on "London's Water Supply" will be delivered by Mr. E. B. Barnard, J.P., M.A., chairman, Metropolitan Water Board. The chair will be taken at 7.30 p.m. by Sir Alexander Binnie, M.INST.C.E., vice-president.

On Wednesday, May 21st, a visit will be made to the King George Reservoir, Chingford.

PROVINCIAL SESSIONAL MEETING, CHESTER.

A sessional meeting will be held on Friday, May 30th, in the council chamber, Town Hall, Chester, at 7.30 p.m., when a discussion will take place on "Modern Methods for the Purification and Softening of Water Supplies," to be opened by Mr. Joseph Parry, M.INST.C.E., chief engineer, Liverpool Corporation waterworks.

It is hoped that the following, among others, will take part in the discussion: Prof. J. Radcliffe, M.SC.TECH., Municipal School of Technology, Manchester; Messrs. W. Matthews Jones, M.INST.C.M.E., city surveyor and engineer, Chester; Coard S. Pain, ASSOC.INST.C.E., F.S.I., Liverpool; F. Storr, M.INST.W.E., water engineer, Wrexham, and James Wilding, F.S.I., surveyor and water engineer, Runcorn.

The chair will be taken by Mr. H. Percy Boulnois, M.INST.C.E., chairman of council of the institute.

On the following morning an inspection will be made of the Permutit softening plant at the West Cheshire Water Company's pumping station (Hooton). The visit to these works, it is expected, will take about two hours and a-half. Chester waterworks will be visited in the afternoon.

E. White Wallis,
Secretary.

INSTITUTION OF MUNICIPAL AND COUNTY ENGINEERS.

President—Mr. R. J. Thomas, M.INST.C.E., County Surveyor, Buckinghamshire.

SCOTTISH MEETING.

A meeting of the institution will be held in the Scottish District at Dundee on June 6th and 7th.

ROCHDALE MEETING.

A meeting of the institution in the North-Western District will be held at Rochdale on June 14th (Saturday).

LEEK MEETING.

A meeting of the institution in the West-Midland District will be held at Leek on June 28th (Saturday).

ANNUAL MEETING.

The annual meeting of the institution will be held from July 16th-19th.

Thomas Cole,
92 Victoria-street, S.W. *Secretary.*

INSTITUTION OF MUNICIPAL ENGINEERS.

President—Mr. Frank Latham, M.INST.C.E.I., F.S.E., Borough Engineer and Surveyor, Penzance.

NORTHERN DISTRICT MEETING AT NEWCASTLE.

A meeting of the Northern district of the institution was held at Newcastle on Saturday, April 26th. Mr. J. W. Moncur, chairman of the district, presided, and others present included Messrs. J. Davison (Morpeth), Geo. Symon (Blaydon), Lionel Simpson (Barnard Castle), John W. Holbrook (Houghton-le-Spring), W. J. Coulson (Cramlington), H. G. Kaines (Durham), G. W. Ayton (Chester-le-Street), Leonard Tait (Morpeth), W. Finch (Cumberland), and John Robinson, honorary district secretary.

The following dates were fixed for meetings during the summer, the arrangements of the programmes being left in the hands of the chairman, district secretary, and local surveyor in each case: May 31st, Middlesbrough; June 23rd-28th, International Road Congress in London; July 12th, Middleton-in-Teesdale; August 23rd, Carlisle; September 28th, Chester-le-Street.

It was agreed to recommend members to charge third-class railway fare and one guinea per day expenses for the time that they are in London attending the International Road Congress. The district secretary was asked to write to Mr. Wyand suggesting that it would be advisable to call the council meeting for earlier in the week than Saturday, June 28th, as many surveyors attending the congress would not stay throughout the whole week.

COUNCIL MEETING.

At a meeting of the council held in London on April 30th the following applicants were recommended for admission:—

To Membership: Messrs. J. W. Thomas, surveyor to the Gwyrfai Rural District Council; G. H. Buckett, borough engineer's office, Lambeth; and S. J. Higgs, dock engineer's office, Grimsby.

To Associate Membership: Mr. J. T. James, county surveyor's office, Hereford.

Transfer to Membership: Mr. F. A. Moore, borough engineer's office, Wolverhampton.

(Under the new by-laws these elections will be ratified at the next council meeting if no written objections are lodged within fourteen days.)

Elected to Studentship: Mr. J. R. Evans, town engineer's office, Swadlincote.

New Members, &c.—From the applicants recommended for admission at the last meeting three members and three associate members were elected.

Examinations.—The report of the Examination Board was received and adopted, the arrangements made to hold the examination at the council offices on May 16th and 17th being approved.

VISIT TO CHINGFORD.

A visit will be paid to the works of the Metropolitan Water Board at Chingford and Enfield Lock on May 14th.

Programme.

12.30 p.m.—Meet at Liverpool-street Station (G.E.R.), Continental booking hall.

12.50 p.m.—Train leaves for Enfield Lock Station.

1.26 p.m.—Train arrives at Enfield Lock Station.
1.35 p.m.—Leave Enfield Lock Station and proceed to pumping station.
1.50 p.m.—Arrive at pumping station and proceed thence on round of visits kindly arranged by Mr. William B. Bryan, M.INST.C.E., chief engineer to the Metropolitan Water Board.

NORTH-WESTERN DISTRICT.

A North-Western District meeting will be held at the Town Hall, Salford, on Saturday, May 31st.

PROGRAMME.

1.30 p.m.—District business meeting.
2 p.m.—Paper, "The Sewage Sludge Problem and its Solution," by Dr. Grossman, M.A., F.I.C., to be presented for discussion.
4 p.m.—Council meeting.

B. WYAND,
Secretary.

39 Victoria-street, S.W.
May 1, 1913.

INSTITUTION OF WATER ENGINEERS.

EIGHTEENTH SUMMER GENERAL MEETING.

The eighteenth summer general meeting of the Institution of Water Engineers will be held at Wakefield on Thursday, Friday and Saturday, June 5th, 6th and 7th, under the presidency of Mr. C. Clemesha Smith, M.INST.C.E., corporation waterworks engineer.

By kind permission of the mayor and corporation the meetings will be held in the town hall, and at the opening of the proceedings on Thursday the institution will be welcomed to Wakefield by his worship the mayor (Councillor Edwin Lodge Hirst, J.P.).

Ladies will be cordially welcomed at the meetings and visits.

The programme will include the presentation of premiums awarded by the council for papers presented during the year 1912.

PAPERS AND COMMUNICATIONS.

The following papers have been promised for reading and discussion at this meeting, and advance copies will be sent out as soon as printed to members who signify their intention of attending the meeting.

(1) "The Valuation of Water Undertakings on Transfer to Local Authorities," by E. J. Silcock, M.INST.C.E. (held over from winter meeting).

(2) "The Water Supply of Jersey," by Alfred J. Jenkins, ASSOC.M.INST.C.E.

(3) "Animal Growths in Water Pipes," by Samuel C. Chapman, M.INST.C.E.

(4) "Reservoir Storage in Relation to Stream Flow," by W. J. E. Binnie, M.INST.C.E., F.G.S., B.A.(CANTAB.), and Herbert Lapworth, D.SC., M.INST.C.E., F.G.S.

The president-elect (Mr. C. Clemesha Smith) will deliver his presidential address on Thursday, June 5th, and will also supply an illustrated description of the Wakefield waterworks, which will be circulated among those present at the meeting.

A lecture on "The Underground Waters of the Lower Calder" will be delivered by Prof. Percy Kendall, F.G.S.

VISITS TO WORKS.

On Thursday afternoon, June 5th, visits will be made to the Kirkhamgate filtration works and the Ardsley reservoir of the Wakefield Corporation waterworks.

On Friday, June 6th, visits will be made to the Green Withens and Ringstone reservoirs (Rishworth Moors) of the Wakefield Corporation waterworks, and to the works of Messrs. J. Blakeborough & Sons, at Brighouse.

SOCIAL FUNCTIONS.

The annual dinner will be held in the banquet chamber of the town hall on Friday evening, June 6th, when the Mayor of Wakefield and other distinguished guests will be entertained by the institution.

On Thursday evening, June 5th, there will be a reception at the town hall on behalf of the Corporation of Wakefield.

On Friday, June 6th, luncheon will be provided by the Water Committee of the corporation, and on Thursday and Friday afternoons tea will be provided (by invitation) for those taking part in the visits arranged for those days.

PERCY GRIFFITH,
20 Victoria-street, S.W. *Secretary.*

APPOINTMENTS VACANT.

Official and similar advertisements received up to 4.30 p.m. on Thursdays will be inserted in the following day's issue, *but those responsible for their despatch are recommended to arrange that they shall reach* THE SURVEYOR *office by noon on* **Wednesdays** *to ensure their inclusion in the weekly list of summaries. Such advertisements may, in cases of emergency only, be telephoned (No. 1359 Holborn), subject to later confirmation by letter.*

SURVEYOR'S CLERK.—May 9th.—Esher and the Dittons Urban District Council. £65—£85 per annum.—Mr. John T. Metcalf, clerk.

ASSISTANT HIGHWAY SURVEYOR.—May 10th.—Settle Rural District Council. £60 per annum.—Mr. T. E. Pearson, clerk.

BOROUGH SURVEYOR'S ASSISTANT.—May 10th.—Paddington Borough Council. £180—£250.—Mr. Arthur W. J. Russel, town clerk.

CLERK OF WORKS.—May 12th.—Corporation of Aberavon. £2 10s. per week.—Mr. M. Tennant, town clerk.

SECOND-CLASS CLERK (Surveyor's Department).—May 13th.—Leyton Urban District Council. £120—£150.—Mr. E. H. Essex, engineer and surveyor.

BUILDINGS SURVEYOR.—May 13th.—Shoeburyness Urban District Council. £125 per annum.—Mr. F. Gregson, clerk.

SURVEYOR'S CLERICAL ASSISTANT.—May 13th.—Cirencester Urban District Council.—Surveyor, Council Chambers, Cirencester.

JUNIOR ENGINEERING ASSISTANT.—May 14th.—For a county borough surveyor in the Midlands. £75 per annum.—THE SURVEYOR, 24 Bride-lane, Fleet-street, London, E.C.

TEMPORARY ASSISTANT.—May 14th.—Corporation of Colne. £85 per annum.—Mr. Alf. Varley, town clerk.

WATER ENGINEER.—May 15th.—Corporation of Sheffield.—Mr. R. M. Prescott, town clerk.

CLERK OF WORKS.—May 15th.—Ashby-de-la-Zouch Rural District Council. £3 per week.—Mr. G. Farmer, clerk.

ASSISTANT ENGINEER.—May 15th.—Board of Trustees for the Improvement of Calcutta. 500—700 rupees per mensem.—Mr. C. H. Bompas, chairman, 5 Clive-street, Calcutta.

SECOND ASSISTANT SURVEYOR.—May 15th.—Heston and Isleworth Urban District Council. £90—£120.—Mr. J. G. Carey, engineer and surveyor, Council House, Hounslow.

ROAD SURVEYOR.—May 17th.—Carrick District Committee, County of Ayr. £300 per annum.—Mr. P. Paterson, district clerk, Maybole.

QUANTITY SURVEYOR.—May 17th.—Education Committee of the Monmouth County Council. £160—£200.—Mr. C. Dauncey, secretary, County Council Offices, Newport (Mon.).

INSPECTOR OF NUISANCES.—May 19th.—Corporation of Chester. £150—£200.—Mr. J. H. Dickson, town clerk.

SEWAGE FARM MANAGER.—May 21st.—Wanstead Urban District Council. £120—£150.—Mr. Bruce Blewitt, clerk.

BOROUGH ENGINEER'S CLERK.—May 21st.—Corporation of Stockton-on-Tees.—Mr. M. H. Sykes, borough engineer.

CLERK OF WORKS. May 28th.—Repton Rural District Council.—Mr. C. F. Chamberlin, clerk, Union Offices, Burton-on-Trent.

BUILDING ENGINEER.—June 6th—25th.—Municipality of Rangoon. 600—800 rupees per mensem.—The Secretary, Rangoon Municipality, Burmah. The latest date of despatch of letters to reach Rangoon by June 25th is by the Indian mail leaving London on June 6th.

MUNICIPAL COMPETITIONS OPEN.

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CHEPPING WYCOMBE.—September 1st.—Designs for town-planning the borough and an area immediately adjoining. Premiums, £25, £10 and £5.—Mr. T. J. Rushbrooke, borough surveyor, High Wycombe.

MONAGHAN.—No date.—Plans for the conversion of barracks into working-class dwellings, for the urban district council. Cost of scheme not to exceed £4,000.—Mr. P. MacGeough, town clerk.

MUNICIPAL CONTRACTS OPEN.

Official and similar advertisements received up to 4.30 p.m. on Thursdays will be inserted in the following day's issue, *but those responsible for their despatch are recommended to arrange that they shall reach* THE SURVEYOR *office by noon on* **Wednesdays** *to ensure their inclusion in the weekly list of summaries. Such advertisements may, in cases of emergency only, be telephoned (No. 1359 Holborn), subject to later confirmation by letter.*

Buildings.

MALDENS AND COOMBE.—May 10th.—For the erection of boundary walls, piers and gates, and the construction of surface-water drainage, for the urban district council.—Mr R. H. Jeffes, engineer and surveyor.

LEEDS.—May 10th—24th.—For the erection of a tramway shed and other buildings, for the corporation.—Messrs. Connon & Chorley, 16 Park-place.

CORNWALL.—May 12th.—For improvements to a public school, for the Education Committee.—Mr. Sampson Hill, architect, Green-lane, Redruth.

ALSAGER.—May 13th.—For the boring and lining of Borehole No. 2 in connection with the Oak Farm water supply, for the urban district council.—Mr. John J. Nelson, clerk.

LEIGH (Lancs).—May 13th.—For the erection of 100 cottages, for the corporation.—Borough Engineer.

TEDDINGTON.—May 13th.—For the erection of corrugated iron and steel cart shed, for the urban district council.—Mr. M. Hainsworth, surveyor.

LARNE.—May 14th.—For building twelve single and three double labourers' cottages, for the rural district council.—Mr. S. M. Wallace, clerk.

EAST RIDING.—May 14th.—For the repair and partial rebuilding of a stone bridge, for the county council.—Mr. John Bickersteth, clerk, County Hall, Beverley.

WILTS.—May 14th.—For alterations and additions to secondary school, for the county council.—County Surveyor, Trowbridge.

NEWCASTLE-ON-TYNE.—May 14th.—For the erection of a bowling green shelter, for the corporation.—City Engineer.

HASLINGDEN.—May 14th.—For the erection of a school, for the corporation.—Mr. J. S. Green, borough surveyor.

RISHTON.—May 15th.—For the erection of fifteen cottages, for the urban district council.—Mr. J. Parker, architect, 112 High-street.

CHELMSFORD.—May 15th.—For the erection of stables, for the corporation.—Borough Engineer.

RHONDDA.—May 16th.—For the erection of a school, for the urban district council.—Mr. Jacob Rees, architect, Hillside Cottage, Pentre.

LANARK.—May 17th.—For extensions of the Middle Ward hospital, for the county council.—Mr. W. E. Whyte, district clerk, Hamilton.

HUDDERSFIELD.—May 17th.—For additions to council school, for the Education Committee.—Mr. K. F. Campbell, borough engineer and surveyor.

ST. HELENS.—May 19th.—For alterations at a school, for the Education Committee.—Messrs. Biram & Fletcher, architects, George-street.

MONMOUTH.—May 19th.—For the erection of a school, for the Education Committee.—Mr. J. Bain, County Council Offices, Newport.

LEEDS.—May 19th.—For the erection of an economiser chamber at generating station, for the corporation.—1 Whitehall-road, Leeds.

CHESHIRE.—May 19th.—For alterations and additions to an asylum, for the county council.—Mr. H. Beswick, county architect, Newgate-street, Chester.

DURHAM.—May 20th.—For the erection of a cookery centre and other works, for the county council.—Mr. W. Rushworth, Shire Hall, Durham.

KINSALE.—May 21st.—For the erection of cottages, for the rural district council.—Mr. J. Murphy, clerk.

HAMPSHIRE.—May 21st.—For the erection of a school, for the county council.—Mr. A. L. Roberts, architect, The Castle, Winchester.

BIRMINGHAM.—May 22nd.—For extensions to sanatoria, for the corporation.—Mr. J. Keyte, clerk to the Public Health Committee, Council House.

HULL.—May 22nd.—For alterations and additions to a council school, for the corporation.—Mr. J. H. Hirst, city architect, Guildhall.

CHESTERFIELD.—May 24th.—For the erection of a filter-house and valve-house, for the rural district council.—Mr. G. Frith, waterworks engineer.

SOUTHMOLTON.—May 24th.—For the erection of ten cottages, for the corporation.—Mr. H. C. E. Rayner, borough surveyor.

BUCKS.—May 26th.—For alterations to police court and erection of police cottage, for the Standing Joint Committee.—Mr. R. J. Thomas, county surveyor, County Hall, Aylesbury.

MIDDLESEX.—June 6th.—For extensions to the Napsbury Asylum, including additional accommodation for female staff, residence for an assistant medical officer, and alterations and additions to the upholsterer's shop, for the Sub-committee of Visitors.—Mr. Henry G. Armour, clerk, Napsbury Asylum, St. Albans.

HERTS.—June 27th.—For the construction of a bridge, for the county council.—Mr. Urban A. Smith, Hatfield.

Iron and Steel.

DUNDEE.—May 12th.—For the supply of cast-iron pipes, for the Water Commissioners.—Mr. George Baxter, engineer and manager, 93 Commercial-street.

BIRMINGHAM.—May 15th.—For the construction of a cast-iron lined well and the sinking of a borehole, for the corporation.—Mr. J. Cox, superintendent engineer, Baths Department, Kent-street.

BELFAST.—May 19th.—For the supply of a circulating water pump, for the corporation.—Mr. T. W. Bloxham, city electrical engineer, East Bridge-street.

LEEDS.—May 19th.—For the extension of an engine-room flooring, for the corporation.—Mr. C. Nelson Hefford, 1 Whitehall-road, Leeds.

BIDEFORD.—May 21st.—For the extension of the water supply, for the corporation.—Mr. W. O. Seldon, town clerk.

STOKE-ON-TRENT.—May 31st.—For the supply of cast-iron work for storm-water drainage scheme, for the corporation.—Mr. A. Burton, borough surveyor.

Roads.

CLEETHORPES.—May 10th.—For making up a road, for the urban district council.—Mr. C. H. Waithman, surveyor.

LEEDS.—May 12th.—For making up tar-macadam carriageways and asphalt footways, for the corporation.—City Engineer.

FAREHAM.—May 12th.—For the supply of granite, basalt, or other hard stone, for the rural district council.—Mr. J. F. Whitear, surveyor.

SALCOMBE.—May 13th.—For the supply of broken blue Elvan stone, broken limestone, blue Elvan chippings and limestone chippings, for the urban district council.—Mr. G. I. Holmes, surveyor, 74 Fore-street.

ROCHDALE.—May 14th.—For work of making up and sewering, for the corporation.—Borough Surveyor.

BRIGG.—May 14th.—For the supply of 300 tons of granite, for the urban district council.—Mr. G. S. Sowter, clerk.

DURHAM.—May 14th.—For making up a highway, for the rural district council.—Mr. Geo. Gregson, surveyor.

ENFIELD.—May 14th.—For the making up of private streets, for the urban district council.—Mr. T. W. Scott, clerk.

HOUNSLOW.—May 15th.—For making up two streets, for the urban district council.—Mr. J. G. Carey, engineer and surveyor.

ENFIELD.—May 15th.—For providing and laying about 8,000 yds. super. of artificial stone paving, for the urban district council.—Mr. T. W. Scott, clerk.

ABERDEEN.—May 15th.—For road improvement works, for the county council.—Mr. A. Blacklaw, district clerk, 189 Union-street, Aberdeen.

CHELMSFORD.—May 15th.—For surfacing portions of High-street, Moulsham-street and Springfield-road, containing about 9,000 sq. yds., with tar-macadam or

other bituminous materials, for the corporation.—Borough Engineer.

PRESTON.—May 16th.—For making good certain streets, for the corporation.—Borough Surveyor.

DORSET.—May 17th.—For tar-spraying 130,000 yds. super. during the coming season, for the county council.—Mr. W. T. Fletcher, county surveyor, County Offices, Dorchester.

PEMBROKE (co. Dublin).—May 19th.—For laying asphalt or other kindred material in three roads, for the urban district council.—Mr. J. C. Manly, clerk.

STOCKTON-ON-TEES.—May 19th.—For levelling and paving several streets, for the corporation.—Mr. Arthur B. Crosby, town clerk.

WHITLEY AND MONKSEATON.—May 19th.—For making-up work in certain streets, for the urban district council.—Mr. Augustus Whitehorn, 60 Saville-street, North Shields.

BRIGHTON.—May 20th.—For the supply of broken granite, for the corporation.—Mr. H. Talbot, town clerk.

BUNGAY.—May 21st.—For the supply of 2-in. granite, for the urban district council.—Mr. P. J. Sprake, clerk.

WOODHALL SPA.—May 21st.—For laying limestone tar-macadam and tar painting and spraying, for the urban district council.—Mr. E. E. T. Bolton, surveyor.

STOWMARKET.—May 23rd.—For the supply of broken granite, for the urban district council.—Mr. P. C. G. Hayward, clerk.

NORTH WALSHAM.—May 24th.—For the supply of granite, tar, and road rolling, for the urban district council.—Mr. J. W. Stevens, surveyor.

AXBRIDGE.—May 24th.—For the supply of 8,000 tons of granite or basalt macadam and chippings, for the rural district council.—Mr. J. Knight Dunster, district surveyor, Winscombe, Somerset.

RUNCORN.—May 26th.—For laying tar-macadam in certain streets, for the rural district council.—Mr. R. Garnett, Sankey-street, Warrington.

LONDON.—May 26th.—For road construction at Norbury, for the county council.—The Clerk, Spring-gardens.

BURNLEY.—June 2nd.—For work of road reconstruction, for the rural district council.—Mr. H. Pritchard, engineer.

Sanitary.

NEATH.—May 13th.—For the construction of storm-water sewers and manholes, for the rural district council.—Mr. D. M. Davies, engineer.

GRIMSBY.—May 13th.—For the construction of 300 yds. of sewers, for the rural district council.—Mr. A. Hobson, surveyor and engineer.

ROCHDALE.—May 14th.—For the construction of earthenware pipe sewers and manholes, for the corporation.—Mr. W. H. Hickson, town clerk.

DENTON.—May 14th.—For the construction of brick and stoneware pipe sewers, for the urban district council.—Mr. William Richards, clerk.

OLDHAM.—May 14th.—For the supply of six rotating sprinklers, for the corporation.—Mr. J. H. Hallsworth, town clerk.

WOOD GREEN.—May 14th.—For constructing surface-water sewer, culverting, and laying out gardens, for the urban district council.—Engineer and Surveyor.

BLACKPOOL.—May 15th.—For the construction of an underground public convenience, for the corporation.—Mr. John S. Brodie, borough engineer and surveyor.

ASHBY-DE-LA-ZOUCH.—May 15th.—For constructing sewers, manholes and ventilators, for the rural district council.—Mr. T. I. McCarthy, Central Chambers, Coalville, near Leicester.

KIRKCALDY.—May 16th.—For works of sewerage, for the corporation.—Burgh Surveyor.

LYMINGTON.—May 17th.—For the construction of main intercepting sewers, manholes, storm overflows, screen chamber, and alterations and additions to the existing low-level pumping station, for the corporation.—Mr. J. Davis Rawlins, town clerk.

LYMINGTON.—May 17th.—For repairing and cleansing the sewer outfall, for the corporation.—Mr. J. Davis Rawlins, town clerk.

LYTHAM.—May 19th.—For the construction of a 30-in. concrete and cast-iron main sewers and storage culvert, for the urban district council.—Mr. A. J. Price, engineer and surveyor.

BOSTON.—May 19th.—For the roding and cotting of drains, for the Black Sluice Commissioners.—Mr. F. Sanderson-Robins, 6 Bridge-street, Boston.

BINGLEY.—May 19th.—For alterations and additions to sewage disposal works, for the urban district council.—Mr. H. Bottomley, engineer and surveyor.

KEIGHLEY.—May 19th.—For laying pot pipe drain, for the rural district council.—Mr. T. Burton, surveyor and sanitary inspector.

BRADFORD.—May 20th.—For emptying ashpits and cesspools, for the Cleansing Committee.—Superintendent Call, Hammerton-street depot.

BRIGHTON.—May 20th.—For the supply of glazed drain pipes, for the corporation.—Borough Surveyor.

ST. HELENS.—May 21st.—For the construction of a sewer, for the corporation.—Mr. A. W. Bradley, borough engineer.

SPILSBY.—May 21st.—For the construction of sewers and manholes, for the rural district council.—Mr. G. B. Walker, clerk.

HARPENDEN.—May 23rd.—For the provision and erection of sewage pumping machinery, for the urban district council.—Mr. Chas. S. Tuckey, clerk.

UXBRIDGE.—May 23rd.—For the construction of a stoneware sewer, for the rural district council.—Mr. J. W. Harrison, engineer and surveyor.

FINCHLEY.—May 26th.—For the construction of 456 yds. of 15-in. and 9-in. surface-water sewer, part under highways and part under open land, for the urban district council.—Mr. E. H. Lister, clerk.

WHITSTABLE.—May 27th.—For the construction of a brick and concrete tank sewer, concrete tube sewers, stoneware pipe sewers, cast-iron rising main, cast-iron outfall sewer, manholes, pumping station, tanks, cottage, and percolating filters, for the urban district council.—Messrs. Strachan & Weekes, civil engineers, 9 Victoria-street, Westminster.

WOKINGHAM.—May 28th.—For the construction of stoneware sewers, manholes and ejector chamber, and supply of cast-iron pipes, for the corporation.—Mr. C. W. Marks, borough engineer and surveyor.

OAKENGATES.—May 31st.—For sewerage and sewage disposal works extension, for the urban district council.—Messrs. Berrington, Son & Watney, Prudential Chambers, Lichfield-street, Wolverhampton.

Stores.

RICHMOND (Surrey).—May 12th.—For the supply of coal, lime, sulphate of alumina and green copperas and filter cloth, for the Main Sewerage Board.—Mr. W. Fairlie, engineer, West Hall-road, Kew Gardens.

WALSALL.—May 19th.—For the supply of stores for the gas department.—Mr. H. Lee, town clerk.

BRADFORD.—May 20th.—For the supply of iron castings, bolts, nuts, street-sweeping machine brushes, brooms and shovels, for the corporation.—Superintendent Call, Hammerton-street depot.

Miscellaneous.

RICHMOND.—May 12th.—For the supply of Welsh steam coal, house coal, Buxton lime, grey lime, sulphate of alumina and green copperas, and filter cloth, for the Sewerage Board.—Mr. J. Leslie G. Powell, clerk.

TORONTO.—May 28th.—For the removal of 35,000,000 cub. yds. of material by hydraulic dredging, for the Toronto Harbour Commissioners.—Mr. E. L. Cousins, chief engineer.

Housing of the Working Classes (Ireland) Act.—In the House of Commons on the 1st inst. Mr. William O'Brien asked whether the Local Government Board have now ascertained the average rent charged for houses built under the Housing of the Working Classes (Ireland) Act; and how many of those houses are let at a rent under 2s. a week? Mr. Birrell said that from the information furnished by local authorities it would appear that the average weekly rent charged for houses erected since the passing of the Housing of the Working Classes (Ireland) Act, 1908, was 3s. 4d. Twenty-eight houses were let at rents under 2s. a week.

The Surveyor

And Municipal and County Engineer.

Vol. XLIII. MAY 16, 1913. No. 1,113.

Minutes of Proceedings.

The Management of City Trees.

An article which appeared in a recent issue of the *Times* contains a clear statement of an important principle in the management of trees, interwoven with expressions of opinion as to the place of the tree in city life; and it ends with a suggestion that a new policy is desirable as regards the control of trees in London streets. With the passages relating to the principle alluded to above we are fully in accord, but we cannot go the whole way with the writer of the article in his view as to the part played by street trees, and his proposal for a new policy in tree management seems to be very ill-conceived, and especially undesirable in the Metropolis. The principle that governs the pruning and lopping of trees is that all such operations must be carried out with a view to the future growth of the tree, not its present appearance. Each species responds to lopping and pruning in a different way, and some present a much better appearance than others in the intermediate stages. A tree which is pruned too late, or which has to be heavily lopped because it was not pruned in time, will not prove so satisfactory as one which is taken in hand at a suitable age. This is well put in the following passage from the *Times* article: "If it is let grow freely until it is too big for the pavement, it will then have to be heavily lopped, and the result is one of the eyesores — conspicuous both in London and Paris—which have been described as vegetable clothes' props. It is better to apply the process of restraint in time." It has, however, to be remembered that a tree grows by means of its leaves, which are its digestive organs, and, even at a sacrifice of its appearance during several years, sufficient foliage must be left to nourish the tree. When, for instance, it is necessary to keep back the growth of trees alongside a tramway, it may be undesirable to prune equally all round, since the tree would then be starved, so it has to be left lopsided.

If a trolley wire has to be cleared it may also be necessary to have an unsymmetrical top to the young tree, so that some of its future limbs may grow upwards, to spread afterwards into an effective canopy. When this stage is reached the lower branches may, with some species, including limes and elms, be controlled as a minor growth, while with other species it is better to lop the branches close to the trunk. Above the obstructions the tree may be allowed to grow to its full natural height and spread, or may, if necessary, be controlled to suit the restrictions of space, or for other reasons. The *Times* writer considers that the management of trees by local authorities is often lacking in foresight and judgment, but he also points out that many ill-informed criticisms are passed upon the decisions of local authorities in this matter. It will probably be admitted by all foresters who study the streets and open spaces of London that the care and control of the trees of the Metropolis leave little to be desired, and the apparently inferior practice on many suburban thoroughfares is largely due to the fact that the trees had already grown to maturity, or to an age at which control is difficult, when these roads developed to their present condition as regards buildings and traffic.

There are probably but few persons who, being familiar with the streets of London in the months of July, August, and September, will agree with the view that the shade thrown by city trees is of little value; and where the *Times* writer sees "darkness and dampness in the gloomy weeks of autumn," most of us hail with satisfaction our city's hostages for the return of spring. Nor are we pleased with the narrow view expressed with a somewhat heavy touch, as follows: "The real object of growing trees in London streets is purely æsthetic. They have a suggestion of country freshness which delights the eye even in their winter nudity and grime, and they please our English taste by bringing a touch of Nature into the heart of the town." This is pretty sentiment, but let us rather value our London trees for the way in which they supplement and sweeten the grim splendours of our great city, and by their delicacy of form, their lift and sway in the wind, and their annual burst of foliage, set off the massive dignity of "unscoured stone obscured by sluttish time," and this whether they stand in the open spaces, between great buildings, in dark courtyards by old city churches, or, in double rank, keep guard over the rushing traffic of a great thoroughfare. Yet the *Times* writer would have us train our city trees "like an espalier fruit tree," because "we cannot interlard our streets with slices of natural forest, but we could often make them into very pretty gardens if we would consent

to abandon an impossible ideal." Think of it! Imagine it if you can—London, the grim, the splendid, with her streets made into "very pretty gardens."

* * *

The Central Committee on Roads and Road Traffic.

As reported in our issue of last week, two important resolutions of the Highways Committee of the County Councils Association, relating to highway administration, were approved at a meeting of the Central Committee on Roads and Road Traffic. The first resolution (see page 743) was to the effect that roads should be classified by the Road Board after consultation with the local authorities; and the second resolution recommended that Government grants, amounting to half the cost of maintenance of main roads, and more in the case of trunk roads, should be made "on a certificate being given by a Government superintendent that the roads have been properly maintained by the local authorities." It is clearly implied that the classification would be such that, in any part of the country, there would be a suitable mileage of "main or primary roads," and, where necessary, of trunk roads, and we may assume that the line of division between these and "other roads" would be about the same as that between main and secondary roads in those counties which have, under present arrangements, fair proportions of main roads. It is therefore considered that above this dividing line there should be two classes of roads, while it is good enough to class all the rest as "other roads," which may, "if thought fit," be further subdivided. It will be observed that this is a proposal, not of a body representing all local authorities, but of the Highways Committee of the County Councils Association, and we may believe that the words "if thought fit" amount to an invitation to the representatives of district councils to state their views.

Let us now consider what was the composition of the meeting which approved these resolutions. The chairman and secretary are, of course, to be considered as impartial as regards the interests of those concerned with roads, and the same may be said of Mr. Rees Jeffreys, representing the Road Board. There were seven other members present, one representing the County Surveyors' Society, another the Convention of Royal Burghs, but none to speak for ordinary towns or for urban and rural districts. There were, however, no fewer than four others present, directly representing motor interests, and one representing the Roads Improvement Association, which, up to the present, has failed to show that it is representative of road users generally, though its activities may be regarded as providing a wholesome stimulus in the direction of road improvement. Such was the constitution of the meeting which approved of the specific proposal that all roads down to secondary roads shall be under Government inspection, and made no definite proposal as regards other roads. Could district surveyors view with equanimity the passage of a Bill embodying these proposals? If not, the time is ripe for action, and an excellent opportunity will be presented at the International Road Congress for the expression of opinions on this subject. It is probable that among the propositions put forward by the various committees there will be some quite as drastic as these, but there may be others which will recommend legislation dealing with all roads, and laying down, not only the principle on which Government should contribute to the trunk and main roads, but also the general procedure recommended as regards the grants to be made by county councils towards the "other roads," and dealing also with the classification of these.

We are inclined to believe that a policy which is partial in character will not recommend itself to Sir George Gibb and his colleagues on the Road Board, and we hope that when the time comes to frame a Bill the Government will take up the matter, and instead of leaving the drafting of the Bill to private members, which in this case would mean a group such as the "Central Committee," will make it a non-party Government measure, and in drafting its provisions make full use of Sir George Gibb's experience as chairman of the Road Board. In conclusion, to revert to the resolutions which form the subject of these remarks, it may be pointed out that the first resolution was that the classification of roads should be made by the Road Board, not in consultation with the local authorities, but "after consultation" with these bodies. We do not take exception to this wording, or to the procedure implied, but it is worth noting.

* * *

New York Sewage Disposal: British Experts' Reports.

The recently published seventh interim report of the Metropolitan Sewerage Commission of New York deals with the reports of Dr. G. J. Fowler, F.I.C., and Mr. J. D. Watson, M.INST.C.E. These two British experts were called upon by the commission last autumn to examine and report upon the various projects which had been prepared for the solution of the most difficult portion of the problem of protecting the waters of New York Harbour from excessive pollution by sewage. In issuing these documents the commission state that "the reports of Messrs. Fowler and Watson contain so much that is of value from scientific and practical standpoints, and their statements seem so capable of aiding the public to understand New York's large and complicated problem of sewage disposal, that their reports are herewith published in full." In these two reports, which are of similar scope, the subject is approached from the separate standpoints of the chemist and the engineer, and each arrives at practically the same conclusion. Both experts were impressed by the vastness and complexity of the problem, the largest which has ever been brought forward for solution in the past, and it is gratifying to find that British experience, in the persons of Dr. Fowler and Mr. Watson, has been called upon to assist our cousins on the other side of the Atlantic Ocean in their difficult work. Another point upon which both agree is the high value of the preliminary studies and investigations which have been carried out by the commission. Dr. Fowler states that this work has been done "with masterly completeness. No question necessary for the formation of a right judgment on the questions which should be settled at this time appears to have been left unstudied by the commission." Each recognises the necessity of stopping the existing pollution and improving the harbour without loss of time.

In dealing with one of the earlier reports of this commission (THE SURVEYOR, June 23, 1911, page 916), we drew attention to the peculiarly difficult conditions of the East River, where the sewage is at present discharged into water which simply oscillates with the ebb and flow of the tide, and it is now pointed out that the most urgent step is to deal promptly with this section. After carefully considering the whole matter from every point of view, both experts concur in the proposal to remove entirely the sewage now discharged into the lower East River, and take it out to sea. This involves some very deep large sewers of considerable length, and two pumping stations. The proposals for the ultimate outfall into the sea are novel. The sewer, after it reaches the well-

known Coney Island, is continued for a distance of 3 miles out to sea, terminating at a point about half way between that island and Sandy Hook in an artificially constructed island. This island is to be of considerable extent, and will contain the necessary settling tanks for the preliminary treatment of the sewage. The tank effluent will be discharged into deep water through a number of outlets, and the sludge from the tanks will be taken out to sea. As the estimated total cost of construction of these main sewers and the sea-island is about £4,500,000, it is evident that the commission has approached its task in a courageous manner, and it is to be congratulated on having devised a solution of the problem which goes to the root of the matter. While disposal by dilution of limited quantities of sewage, suitably treated, is quite possible where rivers of large volume are available for the purpose, the results of recent investigations into the conditions of the Great Lakes, and New York Harbour itself, indicate that, unless there is a continuous flow in one direction of thoroughly aërated water, as in the case of large rivers or well-defined currents in the sea, the satisfactory disposal of the enormous volumes of sewage produced by large cities is a problem of immense difficulty and expense, and we shall not be surprised if, in the end, the tentative proposals of the New York commission to carry the sewage from other sections of the city out to the suggested sea-island are definitely adopted and carried out. A solution on similar lines of the problem of dealing with the London sewage is worthy of careful consideration.

* * *

Lightning Rods.

The use of lightning rods on buildings is general, but the number of cases in which these are useless and even dangerous is not understood. It is common practice to erect one or more lightning rods on any building of importance, and these may or may not be set up by competent persons; but cases where such rods are tested or periodically inspected are indeed rare. Moreover, the instances in which the protection afforded is practically nil are common. It will come as a surprise to most readers to learn that for the protection of a house measuring 100 ft. by 50 ft. in plan half a dozen rods will probably be required.

This fact and many similar and important statements are made in a paper read before the Illinois State Electric Association by Mr. Ernest J. Berg, of which a more detailed account is given elsewhere in these pages. Perhaps the most useful fact recorded is the value of the galvanised wrought-iron rod, which in the country —where it is not affected by the corrosive acids present in town air—is preferred to the ordinary expensive copper rod. Many rods are badly placed, some are broken or improperly jointed, while others have no proper connection to earth. Elaborate or unnecessary devices are certainly not uncommon with regard to the earth connections, while in other cases practically no proper connection exists. The author gives valuable practical advice on many points; as an example it is shown that an excellent earth connection may be made by driving an ordinary galvanised-iron gaspipe a few feet into the ground. Happily, severe thunderstorms are comparatively rare in this country, while in cities the risk from lightning is minimised by the number of grounded metal structures and overhead wires; still it is to be remembered that even in London buildings are occasionally struck, and that practically every thunderstorm does considerable damage in the country. The possible inadequacy of the protection provided for the average building by the lightning rod is therefore a matter of importance, and a careful study of Mr. Berg's paper is to be recommended.

* * *

Automobilism and Blither.

Under the ill-starred heading "Automobilism," a correspondent of the *Times* contributed to the issue of April 22nd a whole column on the subject of "The Wear of Roads and Trackways." Beginning with a few somewhat vague platitudes, the writer proceeded to draw "a parallel from railways," leading up to the "surprising fact" that "something less than 4 per cent of the width of a roadway of this width (18 ft.) is used at one time by one vehicle . . . ." He then embarked upon an advocacy of trackways, and stated that: "It has been calculated that if two strips of concrete blocks 3 ft. long and 1 ft. wide each, carefully jointed into each other, were laid down the centre of a main road the life of the road would be lengthened to four or five times its present period." It is comforting to learn that the cost of the concrete strips would not be "unduly excessive," and that materials for the concrete "could often be found on or near the edges of the road itself." The financial significance of the word "found" is not quite clear, but it seems intended to suggest possible economies. We have given careful attention, for many years, to the possibilities and limitations of the plateway principle, and although surveyors have not, so far, found it desirable to adopt it or to recommend its adoption, except in special cases, we had supposed that they were fully aware of the facts, and alive to the bearing of recent developments upon the economies of plateways for ordinary roads. Whatever may be the future possibilities of the system, it is unfortunate that it should have been put forward in a way so little complimentary to the capacity of surveyors, and it is a matter for surprise that the absurd reasoning—if such it may be called—with which it is now put forward should have found a place in the columns of a daily paper of great repute.

* * *

Ventilation of Cinematograph Buildings.

Our contemporary the *Lancet* has recently been inveighing against the lack of ventilation which is said to be so serious a feature in many buildings used for cinematograph purposes. It contends that the cinematograph theatre is frequently a veritable Black Hole of Calcutta, with no ventilation at all, and very truly states that the worst offenders are old buildings which, with the minimum of alteration required by law, are adapted for use for cinematograph purposes. A perusal of the Cinematograph Act, 1909, and of the regulations made by the Home Secretary under the provisions of the Act, will show that the requirements are confined to questions affecting the safety of the audience. Apparently the ventilation of such buildings for purposes of health can be enforced only when, as is the case in most urban districts, the by-laws include a requirement for the ventilation of public buildings. This requirement has for the most part in the past needed comparatively little attention, for in the case of important buildings of a public character the persons responsible for their erection will, in their own interests, install a satisfactory system of ventilation. But the cinematograph has rendered possible the existence of public buildings of a much lower grade than has hitherto been the case, and it will be necessary for local officials in urban districts to pay more attention to obtaining compliance with requirements as to ventilation. Having regard to the fact that the cinematograph is now making its appearance in rural districts of a populous nature, it will also be well for rural authorities throughout the country to see that their powers are sufficient to enable them to deal with the buildings from all points of view.

Ouseburn Valley Works.

By FRANK I. MORGAN, ASSOC.M.INST.C.E.

The city of Newcastle was at one time intersected by quite a number of small denes, running through what is now the centre of the town down to the river Tyne. The increasing expansion of the city from year to year rendered necessary the filling up

Mr. F. I. Morgan.

[Mr. Morgan served his pupilage from 1886 to 1896 with, and afterwards became assistant, and later chief assistant, to, Mr. E. M. Smith, M.INST.C.E., the divisional new works engineer of the London and North Western Railway Company for the Birmingham district. During this period he was constantly engaged upon large and important railway schemes for new lines and widenings, comprising heavy constructional work in bridges, viaducts, retaining walls, &c., and the general work contained in railway construction. In 1896 he was appointed engineer and manager to Mr. Herbert Weldon, ASSOC.M.INST.C.E., Birmingham, civil engineer and contractor, and from that year until 1904 was engaged in the carrying out of many schemes of main drainage works, sewage disposal works, reservoirs, pumping stations, and other engineering works. He passed the examination of the Institution of Civil Engineers in 1899, and was elected an associate member. In 1904 he carried out the reconstruction of the Devizes sewage disposal works, for which Mr. W. J. Dibdin and Messrs. Beeseley, Son & Nichols, Westminster, were consultants. In 1906 he was appointed engineering assistant to Mr. C. R. S. Kirkpatrick, M.INST.C.E., city engineer of Newcastle-upon-Tyne, and later to his successor, Mr. W. J. Steele, M.INST.C.E., the present city engineer. While at Newcastle Mr. Morgan has been engaged upon many schemes of public improvements and engineering projects, among these being the Ouseburn Valley works, the subject of the paper reproduced herewith.]

of many of these, and their ultimate conversion into building land and streets—some of the principal thoroughfares and buildings in the centre of the city to-day stand upon the site of these valleys. By far the largest of them, however, and which is the subject of this paper, still remains to be dealt with, as for some time past its existence has constituted a serious obstacle to the efficient working of the traffic between the eastern and western portions of the city.

The eastern areas, known as Byker and Heaton, are divided from the western part of the city by a steep and wide valley, called the "Ouseburn Valley," at the bottom of which the "Ouse Burn" stream flows to the river Tyne. The only direct means of communication between the city and these suburbs is by a brick viaduct, called the "Byker Bridge," which crosses the valley at a height of about 120 ft. above stream surface. This was built by a private company in the year 1877, and owned by them until the year 1895, during which period tolls were levied for crossing the bridge. In the year 1895 the corporation acquired the bridge from the company at a cost of £120,000 and freed it to the public.

During later years, however, the expansion of the city on its eastern boundary has been so rapid as to render the existing structure altogether inadequate to accommodate the requirements of the traffic, and when the extension of the city tramways to the eastern areas was decided upon it became necessary to widen the bridge to make room for these. The city council recognised, however, that this would be but a temporary measure, and that they would, at no distant date, have to provide additional facilities for the growing traffic needs. Bearing this in mind, they took powers in the Newcastle-upon-Tyne Tramways and Improvement Act of 1899 to construct a viaduct over the valley at an estimated cost of £100,000.

From this date the matter was under constant consideration, and in the year 1900 the council passed a resolution requesting the Town Improvement and Streets Committee to consider the propriety of filling up the Ouseburn Valley, or, in the alternative, a part thereof. Acting upon the council's instructions, the committee gave careful consideration to the subject, and after exhaustive inquiry reported to the council in 1903 in favour of carrying out the filling scheme, which would enable the corporation to provide ample means of communication between the portions of the city east and west of the Ouseburn, without entailing a heavy expenditure upon the ratepayers. This scheme they considered would be much more economical than the building of a viaduct in accordance with the powers obtained in 1899. The cost of acquiring the land, culverting the Ouseburn, the making of roads and all other works in connection with the scheme, was estimated at about £161,000, and to meet such expenditure it was estimated there would be a considerable revenue derived from payment for permission to tip material, and from rent of properties to be acquired, but which would not be pulled down until such time as their site was required to be raised to the new levels. In addition there would ultimately be a large area of land available for buildings in a populous part of the city.

The council, after full discussion of the above recommendations, decided to proceed with the scheme, and in the Newcastle-upon-Tyne Corporation Act, 1904, obtained powers which comprised the following works:—

Works Nos. 1, 2 and 3 include the making of three main thoroughfares, 60 ft. wide, across the valley at intervals from east to west.

Work No. 4 was for the construction of a culvert for enclosing, straightening, and diversion of the Ouseburn stream—the culvert, if required by the Tyne Improvement Commissioners, was to be constructed of such strength, and with foundations of such depth at its lower or southern extremity as would allow, without damage to itself, of such dredging in or deepening of the stream immediately to the south of the culvert as might be necessary for providing there a depth of 15 ft. of water at high water ordinary spring tides.

The total depth of the filling, from the bottom of the valley to the proposed new surface level, is about 100 ft. The greatest approximate width of the valley at the top is about 1,200 ft., and the minimum 550 ft. The estimated total quantity of filling required for the whole scheme is about 4,500,000 cub. yds. The method of procedure was to concentrate all efforts towards tipping one of the main arteries across the valley as quickly as possible, so as to give the much-needed traffic facilities with the minimum of delay, and afterwards, as the filling became available, to gradually fill up the remainder of the valley and form the other main thoroughfares.

REINFORCED-CONCRETE CULVERT.

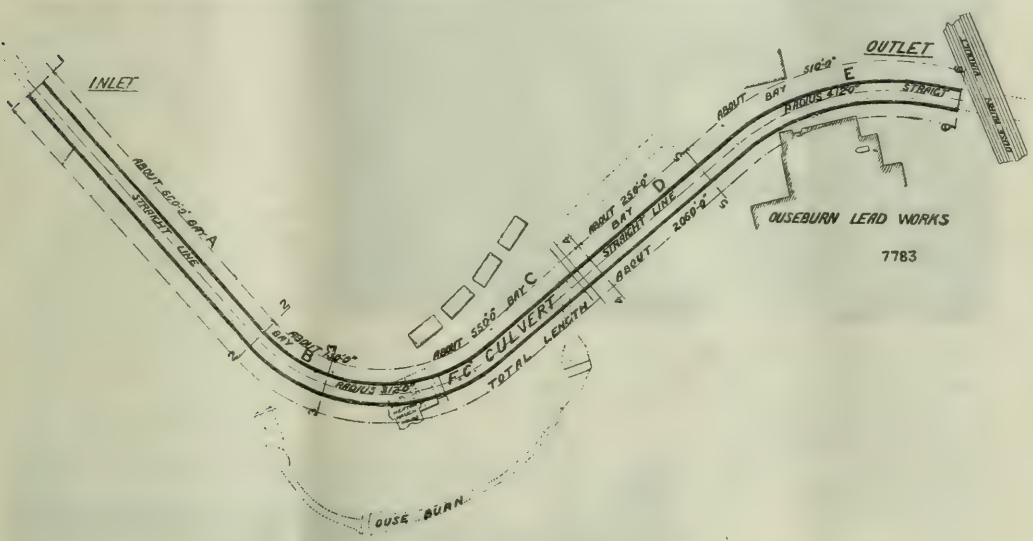
In 1906 a commencement was made with the culvert for enclosing the waters of the Ouseburn, to keep its course free and unimpeded, after the valley had been filled in. This culvert had to be made of sufficient capacity to deal with the flow of the stream at its highest flood. Although a comparatively small stream in dry weather, it is liable to sudden floods, and in winter time assumes the proportions of a fair-sized river. The drainage area of the Ouseburn is 25 square miles, and after taking into consideration the conditions prevailing and the volume that might be expected through the culvert in a heavy flood, also

[1] Paper read on Friday, 2nd inst., at the meeting of the Institution of Municipal and County Engineers at Newcastle-on-Tyne.

the probability of having to deal with cumbersome floating debris and awkward obstacles which might block the mouth of the culvert and cause serious obstruction to the flow, it was decided to make ample provision, and design the culvert to take a 1-in. rainfall per hour over the whole of the catchment area of 25 square miles. This necessitated a cross-sectional area of 477 sq. ft., with a gradient of 1 in 141, and a discharging capacity of 964,800 cub. ft. per minute running full.

Apart from the question of capacity, the design of the culvert had to be governed by the necessity for adopting materials and methods of construction that would be capable of withstanding the severe strains due to unequal loading, which would in all probability ensue during the process of filling up the valley. After careful consideration of the various factors it was decided to adopt a reinforced-concrete form of construction, as being the best calculated to comply with the required conditions of the case, and the Hennebique system was chosen. This method of construction was also, from the point of view of cost, considered to be more economical. The culvert follows the windings of the valley in a tortuous line, the total length provided for in the original scheme being 2,060 ft.

The invert level at the outlet end, close to the Ouseburn viaduct of the North-Eastern Railway, was kept up about 2 ft. above high water ordinary spring tides, to give the culvert a free discharge at all states of the tide. Plate No. 3 is a typical cross-section of the culvert, which is in the form of a semi-parabola, and was adopted as being the best suited to resist the unequal earth loads anticipated during the operations of filling in. The invert joins the parabola with a curve of 4 ft. 9 in. radius, and its centre portion is paved with sandstone grit penning, to provide a summer channel for the river during the season of dry-weather flow. The maximum internal dimensions of the structure are 30 ft. wide at springing and 20 ft. high, with an over-all width across its base of 42 ft. The thickness at the crown is 8 in., and at the springing 14 in. The base is reinforced horizontally with mild-steel bars for withstanding tension, and vertical stirrups for resisting the shear. The arch is reinforced by two series of main bars following the inner and outer curves of the parabola, and securely anchored in the invert; sufficient vertical stirrups are also provided for resisting the shear stresses. Additional reinforcement is provided throughout the structure by longitudinal bars, at short intervals apart, placed near the inner and outer surface of the concrete. This arrangement gives a double system of reinforcement of sufficient strength to withstand any tension that may be developed near either surface of the concrete.



Ouseburn Valley Works: General Plan.

Ouseburn Valley Works: The Ouseburn in Flood.

FOUNDATIONS.

To enable the contractor to proceed with the excavations for the foundations it was necessary to divert the stream. The dry-weather flow was deflected by means of temporary dams into existing sewers running through the valley, and auxiliary channels were provided for dealing with small rainfalls by means of troughing laid along the bottom of the valley. It was impossible, however, to provide against heavy floods, which, when they came, necessitated suspension of the work. Borings were taken along the line of the culvert to ascertain the nature of the foundations, but, as is often the case, they gave no true indication of what was eventually met with in the course of the excavations.

After the works had commenced it soon became apparent that considerable difficulties were to be encountered. Large pockets of silt deposit were discovered at intervals, some of them extending the whole width of the foundations, and reaching to considerable depths before the shale bed proper was touched. In addition, old disused coal workings were discovered, crossing and recrossing the valley in all directions, some of them of formidable dimensions. In each instance the unstable ground was excavated and the old workings thoroughly explored for some distance on each side of the foundations, and the whole filled in solid with concrete in mass.

Great attention was paid to the putting in of these foundations, and every precaution taken to ensure a thoroughly reliable bottom, in view of the great weight of the filling that would ultimately come upon the culvert. In the construction of these foundations about 28,000 cub. yds. of material were excavated and about 9,000 cub. yds. of cement-concrete were used. Details of the construction of the superstructure will be dealt with later.

Ouseburn Valley Works: Flooding of the Cut During Construction.

After the works had been in progress about two years, and the whole of the land and properties for the scheme acquired, it was found that the cost of these latter had exceeded the amount provided in the original estimate; moreover, the quantity of material tipped was not sufficient to ensure the filling of the valley in a reasonable period of time. The comparatively small quantity of material received was undoubtedly due to the marked lull in building operations in the district. Owing to these circumstances the construction of the culvert was temporarily stopped, and a general review of the conditions was made. After considering reports by the then city engineer, Mr. C. R. S. Kirkpatrick, M.Inst.C.E., the council decided in 1909 to adopt a partial filling scheme, or a modification of the original. This was to continue their efforts to concentrate the tipping in the centre of the valley, and gradually to fill up in a northerly direction, so as to form two main arteries across—viz., work No. 2, between Rosedale-street and Warwick-street, and work No. 1, between Starbeck-avenue and Newington-road—these two roads being slightly altered in direction. For this purpose they decided to continue the culvert works for another 800 ft. or 900 ft. The approximate total gross cost of the scheme, including expenditure upon land, sewers, retaining walls, culvert, main thoroughfares and subsidiary streets is £226,500. When the reclaimed land is built upon, however, there will be a considerable revenue derived from this, in addition to that obtained from properties which may not be pulled down. The amount required to complete the work—*i.e.*, the difference between the sum already borrowed—viz., £161,000—and the above total was £65,500. In 1910 the council applied to the Local Government Board for a Provisional Order, so as to provide borrowing powers for this sum and to amend the 1904 Act as might be desirable.

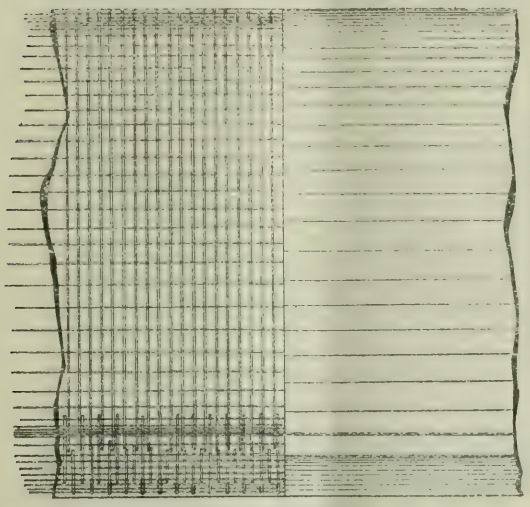
Ouseburn Valley Works: The Cut Looking South.

This was granted by the board and arrangements were made for proceeding with the scheme. Estimates of time must necessarily be approximate, but it is hoped to be able to tip the embankment for work No. 2, to obtain a road 20 ft. in width in about five years, and a road of the full width of 60 ft. in about eleven years. The high-level area to the north, including the embankment for work No. 1, it is anticipated, will be tipped in a further period of about fifteen years; an improvement in the building trade will undoubtedly shorten these periods. When the scheme is completed as above there will be two main arteries across the valley, and the available area for building land and streets will be divided somewhat as follows: Two main roads, 10,700 sq. yds.; subsidiary streets, 14,600 sq. yds.; building sites, 31,600 sq. yds.; slopes of embankment and bed of Ouseburn, 68,500 sq. yds.; low-level area, including streets, 40,000 sq. yds.; existing buildings and streets

Ouseburn Valley Works: The Cut Looking North.

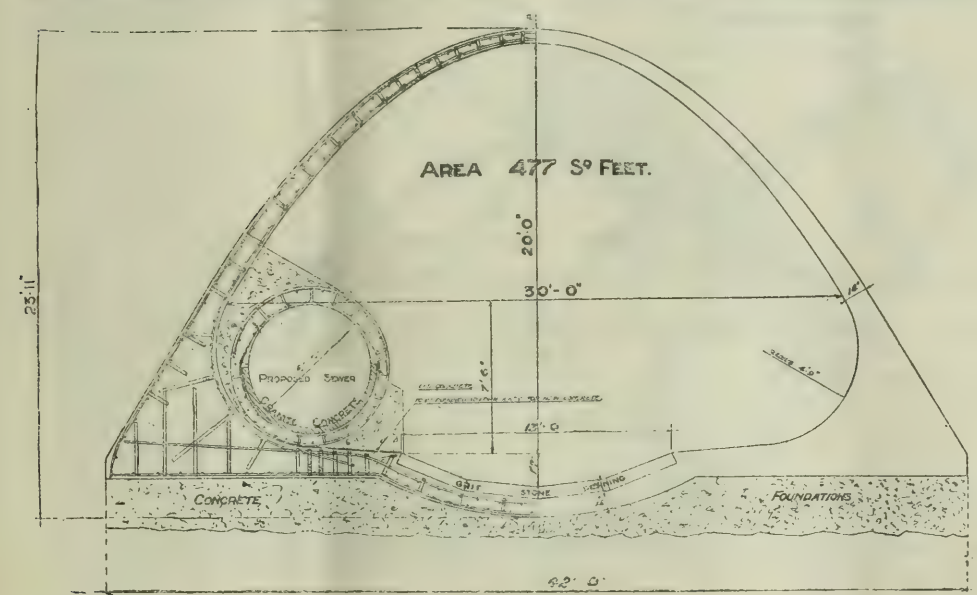
within the area previously dealt with, but which will not be demolished under the partial filling scheme, 16,600 sq. yds.: total, 182,000 sq. yds.

The approximate quantity of filling required for the amended scheme is 1,750,000 cub. yds., as against 4,500,000 cub. yds. for the original scheme. Before proceeding with the extension of the culvert, the city engineer, Mr. W. J. Steele, M.Inst.C.E., considered the advisability of reducing its sectional area, and for this purpose rainfall calculations and



Longitudinal Section.

Bridge, near Craghall Dene, there is a weir placed between the abutments, and this formed an excellent means of gauging the discharge at this point. With the depth of water passing over the sill, given by the highest flood marks, and a velocity of approach of 6 miles per hour, the discharge was 124,000 cub. ft. per minute. In considering the capacity of a culvert which would discharge the whole of the flood water draining to the Ouseburn, it was necessary to note that the conditions applying to a main sewer draining an urban area were not the same as would apply to the culvert. In the case of a sewer it is the intensity of rain falling in a short period that has to be provided for, as, owing to the large proportion of impervious surface in an urban area, not only is the percentage of the total rainfall reaching the sewer comparatively high, but it arrives in a very short time. With the culvert, however, the whole of the area drained would remain more or less pervious until it became waterlogged by continuous rain, and, owing to the long period that would elapse before the rainfall reached the culvert, the volume, due to an intensely heavy fall in a short period, would become so dissipated as to give a comparatively low discharge. The basis of calculation was therefore taken to be the greatest continuous rainfall likely to occur over a period which such rainfall would take to reach the culvert after the whole of the catchment area had become waterlogged. To arrive at this period, tests of the velocity of the stream were made, and it was decided to adopt 2½ hours as the period which the rainfall would take to reach the culvert. A rainfall of 0·75 in. in 2½ hours was provided for, which is equivalent to 7·2 in. per day. With this provision the volume to be carried by the culvert would be 295,754 cub. ft. per minute. When completed the culvert will have a fall of about 37 ft. per mile, whereas the stream —over the greater part of its length—has a fall of



Cross-section (Looking North).

Ouseburn Valley Works: Ferro-Concrete Culvert.

other data for determining the size of the structure were investigated, as follows:—

The catchment area of the Ouseburn is 16,295 acres; the highest portions are about 400 ft. above ordnance datum, and the lowest about 30 ft. (in the valley adjoining the existing invert), but generally, with the exception of Jesmond Dene, the catchment area consists of gentle slopes to the stream. From information collected over a long period of years, the greatest flooding in the Ouseburn Valley appears to have been in October, 1900. Careful records of this, and the rainfall which caused it, were made; between 9 a.m. on the 26th and 9 a.m. on October 27th the quantity of rainfall registered was:—

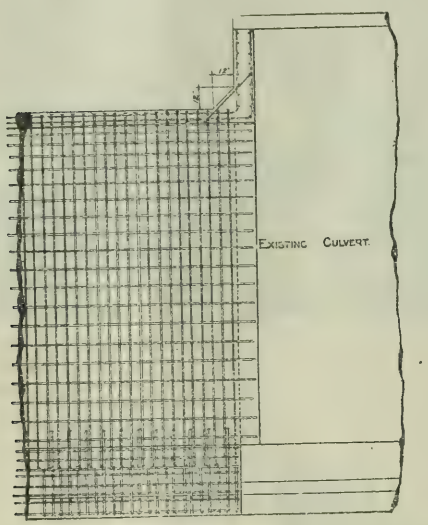
	Inches.
Wellbourne, Jesmond	3·72
Leazes Park	3·24
Newcastle *Chronicle* Office	3·68

The flood heights were marked on the various bridges along the course of the stream. At the Dene

only about 25 ft. per mile; also, the culvert will have a smooth surface, while the bed of the burn is rough, with numerous obstacles; consequently, the velocity of the stream through the culvert will be much greater than at any other point in its length.

Provision had also to be made in the culvert for carrying a main outfall sewer through it. There are two sewers in the valley, one on either side of the stream. The sewer on the west forms the outfall for the sewage of Gosforth and part of Long Benton, within the Ouseburn drainage area, and that on the east drains a portion of Byker and Heaton. When the valley is wholly filled in, the sewers will have to be entered by manholes of great depth, and having regard to the uncertainty of the stability of the sewers to withstand the great weight caused by the filling in of the valley, it was considered advisable that they should be connected at a point above the inlet of the culvert, and carried down in one sewer through the

same. In estimating the size of this sewer, the ultimate needs of the various districts within the drainage area, when fully built upon, were provided for, together with a five-times dilution for rainfall, all excess storm water being taken to the Ouse Burn. This necessitates a sewer 6 ft. in diameter, which will occupy an area within the culvert of 50 sq. ft. It is not proposed to construct the sewer at present, owing to the long period that must elapse before the valley is filled in, but it was thought advisable to

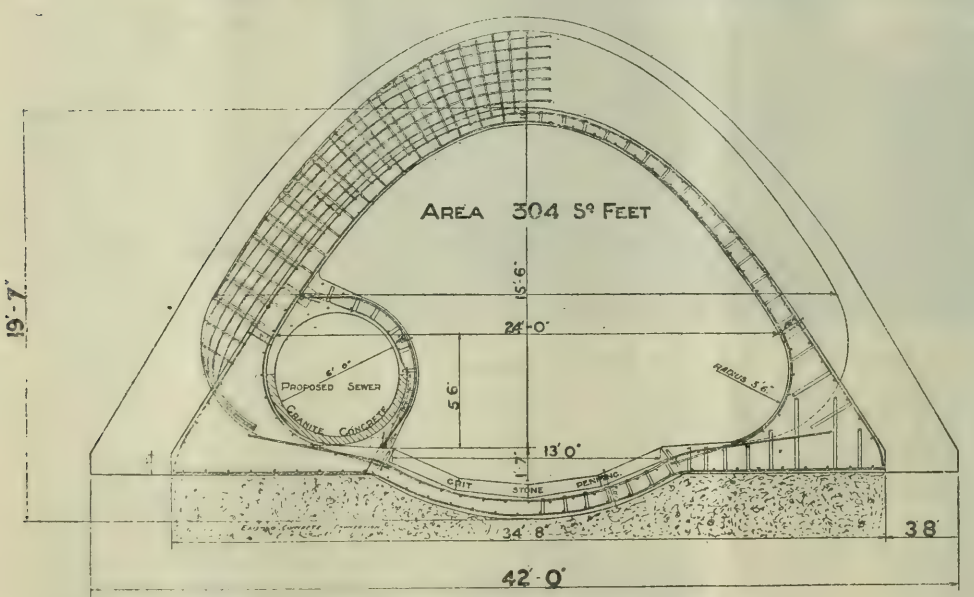


Longitudinal Section.

6-ft. sewer is built inside it will have a nett discharging capacity of 408,654 ft. per minute, which is much greater than that required by the calculated discharge from the catchment area. Under such conditions the culvert, when discharging its maximum calculated volume, will only be running three-quarters full. Plate No. 4 shows a typical cross-section of the reduced culvert, also the details of the junction between it and the larger culvert. The maximum internal dimensions are 24 ft. at springing by 15 ft. 6 in. high, with an over-all width across its base of 34 ft. 8 in. The same arrangement of reinforcement as was adopted for the larger culvert has also been preserved throughout the extension.

EXPERIMENTS FOR ASCERTAINING EXTENT OF LOAD TO BE SUSTAINED BY THE CULVERT.

With a view to arriving at some practical basis as to what proportion of the filling would become effective on the culvert, a model of a section of the valley one-sixteenth full size was constructed, which represented a width across the top of 354 ft., with side slopes 1½ to 1, and a total height of 80 ft. of filling above the crown of the culvert; over and above this the depth of the filling was increased to represent an equivalent distributed load of 7 cwt. per square foot. One end was glazed, so that the behaviour of the material during the test could be observed. The model was filled with ordinary excavated material, free from clayey or other substances tending to increase its adhesion, and representing as far as possible an average sample of the filling that would be likely to be tipped during the process of filling in. It was allowed to remain for a period of twenty-eight days, when the culvert was slowly lowered from the model, thus leaving the material free to fall out. Only a small quantity fell out with the culvert, the majority being retained in the model by reason of its having become arched on the under side and rendered self-supporting, thus



Cross-section (Looking North).

Ouseburn Valley Works: Ferro-Concrete Culvert.

make provision for it in fixing the size of the culvert. Having regard to the high velocity that would be attained in a culvert of such large size if allowed to run full, and to the excessive friction that would be set up over the walls of the structure, resulting in probable damage to the surface, it was decided to provide a liberal margin of safety to meet such contingencies. The gross cross-sectional area of the culvert was therefore fixed at 304 sq. ft.; this is inclusive of the area required for the 6-ft. diameter sewer at some future date. Steel hangers are being built into the wall of the culvert as the work proceeds to save any future cutting into the structure; steel bars will be threaded through these projecting links at a later date, around which the reinforcement for the sewer will be hung, and fixed as shown on Plate No. 4. The discharging capacity of the culvert running full is 525,180 cub. ft. per minute, and when the proposed

demonstrating the principle that arching is set up in deep embankments when the material has become sufficiently consolidated, and that there is a point above the structure where the filling becomes self-supporting. The height of this point from the experiment was found to be equivalent to 4 ft. 8 in. at the moment the culvert was removed. The model was allowed to stand for a further period of six days, during which time further material fell out, representing a total height of 16 ft., or a load of 1 ton per square foot over the culvert base. At this period an additional super load was placed upon the model to represent a heavy rolling load, and equivalent to 1·21 tons per square foot. This was allowed to remain for twenty-one days, at the end of which time no further material had fallen out.

As a result of the above experiment it was decided to design the culvert to support 40 ft. of filling above

the crown of the arch, which provided for a factor of safety of 2½.

LOADING TEST APPLIED TO THE EXISTING CULVERT.

On the strength of the foregoing it was decided to apply the results obtained as a test load upon the existing culvert. The curve of the earth arching given by the experiment was enlarged to 2½ times, representing a height of 40 ft. above the culvert. This gave the resultant load to be borne by the culvert of 3 tons per square foot. A test load equal to 3 tons per square foot was therefore placed upon the existing culvert. As this test proved entirely satisfactory it was decided to use the same section of reinforcement for the proposed extension as was used in the existing structure, likewise to adopt the same thickness of arch ring at the springing and the crown. As the extension is of smaller area than the existing structure, it would therefore be given an additional factor of safety.

Notwithstanding the above results, however, the Local Government Board, upon consideration of the scheme submitted to them, required provision to be made in the design of the structure for a total height of 80 ft. of filling becoming effective upon the culvert. This necessitated a thickness at the crown of 10 in., and at the springing of 16 in., together with a much heavier percentage of reinforcement than was used for the preceding section. A commencement was made with the extension in 1912. The length included in the present contract is 820 ft.

METHOD OF CONSTRUCTION.

This is briefly as follows: The reinforced invert is first put in upon foundations already prepared, and temporary longitudinal sills are fixed in position on each side at the benching level; upon these the centring ribs for the arch are erected at distances of from 3 ft. to 4 ft. apart. These ribs are constructed in two portions, and blocked out from each other at the crown, so that upon completion of the arch they can be slackened and drawn together, thus facilitating the process of removal when the time arrives for taking the centres out. After the ribs are in position the lagging boards are placed on top and securely fixed, thus completing the inner drum of the parabola. Next, the curved intrados bars are placed in position on the drum and blocked out to their correct distances from the face of the concrete; for this purpose cement blocks are used, which ensure the bars receiving their proper amount of cover. The external bars are next fixed in the same manner, and the spaces between the two sets temporarily preserved by boards placed on edge longitudinally in convenient positions. The external ribs are next fixed in position to correspond with the internal ones—the inside faces of these frames form the profile of the extrados of the culvert, and to these the outside shuttering is fixed as the concreting proceeds. Thus a complete mould is formed, the exact shape of the parabola, into which the concrete is placed and thoroughly rammed between and around the bars of the reinforcement. All laps in the main bars are made at the crown of the arch.

The culvert is constructed in 30-ft. lengths, and straight joints are made at these distances. Where a fresh length is joined on to an old one the surface of the set concrete is thoroughly hacked and roughened and covered with thick cement grout; afterwards the new concrete is firmly rammed against the old. The period of rest allowed for the centres before removal varies according to circumstances and the weather; in no case, however, are any centres struck under ten days, and from this the periods vary up to three weeks. The culvert, for the greater part of its length, is on curves of 312 ft. radius, and this necessitates considerable care being observed in the construction of the centring and falsework.

BENDING OF BARS.

Substantial staging is laid down, upon which a full-sized section of the culvert is set out. Steel pins are inserted at intervals along the intrados and extrados of the arch and invert, and around these the bars are strained and bent to their respective shapes. The bars show little tendency to revert to their original shape after being bent, and when placed in position in the work are found to fit very satisfactorily.

WORKING STRESSES.

The working stresses used in the calculations for the culvert were as follows:—

Concrete in compression	... ...	355 lb. per square inch.
,, shear	... ...	60 ,, ,, ,,
,, tension	... ...	Nil.
Steel in compression	... ...	17,000 ,, ,, ,,
,, shear	... ...	12,880 ,, ,, ,,
,, tension	.. ..	17,000 ,, ,, ,,

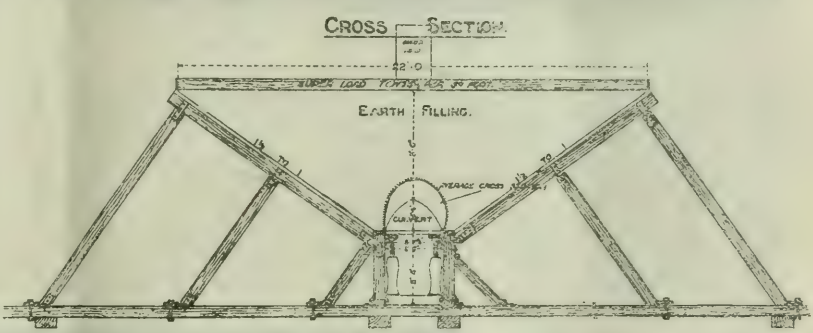
STEEL FOR REINFORCEMENT.

The steel used is in the form of round bars and strip, manufactured by the Open Hearth or Basic process. Periodical tests of the material gave average results as follows:—

Contraction of area	... ... about 56 per cent.
Elongation in 8 inches	.. .. ,, 29 per cent.
Limit of elasticity	... . 20 tons per square in.
Ultimate tensile strength	.. .. 29·6 tons per square in.

EXPANSION JOINTS.

The advisability of providing expansion joints was carefully considered, but as the structure will be buried upon completion it will not, of course, be affected to any appreciable extent by temperature. The only way in which it is likely to be affected will be by the change in the temperature of the water flowing through it in different seasons, but this was considered to be so slight as not to warrant provision being made for it. As an extra precaution, however, to ensure water-tightness at the straight joints, bands of pure bitumen are being placed over each joint around the extrados of the arch, so that in the event of any slight cracks occurring at these points it will preclude any moisture leaking through and affecting the steel.



Ouseburn Valley Works: Experimental Model to Ascertain Load on Culvert.

CEMENT.

The cement used throughout the work conformed, as to preparation, quality, and chemical composition, with the British Standard Specification, with slight modifications as to grinding and setting time. The fineness of grinding is 15 per cent by weight left on a sieve of 32,400 meshes to the square inch. Each consignment brought to the works is thoroughly tested, and the results of the whole average as follows: Initial set, 59 minutes; final set, 6 hours; expansion at one day's aëration, 3 millimetres; specific gravity, 3·12; ultimate tensile strength at seven days, 553 lb. per square inch, and at twenty-eight days 674 lb. per square inch.

CONCRETE.

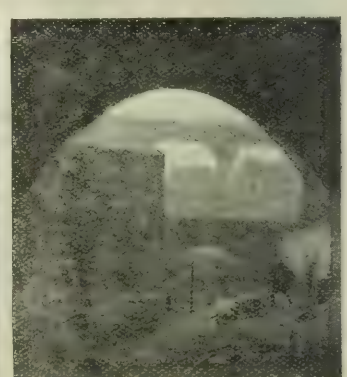
The aggregate used for the concrete consists of river ballast obtained from the Tyne at Newburn. The ballast is put into the crusher, and the sand separated by passing it over a rotary screen with ¼-in. square mesh. The larger stones in the ballast are at the same time broken to the required size, and every-

thing from ¼ in. to ⅝ in. is passed through a ⅝-in. screen. Thus the sand consists of a mixture of coarse and fine grains from ¼ in. downwards, and the aggregate, of assorted sizes, not less than ¼ in. nor more than ⅝-in. gauge. Afterwards the sand is added in true proportions. The concrete is mixed in the following proportions: 7½ cub. ft. of aggregate, 3¾ cub. ft. of sand, 2 cwt. of cement. The quantities for each mixing are accurately gauged, and careful supervision is exercised over this operation during the progress of the work. The consistency of the concrete is kept such as to give a plastic mixture, capable of being easily worked and rammed between all the bars of

Ouseburn Valley Works: Centring for Ferro-Concrete Work.

the reinforcement. It is machine-mixed throughout, the sizes of the mixings being kept small to ensure the material being used quickly, in order to avoid loss of setting properties and strength. Frequent tests of the voids in the aggregate and sand are made to ensure that the proper proportioning of the mixture is being maintained.

Four-inch cubes of the actual concrete used in the works were made and tested. At three months old these crushed at an average of 2,432 lb. per square inch, giving a factor of safety of 6·85. Cubes of concrete of other proportions were also made and broken. Concurrently with the cubes first mentioned briquettes of cement concrete (1-in. sectional area) were made of the same proportions and ages respectively, and tested for tensile strength, and tests of the concrete made of the contract proportions were conducted on briquettes of 1-in. sectional area for tensile strength. Pieces of concrete of varying ages were cut out of the actual culvert and subjected to tests for specific gravity, absorption and friability. A representative selection of the constituent parts of the aggregate contained in the river ballast was made and subjected to tests to ascertain its suitability for the purpose for which it is being used: the results show that a good and durable aggregate is being obtained. Other tables are also appended which it is hoped will be found of interest.



Ouseburn Valley Works: One End of the Culvert.

The author's acknowledgments and thanks are due to Mr. W. J. Steele, M.Inst.C.E. (city engineer), for permission to write this paper; Mr. Laurence E. Greening, Stud.Inst.C.E., for assistance in conducting the tests, and Mr. H. E. Lightfoot for his assistance in the preparation of the drawings.

[We are indebted to the proprietors of *Ferro Concrete* for the use of the blocks of the photographic views which illustrate the foregoing paper.—Ed. The Surveyor.]

Royal Institute of British Architects.—The annual dinner of this body will take place on Wednesday, the 4th prox., at Whitehall Rooms.

SCOTTISH ROAD AUTHORITIES AND THE ROAD CONGRESS.

The following letter from the Under-secretary for Scotland has been sent to us for publication:

"Sir,—Several road authorities have recently communicated with the Secretary for Scotland with regard to the incurring of expenditure in sending representatives to the International Road Congress proposed to be held in London towards the end of June next.

"The English Local Government Board have, it is understood, intimated that they will be prepared to entertain applications from road authorities in England for sanction to the payment of reasonable expenses incurred in this connection. Any such sanction would doubtless be given under the Local Authorities (Expenses) Act, 1887, which, as you know, does not apply to Scotland.

"The only provision under which the Secretary for Scotland is empowered to sanction in advance the incurring of expenditure for a purpose which is not regarded as coming strictly within the purposes for which a rate may be levied is sec. 2 (5) (*c*) of the Education and Local Taxation Account (Scotland) Act, 1892, in terms of which he may (on the application of a county or town council) consent to the appropriation of a sum from the grant distributed under sec. 2 (5) of that Act for any purpose which on consideration appears to him to be a scheme of public utility within the meaning of the section.

"Mr. McKinnon Wood is prepared to avail himself of this power on the present occasion, and would be disposed to consider favourably an application for his consent to defray in this way the reasonable expenses of a county or district road surveyor in attending the congress, including the necessary subscription to the expenses of the congress.

"It would be convenient that such applications in respect of county road authorities should be made through the county councils as the authorities entrusted with the disposal of the grant under sec. 2 (5) of the Act of 1892."

(Signed) J. M. DODDS.

May 8, 1913.

Junior Institution of Engineers.—A week-end excursion to Brussels, from 4th to 7th July, has been arranged by this institution for the purpose of visiting the Ghent Exhibition. The party will leave London on Friday, July 4th, and visit the exhibition on the Saturday. For the Sunday excursions will be arranged to Dinant, the valley of the Meuse, the Field of Waterloo, or Antwerp, and on the Monday places of interest in Brussels will be visited, the party returning to London in the evening.

Institution of Municipal and County Engineers.

THE WHITSUNTIDE VISIT TO HOLLAND.

It was an unexpectedly small party that left London on Thursday evening of last week for Amsterdam, but happily, as events proved, the measure of success which attended this the latest visit of the Institution of Municipal and County Engineers to the Continent was not to be judged by mere numbers. Business was combined with a reasonable amount of pleasure in the shape of excursions to places of interest, and as the weather was, for the most part, of a propitious character, a really delightful holiday was spent by those who took part in the tour. On Friday afternoon the members and their friends—who included Mr. R. J. Thomas (the president), Mr. and Mrs. G. F. Carter (Croydon), Mr. and Mrs. J. Sutcliffe (Deptford), Mr. Thomas Cole (the secretary of the institution) and Miss Cole, Messrs. R. T. Surtees (Newton-le-Willows), A. Hosken (Smethwick), W. H. Goodyear (Smethwick), J. P. Spencer (North Shields), J. Lobley (Stoke-on-Trent) and W. Clifford (Wolverhampton)—met at Amsterdam Town Hall, where the Burgomaster, Baron Roell, who was accompanied by the acting Burgomaster, Mr. Delpratt, and a number of the city officials, extended a warm welcome on behalf of the council, expressing the hope that the visit would prove both instructive and agreeable. Thanks on behalf of the visitors were returned by the president, who, after referring to the friendly relations existing between the people of Great Britain and Holland, paid a tribute to the high skill which had been shown by Dutch engineers in their long struggle with the sea. The unique problems with which Amsterdam in particular is confronted were later on, at the Exchange, described in considerable detail by Mr. A. W. Bos, the director of public works of the city, Mr. F. S. Jacob and Mr. P. Lohr, the city engineers, Mr. W. A. de Graaf and Mr. D. Drost, following which the members proceeded to visit the sewage-pumping station and outfall works in course of construction, the old sewage works of the town and the extensive tramway depot which the corporation—who, by the way, own not only the tramways, but the gas and water works—are erecting on the outskirts of the city, this last-named undertaking providing an admirable object lesson to the visitors in regard to the many and varied uses to which reinforced concrete is being put by continental engineers. This ended the programme for Friday, but the members left their hotel early next morning on a visit to the new "Zuider" gasworks, an installation which, when completed, will be up to date in every respect. Sunday and Monday were passed in pleasant fashion in excursions to the picturesque towns of Broek and Volendam, and to the Isle of Marken and Leyden, and the final inspection of works was made on Tuesday, when the splendidly equipped abattoirs at The Hague were visited, the party being cordially received and shown over the buildings by Mr. Lindo, the director of public works. A visit to "The House in the Wood" and a drive to the famous North Sea resort, Scheveningen, followed in the afternoon, the members leaving in the evening for the Hook of Holland on their return to London, which was reached on Wednesday morning.

AMSTERDAM AND ITS DRAINAGE WORKS.

It may not be generally known that the canals for which the city of Amsterdam is famed are now the source of the very greatest anxiety to the authorities of the city, the once pure water being at the present time in a condition which is perhaps best described as deplorable. As long as the river known as the Y was in open communication with the Zuider Zee the daily influx of tidal water sufficed to maintain a tolerable state of cleanliness of the canals; but when, in 1872, this open communication was cut off, artificial means became necessary to get rid of the polluted water and to introduce pure water in its place. This question became of greater importance when a new town began to arise outside the old boundaries of the city.

The renewal of the water in the canals is effected by means of eight huge paddle-wheels, which carry in sea water through nine syphons under the Merwede Canal. During the night the canals are shut off from the North Sea Canal and the Y by locking several floodgates, and early in the morning the swollen canals discharge into the Y, which discharges its water into the sea at low tide. The arrangement of the paddle-wheels is such as to allow water to be pumped in a contrary direction from the canals into the Zuider Zee.

As early as 1870 a new sewage system was planned for the old town. The works included the filling in of some 600 miles of canal, by which the picturesque aspect of the town would have badly suffered, and as the cost was naturally very great the scheme was shelved. In later years, however, the street traffic increased so enormously that the filling in of 200 miles of canal could not be avoided.

The fact that, when the revival of Amsterdam began, a new complete sewage system was not planned, is explained as follows: The so very rapid growth of the town was not foreseen, a great part of the ground occupied by the new sites did not belong to Amsterdam, but to suburbs, the cost of the works was prohibitive, taking into consideration the state of the finances in those days, while there was also a great difference of opinion as to the real cause of the unsatisfactory state of the canals. This was attributed by some to the fæces brought into the canals from the surrounding premises, but others, again, were of opinion that the main sources of pollution were sewage water and town refuse. After serious consideration by the municipal council a pneumatic system for the removal of fæces was adopted, the main feature of this system being that the fæces were drawn from the premises by means of a vacuum, thus avoiding the necessity of making sewers of large sectional area and steep gradients.

It would appear that while from a technical point of view the system has been a success, from an economical one it has proved to be a failure. As a result of the introduction of water-closets the fæces got mixed with such a quantity of water that it was impracticable to transform them into manure. As a last attempt to employ them profitably, the diluted fæces were treated with lime so as to bind the ammonia, which, when heated, was brought into contact with sulphuric acid, a good manure thus being obtained. Though by this process considerable sums of money found their way into the city treasury, the working expenses of the system proved to be prohibitive, for even by this process by far the greater part of the fæces had to be thrown into the canal adjoining the works, causing pollution over a long distance.

This system having proved a failure, no further extensions were embarked upon, all new premises being connected to underground reservoirs which, at regular periods, were emptied pneumatically into tank wagons.

In 1907 the city engineer at last gained his cause by the granting by the city council of a sum of £250,000 for the making of a proper sewage system worked by a system of powerful pumps.

Physical and financial reasons made it impossible to construct sewers of such dimensions as would carry off the whole volume of rainfall during periods of storm.

Since the main sewer runs round the inner city, following one of the canals, it was possible without difficulty to choose a number of points at selected places along the canal banks where sewage could be discharged to the greatest advantage. The branch sewers have a sufficient capacity to allow of their conveying the storm water to these outlets in spite of the flatness of the gradient. The sluggish flow may, of course, lead to deposits of road grit, sludge and other solid materials; on the other hand, the velocity of the dry-weather flow, which will attain a minimum rate of 1¼ miles per hour, is expected to remove these deposits and even to prevent them. Moreover, the sewer system, being constructed, even at the beginning of its course, at a considerable depth below canal level, may be flushed by canal water.

The sewage would flow until a depth of 15 ft. below the street surface is reached. Here the new electric pumping station will lift the sewage, and pass it on to the chief pumping station, which will be able to deal with about 380 gallons per second. The quantity of sewage to be dealt with precludes all ideas of building collecting basins. It was decided, therefore, to provide only large settling basins or grit chambers. As no other purification treatment will be applied to the sewage, these chambers are provided with removable screens which protect the pumps by keeping all

floating substances effectually away. It being desired to place the pumps below the dry-weather flow level of the main sewer, the basins have a considerable depth. Each pump is placed separately in a chamber.

The substructure of the station and basins is in reinforced concrete. As regards extension of the capacity of the station, the members were given to understand this could be undertaken without any difficulty. The plan of the building is in keeping with the simplicity of the mechanical arrangements. The architectural details give it a simple but tasteful outward appearance, making it quite an ornament to the new quarter of the town, which begins here.

The construction of the works has been in operation since 1908.

In addition to this a project is now in a far-advanced state of preparation for the destruction of town refuse, and a sum of nearly £67,000 has been granted for the connection with the new sewers of those premises which are at present dependent on the existing system. These sewers are placed horizontally at the level of the water in the canals and in the North Sea Canal, that is 1 ft. 6 in. under the level known all over Holland and in the greater part of North Germany as Amsterdam level. The main sewer now in course of construction follows the direction of the old town boundary and by means of powerful electric pumps situated at the east end of the town its contents are forced through a conduit of reinforced concrete over a length of 3 miles into the Zuider Zee.

THE OUTFALL WORKS.

Reinforced concrete was chosen as the material of the tube, which has a circular section with an inner diameter of 60 in., the sides having a thickness of 4in.

From the pumping station the tube mainly follows an old sea dyke, called the Zeeburgerdyk, passes with a syphon under the Merwede Canal, and then runs along a dam in the sea to the point of discharge This last dam had originally been constructed to preserve a navigable channel in the Zuider Zee, and advantage was taken of the dam to lay the tube along it.

Although the ordinary movement of the water and the usual difference between high and low tide at the end of the tube are not very considerable, it is believed that so far out at sea the sewage can be discharged without further purification.

To counteract any harmful effect of the sea water upon the concrete, slowly hardening Portland cement and some trass were used in the strong mortar, while the separate pieces which form the tube were not allowed to come into contact with the salt water until they were at least one month old.

These separate tube pieces are about 10 ft. long; between them an opening of 2 in. is left, while round this joint a ring of reinforced concrete, 20 in. wide and 4 in. thick, has been laid. The joint, as well as the space between the tube and the ring, were filled up with Portland cement mortar. In the dam, however, one of every eight joints was filled by a mixture of asphalt and bitumen, in order to allow of the tube following the setting of the subsoil, and of expansion or shrinkage by changes in temperature.

The experience with these asphalt joints has not been entirely favourable, as the asphalt began to melt during warm summer weather, and, because it did not expand as the tube shrank, caused cracks and leaks in the pipe. After the tube had been down sufficiently long to warrant the expectation that the subsoil had finally settled, the asphalt joints were cut out and replaced by cement mortar.

The armouring of the tube is a double network of round iron, $\frac{3}{8}$ in. thick for the principal armouring, and $\frac{5}{8}$ in. for the secondary armouring.

The tube is ventilated by ten automatically working air valves placed at the highest points, while for purposes of inspection a cover has been put about every 110 yds.

The testing of the whole tube under pressure has not yet taken place, so that a final judgment as to the tightness of the joints cannot yet be formed.

At the outflow the pipe's end is provided with a gate to make the closing of the tube possible. From this gate the sewage is carried between two dams of reinforced concrete, resting on a sub-structure of piles about 40 yds. out to sea.

The total length of the tube is about 3½ miles, and about 810 miles of iron, weighing about 660 tons, have been used for the armouring.

The total cost of the work was about £35,000.

THE PUMPING STATION.

At the main pumping station three pumps have been installed up to the present, two of these having a capacity of 134 gallons per second each, and the third a capacity of 268 gallons per second. The last-mentioned pump is therefore twice as powerful as each of the smaller pumps. The capacities are figured on a maximum head of about 39 ft. of water, which is necessary to force the sewage through the concrete pressure tube and against the highest registered Zuider Zee tide.

The number of revolutions of the smaller pumps is 485, and that of the larger pump 360 per minute, both numbers being constant on account of the use of alternating current motors. The capacity of the large motor is 300-h.p., and that of each of the smaller motors 150-h.p.

The normal discharge of this pumping station will be about 400 gallons per second, and will be effected by the large pump and one of the smaller pumps when working together.

The cost of the complete mechanical and electrical equipment of this pumping station amounts to about £6,000.

AMSTERDAM'S NEW GASWORKS.

The area of the new "Zuider" gasworks which the Corporation of Amsterdam are erecting is no less than 30 acres, and 52 acres of ground are available for extensions if they become necessary in the future.

The principal building is the retort house, 308 ft. long, 88 ft. wide and 93 ft. high, with six benches of five furnaces, each with eighteen vertical retorts.

The maximum daily output will be 6,360,000 cub. ft.

MEETING AT NEWCASTLE-UPON-TYNE.—(*Conclusion.*)

Following the proceedings reported in last week's issue, attention was given at the recent meeting of the Institution of Municipal and County Engineers at Newcastle-upon-Tyne to a paper upon "The Ouseburn Valley Works," by Mr. Frank I. Morgan, ASSOC.M. INST.C.E. Mr. R. J. Thomas, the president, was again in the chair, and, in addition to those present on the previous day, the attendance included Messrs. E. J. Silcock (Westminster and Leeds), C. E. Rivers (Harrogate) and H. W. Taylor (Newcastle-upon-Tyne).

[Mr. Morgan's paper is reproduced in another part of this issue.]

DISCUSSION OF MR. MORGAN'S PAPER.

Mr. E. J. SILCOCK (Westminster and Leeds) proposed a vote of thanks to Mr. Morgan for his description of what was an exceedingly interesting and important work for the city of Newcastle. This Ouseburn work was one of the public works which had been so much discussed locally that even people at a distance had heard the echoes of the discussion. They knew there had been a great deal of controversy as to what was the best line to be adopted for dealing with this formidable barrier across the traffic of Newcastle. The basis on which the size of the culvert was designed was a matter of great interest. The author stated that the original design was based upon a rainfall of 1 in. per hour for the whole drainage area of the stream down to the point where the culvert commenced, and that 1 in. of rain per hour was estimated all to run off the drainage area as fast as it fell. One inch of rain per hour for anything like 25 miles of area was a very exceptional fall. He was in the neighbourhood of Norwich last August when that very celebrated fall of rain took place which amounted to 7 in. of rain in twenty-four hours. That was absolutely unprecedented in that district. The 7 in. fell during twelve hours, and during the maximum period of fall more than 1½ in. fell in a little over three hours. That was the rate of fall, and it was almost unprecedented in this country—certainly in the eastern counties. He took it, although they were much further north, and the ground considerably higher, they were not in Newcastle in what would be described as a region of very heavy rainfall. The rainfall was nothing like what they got in the hill country in Cumberland. Therefore 1 in. of rain per hour might be taken as being the absolute limit of what was likely to occur, if one considered the area of 25 square miles and took the period of an hour. But the fall of rain and the rate at which it went in the catchground were two entirely different things, and it depended entirely upon the nature of the ground and its perviousness and its gradient as to how

last that water would go off. He must say from the information which he had been able to obtain that Mr. Steele was fully justified in reconsidering the sectional area of this culvert before proceeding with the works when they came under his charge. Apparently he was able to obtain the gauging of an exceptionally heavy flood in 1900, which gave a yield from this valley of something like $\frac{1}{8}$ in. per hour from the catchground. That, no doubt, although a very heavy flood, they would not take as being the absolute limit, and Mr. Steele provided in his design for a culvert which would take $\frac{3}{10}$ in. per hour. For some reason he had increased that, and so he had got a provision of $\frac{4}{10}$ in. per hour. That, in face of the gauge of $\frac{1}{8}$ in. per hour, seemed to be a very ample provision, and shows that the original design of 1 in. per hour was certainly working on a very safe limit. The point which one naturally looked at after all was what difference in cost was made by this alteration in the cross-section. Obviously it must have been something important, and it would be interesting to know what the saving to the corporation was to make this alteration in design. He knew the question was complicated by this—that the original construction of the larger sectional area seemed to have been undertaken when the corporation had borrowing powers under an Act of Parliament, and when they would not have to submit their plans of construction to any criticising engineer; and subsequently, when the culvert was extended, they were told that the Local Government Board sanctioned the loan, and the details of construction had to be submitted to an engineering inspector, and as a result of that process, the strength of construction was largely increased. So the cost of construction as carried out was not strictly comparable with the original design; but perhaps the author would tell them what the saving would have been if constructed with the same margin of strength. The question of strength seemed to have been dealt with by the model exhibited. This was a method of testing which rather appealed to one in the first instance as being a practical test; but one always had to bear in mind this—that when they came to a heavy bank like this, tipped up with all sorts of materials and angles, and at different times, heavy rainfall might alter the constituents of the filling materials. Thus the load brought upon the culvert below was not truly represented by the conditions existing in that model, where the material was more or less dry, and where there were not the alterations of the conditions taking place in the slopes, and the whole of the materials would not have to be carried by the superincumbent material. The Local Government Board were severe in their requirements in requiring the culvert to carry the whole load of the bank. He noticed with respect to the levels of the culvert that the invert level at the outlet end was fixed above the level of high water spring tide. Unfortunately he had not been able to see the longitudinal section of the valley and the rise and fall of the tide. One would have thought it would have been better to keep the culvert down at the outlet end, and so get a larger discharging capacity if the tide was down. Unfortunately floods did not occur at low water. There was a justification for the belief that heavy thunderstorms took place at high water; but the water did not reach the river at the moment it fell, and even if it fell at high water it did not follow that they would get the maximum discharge from their culvert at the exact moment. With a culvert of this size, if the invert had been kept down 10 ft. it would have improved the gradient, and instead of 1 in 140 it would have been 1 in 80, which would have given three times the discharging capacity. The height of the tide would never be such as absolutely to cover the end of the culvert. That was a criticism which he offered without a full knowledge of the facts, but still it was a point which one would like to have discussed. With regard to the rate at which this valley was going to be filled up, it seemed to be work of very great magnitude. They would have to look for years and years of tipping to get the valley filled up, and the value of the work brought into full operation. He supposed there was no method of obviating this without going to a big expense, and the corporation were not prepared to do that. The diagram on the wall which dealt with the number of houses built during the last twenty or thirty years was rather instructive, as one noticed there had been a very material falling off since 1907. Soon after the extension of the city, when the number of houses built was between 600 and 700 annually, it had fallen off to about 100 per annum. For a city of this importance to have only 100 or 200 houses built per annum showed there had been a terrible slump in the building trade. Perhaps they could not discuss all the causes of it, but Mr. Steele might give them some information on that subject. He presumed the falling off was only temporary; there was probably some over-building in the past, but that must be overtaken in a progressive city, and one might expect that a larger number of houses would be built, and the valley would get filled up at a much quicker rate.

Mr. C. E. RIVERS (Harrogate), who seconded the vote of thanks, asked whether in the design of the reinforcement of the concrete any efforts had been made to resist the surface action in the culvert due to the enormous capacity and velocity of the flow. An enormous amount of material would eventually be required for filling the valley, and although the rate of building had decreased to such a low limit during the last year or two, when building did increase it would take place on the outskirts of the city, and the cost of conveying material to this valley would be very great. He asked as to the provision for access to and ventilation of the sewer to be laid in the culvert. Apparently the only access would be at the two ends of the culvert.

Mr. L. ROSEVEARE (South Shields) said what struck him in this paper was the fact that Newcastle seemed to have been blessed from the very commencement with engineers who had the courage of their conviction. To start with, in 1894, when British engineers had a very prejudiced view of reinforced concrete, to put in a culvert 100 ft. below ground showed the engineer had the courage of his convictions, and perhaps the suggestion of Mr. Steele to make the culvert of a smaller section showed more pluck than ever. The line of least resistance was to continue the work as before. It was not always a paying thing to do to cut down a section, but it showed that engineers were appreciating a little more the discharge of water from areas. It seemed to be a subject in which previously they were following rule of thumb. Some of the leading engineers assumed the whole of the rainfall over the area without any data or calculations as to the impermeability, and some of the younger engineers had followed their lead and assumed the rainfall of an area to be similar to some other area elsewhere, where the engineer had estimated $\frac{3}{4}$ in. or $\frac{1}{2}$ in., or whatever it might be. After the paper of Mr. Lloyd Davies they had no excuse for so doing. The charts, rainfall figures, and the fact that it was an entirely impervious area, proved conclusively that Mr. Steele had done the right thing. Even if this area was developed above the extra flow which would come into the sewer would only be extra owing to the shortened time of concentration due to the fact that the water would be running down sewers rather than from the land. Taking the design of a culvert of this description it was quite feasible that the size of the culvert would depend entirely upon the flow off of an urban district with a very quick fall and a resultant short time of concentration and a high rainfall. It was quite possible that a culvert would have to be designed for that same area rather than the larger area above. He noticed that the author suggested that the borings he took were absolutely wrong—at least, did not prove what they were going to meet. He had often thought it would be well to get a factor of safety as to reliability of borings. He would give them one example. In boring for a reservoir dam they came to rock at 17 ft. deep. When they opened out the ground the only place where the rock existed was the place where the borings were, and elsewhere they had to go down 104 ft., and had £2,000 worth of timber in it. The arches were most interesting, and it was well that the engineers in large boroughs were able to carry out experiments in the way they did. He agreed with Mr. Silcock it was a pity the Local Government Board did not compensate them for the trouble taken with the test experiments. As to the lowering of the outlet as suggested by Mr. Silcock, the strength of a chain was its weakest link, and in these calculations it would be well to calculate the highest rate of flow at the highest water.

Mr. G. NELSON (Gosforth) said when he first saw the complete section of this Ouseburn culvert at its mouth he thought it was too large for its purpose. Mr. Morgan said that it was originally designed to allow for 1 in. of rainfall over the whole watershed area, and the question resolved itself into whether they calculated that this was all going into the culvert at one time, or would be distributed over a period of time. It was usual in designing a sewer to provide for 1 in. of rainfall, but a quarter of that was only

to be dealt with at one time. This 1 in., as it was agricultural land, seemed to be a very large computation. It reminded him of an anecdote: An assistant in the South of England was instructed by his chief to get out the formula of a chimney, and the formula worked out at 6 ft. The chief said: "We will make it 15 ft., and we shall then be safe."

Mr. W. J. Steele (Newcastle-upon-Tyne) said this question of rainfall had vexed a good many of them. but he did not think they had given it the consideration given to it by Mr. Morgan and himself. They investigated charts for he did not know how many years back. They did what was of equal importance —they interviewed the oldest men they could find who lived on the banks of the stream, and they were very fortunate in finding a very intelligent gardener who had known the stream for fifty years, and he gave them various flood marks which he had made out of curiosity. They based their calculations as detailed in the paper for several reasons. He had got there a chart—an automatic rain gauge—which showed the fall of rain they had in June, 1911. During fourteen hours they had 2·30 in., but twice during that fourteen hours ¼ in. fell in an hour—that was to say, for the whole of one complete hour. They could see the chart was remarkably steady; the pointer was very uniform, the curve was true. The point was raised by Mr. Roseveare that the culvert was the same as a sewer. It was only a question of degree. The same principle applied, but what Mr. Morgan had brought out in his paper was that the two things were entirely different. The time of concentration was two and a-half hours. The time of concentration being two and a-half hours, it altered the question of the quantity of water that got off the watershed. The culvert would run three-quarters full with the greatest quantity that could come off the watershed, as calculated in the paper. That brought up another point, raised by Mr. Silcock, as to the reason for keeping the outlet of the culvert above high water. To begin with, he thought one would never have the outfall of a culvert blocked by the tide if one could help it. Here a few feet did not matter. Another point was if they could get a free outlet they ought to have it. But there was another point which was very much more important. Mr. Silcock said if they had dropped the mouth of the culvert they would have got a gradient of 1 in 80; but a gradient of 1 in 80 would be dangerous. They had got 1 in 140, and that was quite quick enough. The velocity was something like 15 miles per hour. They came to the conclusion that if they increased the velocity the culvert would not stand it; the friction would be so enormous as to sheer off the lining of concrete from the reinforcement. If the velocity was so great that the whole thing would be destroyed, they would waste £30,000 or £40,000. They might discuss the question of rainfall for a very long time. He was reading the other day some experiments of Mr. Sandeman in the Derwent Valley, where they found they got 75 per cent of the actual rainfall, and only 25 per cent was absorbed or evaporated. That generally followed what they had done. There was another point raised as to the tipping into the valley, and the time it would take to fill up. That had given them a good deal of thought. When the shipyard of Messrs. Armstrong, at Walker, was about to be constructed, and some 4,000,000 tons of material were taken to sea, they endeavoured to come to an arrangement with the contractor for that material. They tried to arrange with the railway company to run a special service of trains during the night and bring the excavation up the valley, but that was found to be too expensive. They experimented with another scheme for a fifteen minutes' tramway service over the whole twenty-four hours, carried down some of the side streets. The idea was to lay a special tramway along Warwick-street and tip the material into the valley. They went into the cost of that, and the committee thought it would be unwise to do it. They charged now 3d. per load for all material tipped into the valley. It was true they only got a small quantity, but they hoped to get a larger quantity. To fill in the whole valley was a matter of a great number of years. The only object in filling in the valley was to reclaim land, and they might spend very much more in reclaiming land than they would get for it eventually. The important thing was to get their road across.

The President (Mr. R. J. Thomas) remarked that the paper showed very keen investigation as to the strength of materials before use. On the previous day, when going down the river, he had been led to ask why those 4,000,000 tons of good English earth which were sent out to sea could not have been used in filling this Ouseburn Valley. Mr. Steele had explained why the difficulties occurred, and no doubt the explanation was ample; but it did seem a pity that it was not possible to utilise that stuff to fill up Ouseburn. Another question was the connections to the sewer inside the length of culvert, how those connections would be made, or if any would be made at all.

Mr. Morgan, in reply, thought most of the criticisms had been answered by Mr. Steele. Mr. Silcock asked what the extra cost of the culvert would be if carried out on the same lines as the original section. It would have made a difference of about £4,000 if they had made the same thickness of arch and construction throughout. Mr. Rivers asked if they had provided any manholes on the sewer. They had provided manholes from the interior of the culvert. They would be able to get at that from time to time, and that was the means of access to the sewer. Mr. Roseveare raised a point as to boring. These were, as a rule, very unsatisfactory. These were taken very carefully, 50 ft. apart, and, as often happened, they did not discover all they wanted. Taken to a depth of 10 ft. to 20 ft. below the foundation consisted chiefly of shale, segar clay, coal mixtures and sand and soft ground. That was taken out, and the foundation in every case taken to the shale. In dealing with the rainfall and estimating the discharge from the drainage area they could not afford to take any risks of under-estimation, as they were faced with the fact that when the valley was filled in the culvert would be the only means of outlet for the stream, and if an abnormal flood should occur at any time, and the culvert proved inadequate to take the volume coming down through blockage or other causes, the whole would be impounded by the filling acting as a huge dam, which would back up the water for a considerable distance with disastrous results to properties higher up the stream. Bearing that in mind, it was decided to treat the whole of the catchment area as impermeable, and arrange to take the whole rainfall falling on the area direct into the culvert. The estimated time of two and a-half hours for this rainfall to reach the culvert was also kept very small, as in reality they knew from frequent observations that the actual time was very much longer. With regard to the calculations for the culvert, the culvert was calculated as an arch fixed at the ends and continuous at the crown. The resultant load from 80 ft. of filling above the crown of the arch was taken for the calculation of the bending material. The various members of the reinforcement throughout the arch were calculated to resist this bending. The structure was also calculated to resist a side loading—that was assuming that the filling was tipped on one side of the culvert only. He might say a word as to the percentage of reinforcement. The ratio of the transverse reinforcement to the concrete was, in the old culvert, at the crown 2·33 per cent, and at the centre of the invert 1·15 per cent. The new culvert was altogether more strong. The reinforcement at the crown was 3·31 per cent, and at the centre of the invert 1·65 per cent. The dimensions of reinforcement were, in the old culvert, inside main bars $\frac{3}{4}$-in. diameter, 6½-in. centres; outside main bars $\frac{1}{3}$-in. diameter, 6½-in. centres; invert bars $\frac{3}{4}$-in. diameter, 10-in. centres; longitudinal bars $\frac{5}{16}$-in. diameter, 13-in. centres; stirrups 2½ in. by 16 in. B and G mainly. In the new culvert inside main bars 1¼-in. diameter, 6-in. centres; outside main bars 1¼-in. diameter, 6-in. centres; invert bars 1¼-in. diameter, 10-in. centres; longitudinal bars $\frac{5}{16}$-in. diameter, 13-in. centres; stirrups 2¼ in. by 16 B N G mainly. With regard to the point raised with regard to the model, they had to consider the question of the stability of the haunches of the arch in case the foundation gave way. The model was made to open sideways, and they had to find out what the pressure would be in filling in the sides of the slopes. It was found that the filling in material from the top followed the side of the culvert, but had no effect on the culvert itself, and the result was that the filling laid at an angle of repose at about 45 deg. The only thing that could happen was that it might be strained by the side loading and the foundation go; but they did not anticipate the foundation giving way because that had been so carefully considered. A few particulars as to the cost of the culvert might be useful to the members. The cost of the first length of culvert was £25,325, and the cost of the second length would be about £16,000. The whole cost would be between £41,000 and £42,000. That worked out at about £11 per lineal foot of culvert, and a cost of about 1s. 6d. per foot of reinforced-concrete work.

That was seven years ago, when the cost of work was much less than it is now. When they came to the second length of culvert, which was started seven years afterwards, the price of everything had gone up 50 per cent, and the tenders they received for the new culvert were considerably higher than for the old. It worked out at £17 10s. per foot run. This was accounted for by the increase of reinforcement and the increase in the price of the materials all the way round.

The paper on "The Newcastle-upon-Tyne Tramways Extensions," which was next submitted to the meeting by Mr. J. McKellar, is reproduced elsewhere in this issue.

DISCUSSION OF MR. McKELLAR'S PAPER.

Mr. H. W. Taylor (Newcastle-upon-Tyne) proposed a vote of thanks to Mr. McKellar for his admirable paper. These extensions of the city tramways would be of benefit to the population of Newburn, Throckley and Lemington, and he hoped they would prove profitable to the ratepayers of Newcastle. The work, including the purchase of land for widening the alteration of sewers and gas and water mains, had been very costly. He would like to know whether the Corporation of Newcastle anticipated a 4 per cent or 5 per cent return on their outlay.

Mr. Gregory (Newburn-upon-Tyne) seconded the vote of thanks.

Mr. H. P. Foster (Leeds) said that Mr. McKellar had referred to the effect of heavy traffic upon rail joints. He would like to observe that heavy traffic was no more destructive to the joints than a lighter service of cars over a longer period. He had always found that high speeds were more destructive to both joints and rails than a heavy service of cars at low speeds. He had had some experience of the continuous rail joints, and he agreed with Mr. McKellar that they formed an excellent joint if they were carefully fitted. In Leeds they had used the Thermit joint for eleven years, and it had been their standard joint for nine years. They had some trouble with breakages during the earlier stages, but it might interest them to know that of the 7,572 joints welded between the years 1908 and 1912 there had only been thirty-seven breakages, or 0·4 per cent. With reference to the important item of rail packing, he might say that in Leeds they had had various methods. For some considerable time they used a system similar to that adopted in Newcastle at the present time by Mr. McKellar—broken steelworks slag being used in place of the whin chips. This was found to act very well, but some years ago they endeavoured to improve upon it, and at the present time they packed the rails with ¾-in. broken granite, and then run with a mixture of hot creosote oil and pitch to over the rail flanges, and they found this gave even better results. Care must be taken, however, that the mixture was uniform in composition and at the right temperature. From Mr. McKellar's paper it appeared that softwood blocks had not been used on the Newcastle tramways. In Leeds they had tried both hard and soft wood (creosoted Archangel red deal), and they found the soft wood wore more evenly, and did not chamfer at the edges like the hard woods. He agreed with Mr. McKellar as to the difficulty in fixing anchors after the track had been laid. Generally the application of anchors to loose or hogged-back rails had the effect of creating a number of short undulations where previously only one of easy camber existed.

Mr. W. J. Steele (Newcastle-upon-Tyne) said he would like to pay acknowledgment not only to Mr. McKellar but also to Mr. Nash, who had charge of the exceedingly difficult Newburn section. It would probably be difficult to find any road in which more difficulties could be found in a yard run than were found in making this track. It involved the lowering of 30-in. water mains and 24-in. gas mains, all within a few feet. They would get some notion of what it meant when he said that on a section of from 100 yds. to 200 yds. the cost of lowering the water main was about £800. That had been their experience all through that track; underpinning road works, new bridges, and works of that kind. He was glad to have the experience of Mr. Foster of Leeds. Mr. Foster touched upon a point that he quite agreed with, that next to joints, if not equally important, the packing under the rail was a vital matter in a tram track. It had been a question which had troubled them for three or four years, whether they should not remodel their methods. He was glad to hear that pitch packing had been a success at Leeds. He believed that to attempt too great rigidity in a tram track was a mistake.

The President (Mr. R. J. Thomas) said he had seen very little corrugation there, and had congratulated the city engineer and his assistants upon that. As to a resilient packing, he was pleased to find that the Leeds experience agreed with that of engineers in the South of England. This question had been very fully discussed at one of their meetings, and the opinion was that a resilient packing was more likely to give easy running than a rigid one.

Mr. G. Nelson (Gosforth) said they had in his district a tram track with granite setts going through a macadam road. Would Mr. Steele tell them who was responsible for the reinstatement of the macadam up against the setts?

Mr. Steele: I am an engineer; that is a legal question.

The vote of thanks having been accorded,

Mr. McKellar, in reply, said he was glad Mr. Foster had a high opinion of the continuous anchor joints, but he had a higher opinion of the Thermit-welded joint. They had used them since 1901; some had been a success, and others had not been. A few years ago everybody put in anchors, 4 ft., 5 ft. and 6 ft. long. He was now following the lead of Manchester, which had never used them, and most engineers were now coming to the view that too much money was spent on anchors. It was quite certain if anchors were not put in at the beginning they were not worth putting in. This year they intended to lay pitch packing for the rails more generally. With regard to corrugation, for some reason or other Newcastle were late in getting that. There was no real trouble.

A vote of thanks was accorded to the Lord Mayor and Corporation for the use of the council chamber for the meeting.

Subsequently the members were entertained to luncheon in the town hall by the Improvements Committee.

The afternoon was devoted to visits to Quayside, the Ouseburn Valley works, Benton Bank Bridge widening and tramway, and Jesmond Dene, where tea was served in the Banqueting Hall.

THE EXCESS LIME METHOD OF WATER PURIFICATION.

In October last the Water Examination Committee of the Metropolitan Water Board submitted a report suggesting an expenditure in connection with practical experiments on the excess lime method of purification which had been described in Dr. Houston's Eighth Research Report. The recommendation was, however, referred back, and the committee have therefore submitted a further report in the hope that the board will see fit to adopt the proposal now made.

The committee point out that Dr. Houston has proved from his experiments in the laboratory that it is possible by adding lime to an impure water to render that water bacteriologically safe—in other words, that the process is capable of destroying all the microbes of epidemic water-borne disease. These laboratory experiments, however, have not enabled him to express any final opinion as to the practical utility of this process, and the only method of arriving at an adequate conclusion is to conduct a series of outdoor experiments on a practical scale.

The committee are careful to observe that the process should not be in any way regarded as an attempt to obviate the construction of storage reservoirs, adding that if it can be shown that the process would enable storm water to be utilised and rendered safe (which at present, owing to its impure condition, is unsuitable for the board's purposes even if passed into storage reservoirs), the double purpose would be served of safeguarding the supply and of increasing the quantity of raw water at the board's disposal by thus utilising water which would otherwise flow to waste.

The filters at Hanworth, it is suggested, could be placed at Dr. Houston's disposal for the purpose of the experiments.

Cremation in Great Britain.—The report of the Cremation Society of England, issued this week, states that increased public attention is being directed to cremation in each succeeding year.

Office Conversations.

MORE OR LESS IMAGINARY.

[*Contributed.*]

XIII.—Concerning Municipal Trading.

Thirty-five to-day, Mr. Marrion, and as sound as a bell. Digestion, heart, lungs, arteries—grand. Eat well, sleep well. Only had one nervous breakdown, and that was seven years and more ago. Overwork? No, nothing of that kind. It only lasted a few hours, but it was terrible while it did last. I was in a state of absolute collapse, and the wife—well, she wasn't quite my wife then—she went through the ceremony without so much as a flicker of the eyelid. Women are always calm on these occasions. It's the poor man that totters to the altar steps and signs his name in the register afterwards with a big blot—kind of blotting out his past, I suppose, and a bottle of ink wouldn't make a big enough blot for some of us. But there, I've switched right off to myself, as usual. I'm really sorry for you, Mr. Marrion, but if you *will* play fast and loose with your constitution, what else can you expect?

* * * *

Here you are, a man leading a strenuous business life, working ten hours a day in the office and bringing piles of letters and things home night after night, and, not content with that, you put in a powerful lot of work at the chapel, you officiate on half-a-dozen committees in the town, you boss the Boy Scouts and the Girl Sleuths, and then, as a crowning act of folly, you take on the chairmanship of the council, with, of course, a seat on the bench—I nearly forgot that. Enjoy it? Yes, perhaps you do, but there're others to think of besides yourself. I needn't talk, I know; but then my evening work is compulsory. It's daily bread to me; but you—— Why not throw some of it up? Take a rest by doing only your own work. *Bono publico* 's good enough, but for myself I prefer the *dulce domum*. Only temporary? No, it's not only that in your case. Your health's growing worse day by day, and unless you give some of your appointments up I'm thinking that your insurance company 'll soon have to shell out. Seriously, Mr. Marrion, is the game worth the candle? You'll excuse my speaking plainly, but is the notoriety you obtain worth the seeking? Give up the committees and the Scouts and Sleuths, anyway. You'll think about it? I know what that means. You'll be fathering the Coal Club and the Widows' Mission before the month's out. Work never hurt anyone? It all depends on what you mean by work, and being harassed and worried, and brow-beaten and heckled by a lot of irresponsible townsmen hardly falls within the definition. Leave the chapel? No, no, I wasn't referring to that. It's the committees I mean—and the council. Get my share? Yes, I do, and more than my share very often, but my "labour of love"—I've heard you use the expression—brings grist to the mill, which makes a mighty difference.

* * * *

But, as you say, this is all beside the question. You wanted to see me about—— Oh, the proposed tramway scheme? Yes? What's my opinion on it? Hum, it's a bit sudden, you know. Really, I haven't given it much consideration—thought it was in the clouds at present. Being pressed by Clangton on the matter? Yes, of course, I know that the idea is to couple up with their system. Do I think it will pay? No, flatly, I don't—not for many years to come, anyway, but that scarcely affects the matter that I can see. What do I mean? Why, that the first consideration is the public convenience. Is there a real demand for tram facilities or not—will the trams be well patronised—these are the all-important questions. You don't understand me? If the scheme isn't going to pay, what's the use of it? Ah, Mr. Marrion, I'm afraid you take too narrow a view of these things. When it comes to that, what undertakings in the district do pay? They're all run, so to speak, at a loss, which the ratepayers have to make up in the end. Wish I'd be a little more explicit? Well, then, look here——

* * * *

Let us take the two main utility services—highways and drainage. We spend some hundreds a year on each, and the return is—well, beyond establishment charges on house drain connection works, practically *nil*. There is no reason but one why we should expend the money we do, and that one is—the public convenience. Obvious? Of course it is, and it's just these very obvious things which escape notice. Everyone uses these things? No, not entirely so. Some of the biggest ratepayers never come into the town at all, in so far as usage of the roads and sewers is concerned. What of the two railway companies, for example—I won't trouble to instance more—how often do the shareholders use the public concerns for which they pay so heavily in rates? But their customers do? They couldn't run their lines without? I don't know about that. They did run them for many years when there was only the one main road through what was then a straggling village. And I rather think, Mr. Marrion, that the boot's on the other foot. We couldn't run the town without the railways, and the time 'll come when we shan't be able to run it without the trams.

* * * *

A believer in municipal trading? Within limits I am. I could scarcely help being, seeing that if there were no such thing I should have a very bad quarter of an hour when pay day comes round! I don't go so far as a municipal food supply, and all that sort of thing. Whether right or not, the time isn't ripe for it, and there's as much work on our shoulders as we can get through with. But when you talk of highways and drainage and gas and water supply—*and* trams and other local means of transport, then I say, Yes, certainly. I don't believe in private enterprise? No thanks, Mr. Marrion, I'm not going to enter into what I don't believe in. It 'd take me the rest of the day and the night and half the morning. It's enough for the present purpose to say what I do believe in, and I *do* believe, and firmly, that if the trams will be useful to the bulk of the ratepayers of the town we ought to have them. Even if they're a dead loss? Well, if they were that, it would be a proof that the bulk of the ratepayers didn't want them, which would be quite the reverse of the reason I give.

* * * *

Strong opposition? The tradesmen in the High-street? Now really, Mr. Marrion, has that any weight with a level-headed man such as yourself? Did you ever hear of any proposal of the council—of this council, or of any other for the matter of that—that wasn't opposed by "the tradesmen in the High-street"? Poor fellows, they're most of 'em about on the verge of filing their petition, and they haven't the remotest idea of working for the very thing that 'll assist to stave off the evil day. They opposed the new paving, they opposed tar-macadamising in every form, they opposed the fire station, they opposed the sewage works extension—why, they even opposed a twopenny reduction in the rates the year before last! Powerful opposition? Yes, I'll allow that, and it 'll mean, as usual, the setting back of the clock for an election or two. A lot of 'em 'll go in on the "No trams" ticket at the next election, but they'll go out again at the one after simply because they'll be proposing something themselves. Really, Mr. Marrion, I wonder you haven't grown sick of the nonsense long ago!

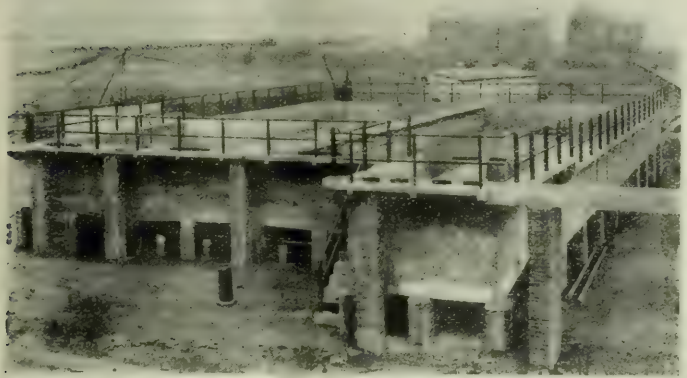
* * * *

Yes, broadly speaking, I'm in favour of the trams scheme. I know they're wanted, and badly wanted, and that's enough for me. Of course, I haven't had an opportunity of going into the figures yet. I'd be the last to advocate rash expenditure. My meaning is that if this added convenience *can* be given to the public, they should have it. It 'll open up a heap of vacant land on both sides of its track, and we shall, in a few years, have an enormously increased rateable value. Unsightly? No, I don't agree. I'm afraid I'm a bit of a utilitarian. Given that a thing is necessary and useful and well carried out, there's not much to find fault with in it. The finest cities in the world are now traversed in all directions by overhead wires, and I think without any detriment to their beauty. Too, if we don't bestir ourselves, it 'll be done by private enterprise, so it's bound to come in the end. No, I prefer a municipal service. It 'd save me endless trouble in many ways. If I agree with the tramways engineer? Well, there is that considera-

tion, certainly. But I don't think I shall fall out with him if he knows his work. He'll have to do that? Ah, Mr. Marrion, I'm not so certain. Suppose the council were to appoint one of the tradesmen in the High-street? Nonsense? I've known worse things than that to be done in municipal appointments.

HORBURY SEWAGE WORKS.

In our issue of September 13th last we reproduced from *Ferro-Concrete* an interesting account of the new sewage disposal scheme of the Horbury Urban District Council given by Mr. J. H. Drew, now acting as consulting engineer for the works in question. We are now able to reproduce two recent photographs showing very clearly some of the principal features of the undertaking and affording our readers an opportunity of judging for themselves the nature of the design, and the manner in which it has been realised by the contractors, the Yorkshire Hennebique Contracting Company, Limited, of Leeds.



Equalising Tanks and Detritus Chambers, Horbury.

Filter Beds and Channels, Horbury.

The first view was taken at the lower end of the two equalising tanks with the detritus chambers and outflow channel in front, all constructed in Mouchel-Hennebique ferro-concrete, and supported on neatly built piers. The second shows the complete series of three circular filter-beds with the branch and main channels for the effluent, these, like the circular channel around each filter, having been constructed in ferro-concrete, which was also employed for the formation of the floors, and of bands strengthening the circumferential brick wall.

AKONIA AND THE DUST QUESTION.

(Contributed.)

Although tar is in great favour with many surveyors for the treatment of roads, it is generally admitted that it is unsuitable for hilly districts and for roads adjacent to trout streams. It is therefore necessary in such cases to have recourse to some other method of dust prevention, and from what one hears from road experts who have had a long experience of Akonia, it would seem that this preparation is one of the best that can be used on gradients, inasmuch as it does not render the road surface slippery.

In districts like Harrogate, Belper, Derby, Aldershot, Westmorland, and other hilly parts of the country, where the question of slipperiness is of vital importance, Akonia has been applied with great success for some years past. The cost of treatment by this compound does not exceed ¾d. per sq. yd., labour included, for the whole season, according to the evidence of numerous authorities who have used it continuously, among these being Kingston-upon-Thames, Nuneaton, Hinckley, Lewisham, Penrith, Penge, Willesden, the Essex County Council and the Crown Estate Paving Commissioners for Regent's Park.

The method involves no complicated modus operandi, and necessitates no special appliance beyond an ordinary water van. It can be carried out at any time except during actual raining. The material is odourless, and, what is most important, innocuous to plant and fish life, while it also possesses disinfectant properties. The suggestion made some years ago, that after a prolonged application Akonia might have an injurious effect upon the road metal, has been entirely set aside by the experience and reports of surveyors who have employed it on their roads for several years in succession. Some surveyors are even of opinion that it prolongs the life of the road, and binds and improves its surface. In this connection, Mr. F. C. Uren, surveyor to the Aldershot Urban District Council, is quite emphatic. In 1909 he said: "I am reporting to my committee upon the five months' test made last summer with Akonia to the effect that this extended trial confirms what I had previously reported to my council in favour of the dust-laying properties and surface-binding qualities of Akonia."

The Road Congress.—A special issue of The Surveyor will be published on June 20th.

Chartered Surveyors' Golfing Society.—By kind permission of the Dunbar Golf Club a one-day competition will be held on that club's course on Tuesday, the 27th instant. In the morning a bogey competition will be played under handicap (optional sweep, 2s.). A prize will be given for the best nett return. In the afternoon a medal round under handicap (optional sweep, 2s.). A prize will be given for the best nett return. The sweepstakes will be divided—two-thirds to the first competitor after the prize-winner, and one-third to the next competitor in the sweepstakes. There will be a limit of handicap of eighteen for the competitions. There will be no entrance fee, and the green fees will be paid by the society. In order to facilitate the necessary arrangements members who intend to be present for either the whole day or any part of the day are requested to notify Mr. W. Jennens Hackett, 47 Cavendish-place, Newcastle-upon-Tyne.

Assistants' and Students' Section.

Conducted by SYDNEY G. TURNER, Assoc.M.Inst.C.E.

All communications in regard to this page must be addressed to The Editor, St. Bride's House, 24 Bride-lane, Fleet-street, E.C. *Envelopes must be marked "Assistants' Section" in the top left-hand corner. Correspondents are invited to submit questions for consideration and answers to the questions which appear. For the contributions considered to be the most meritorious, one or more premiums in books will be awarded monthly. Diagrams must be drawn to scale on separate sheets, ready for reproduction.*

QUESTIONS.

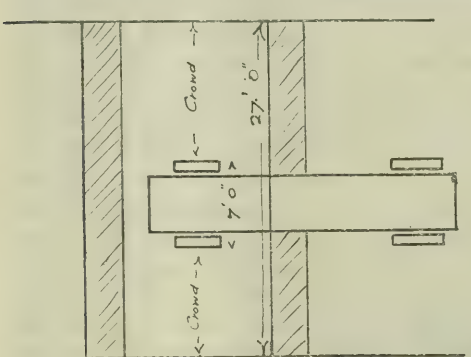
This week answers are invited to the following questions:—

317. Strength of Beam.—A rolled steel I beam of British Standard Section, 12 in. by 6 in., and weighing 54 lb. per foot, is capable of sustaining a load of 15 tons uniformly distributed over a span of 20 ft. What would be the safe load uniformly distributed which could be placed on either half of the lower flange? ("Pupil.")

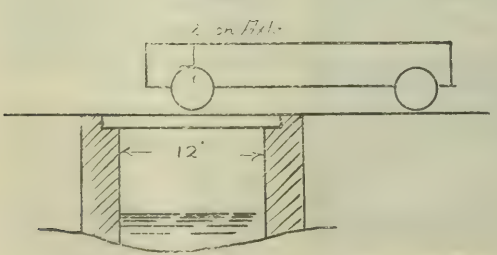
324. Oil Engines.—Assuming two engines of equal horse-power (4-h.p.), one an oil engine and the other a petrol, what would be the approximate cost for running each engine for fuel and repairs? How would the costs compare with each other, including first outlay and oil, repairs, &c.? In regard to efficiency, which engine would be the more efficient from an economic standpoint? ("Griffo.")

325. Air Compressors.—How is the size of an air receiver calculated in connection with an air compressor? Of what thickness of metal would it be made if (1) of cast iron, (2) wrought iron, assuming it had to withstand a pressure of from 15 lb. to 40 lb.? Give any further particulars regarding same. ("Griffo.")

326. Reinforced-Concrete Bridge Design.—Show a suitable design in reinforced concrete, either in a single slab or slab and beams, for a decking to carry a roadway over a bridge; span 12 ft., width



Plan.



Section.

27 ft., cover 9 in. macadam; brickwork abutments. Show the calculations by which the section, steelwork, &c., is arrived at. The maximum live load that can come on the bridge is a 22-ton axle, and the remainder of the bridge covered with a crowd. (G. B. S., *Hove.*)

327. Flow of Sewers.—State the advantages of egg-shaped and circular sewers, and give conditions under which such advantages would occur. Give proofs of velocities and discharge. (D. G. B., *Darlington.*)

[The Editor is at all times glad to hear from readers who desire to submit questions regarding matters of general interest, points of daily practice, &c., for insertion in the "Assistants' and Students' Section." Questions which are published are taken into consideration, as well as other matter, in awarding the Monthly Premium.]

Notes.

The following notes are submitted as preliminary to the study of hydraulics:—

The *physical properties of water* being constantly involved, it is advantageous to devote some attention to them.

Pure water is an almost colourless, transparent, odourless liquid, and is a solvent of very wide application in Nature. Its maximum density occurs at 4 deg. Cent., or 39·1 deg. Fahr. The freezing point is lowered and the boiling point is raised by an increase of pressure, while reduction of pressure raises the freezing point and depresses the boiling point; so that water on mountains is harder to freeze and easier to boil than at sea level.

At *normal* atmospheric pressure water freezes at 32 deg. Fahr., and boils at 212 deg. Fahr.—that is, it freezes at zero deg. Cent. and boils at 100 deg. Cent.

At *maximum density* the specific gravity is unity; the specific heat being 1·000 at 32 deg. Fahr., and rising gradually to 1·013 at 212 deg. Fahr. The latent heat of evaporation at 212 deg. Fahr. is 966·6 British thermal units per pound, and the latent heat of fusion of ice at 32 deg. Fahr. is ·142 British thermal unit.

The weight per cubic foot pure is 62·4 lb., nearly enough; the specific gravity of average sea water being 1·026, sea water therefore weighing about 64·0 lb. per cubic foot.

Compressibility.—For water at rest or in a state of steady motion, the compressibility may be taken at zero, but in certain cases, where sudden starting or stopping of a moving body of water is involved, the compressibility may become so important as to be a predominating factor.

In such cases, the fact that pure water for a temperature midway between freezing point and boiling point decreases about 0·000045 of its volume (V) on an average, while the pressure increase (dP) is one atmosphere, must be remembered, this giving an average value of the bulk modulus (K) of 32,500 lb. per square inch. Note that K is measured as the ratio (pressure increase) ÷ (corresponding volume decrease) equals

$$\frac{dP}{\frac{dV}{v}}$$

Note:—

Value of K.	Temperature: degrees Fahr.
36,800 lb. per square inch	35
30,000 ,, ,, ,,	50 (this value to be adopted in the average calculation)
28,800 ,, ,, ,,	212

Solution of Air.—The fact that at ordinary temperatures and pressures large volumes of gases (usually air) may be dissolved by water, and that a temperature of 180 deg. Fahr. at atmospheric pressures is sufficient to liberate almost all such dissolved gases, is of great practical importance. Often water moving at high velocity past restricted areas—such as valve seats, &c., as in jet pumps and injectors—will hiss. This is due to the pressure being too low, which follows from the velocity needing nearly all the available head to produce it, and the gases escaping due to this reduction in pressure.

Adhesion and Cohesion.—The property of a liquid which enables it to adhere to the surface of a solid brought into contact with it—namely, adhesion—and the property which enables a body of liquid to resist tensile stress by the clinging together of its molecules or particles—namely, cohesion—are both possessed by water, as is plainly exhibited by a drip of water hanging to an iron railing on a wet day. The distance between any two molecules being a, an estimate of each of these forces may be obtained from a formula constant $\frac{}{a^6}$; so that a rise in temperature which causes expansion will increase the molecular distance, and so will *reduce* cohesion and adhesion. The relative values of cohesive and adhesive forces vary very much

The Surveyor
And Municipal and County Engineer.

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according to the material; but it is safe to assume that when a liquid wets a solid *adhesion exceeds cohesion*, and when the liquid does not wet the solid the *cohesion of the liquid* is greater than the adhesion between it and the solid. Example: Since mercury will not wet glass, the force of cohesion of the mercury exceeds any adhesion.

That the mobility of the particles need be in no way hampered by the existence of cohesion will be evident on considering that to slide two clean plane surfaces of solid material over one another needs practically no force compared with that which must be exerted normally to the surfaces to separate them against the forces of cohesion acting between the very small gap existing at their join.

The phenomena of "capillarity" and "surface tension" are held to be generally due to cohesion.

Viscosity in a liquid is manifested in the resistance to sliding of one portion of a liquid relatively to the next, and is only noticeable when the fluid is in motion, being analogous to a friction effect between the moving parts of a mechanical system.

The effect is really due to the setting up of a state of *shear*, the magnitude of the distorting shear stress on any plane being proportional to the rate of the distortion produced—that is, to the displacement in a direction normal to the plane.

Waterproofing of Cement.—A lecture on the advantages of the powder Pudlo for waterproofing cement will be given before the Incorporated Clerks of Works Association of Great Britain at Carpenters' Hall, London-wall, E.C., by Mr. J. H. Kerner-Greenwood on Monday evening next at 8 p.m.

Warrenpoint's New Water Supply.—The Lord Lieutenant of Ireland and the Countess of Aberdeen paid a visit to Warrenpoint on Monday last, and her ladyship turned on the new water supply installed by the urban district council. The scheme was prepared by Mr. J. H. H. Swiney, of the firm of Messrs. Swiney & Croasdaile, of Belfast, and the work was carried out by Messrs. J. & R. Thompson, of Belfast. The amount of their tender was £8,890. The new scheme consists of the interception of the Watergap and Causeway Water Rivers, and the conducting of these waters by means of a 7-in. cast-iron pipe to a service reservoir about a mile from Warrenpoint and thence to town. These rivers rise in the Mourne Mountains, and have a catchment above the points of interception of 2,694 acres.

SOME RECENT PUBLICATIONS.*

CONTINUOUS BEAMS IN REINFORCED CONCRETE, By Burnard Geen, ASSOC.M.INST.C.E., M.S.E., M.C.I. Price 9s. nett. London: Messrs. Chapman & Hall, Limited.

In spite of the many volumes recently published on reinforced concrete, this book forms a really welcome addition to the literature of the subject, dealing as it does in a quite original way with the important question of the theoretical bending moments and shearing forces in continuous beams.

The author does not touch upon the question of the resisting moment and design of the corresponding reinforced concrete member, and in this we think he is wise, as on this aspect there is abundant good literature already existing.

After showing how the theorem of three moments may be deduced, bending moment and shear diagrams are given for any possible arrangement of loading on complete spans, for all the common cases of loading met with in practice, the end supports being assumed free.

These diagrams are then combined, and further diagrams given showing the maximum limiting possible bending moments and shears. The labour involved in preparing such diagrams has no doubt made it quite impossible previously to consider all the various conditions of possible loading in designing any system of beams, and "rule-of-thumb" assumptions have been made; but with the use of the tables and diagrams given these variations can be determined very rapidly, and designs would be vastly improved in many ways if the lines laid down by the author were followed.

In cases of heavily-loaded floors where merchandise is stored, and where the nature of the loading on the floors is constantly changing, there can be no doubt that serious changes in the amount and nature of the stresses do occur.

The question of the bending moments set up in outside columns is briefly discussed, and in view of the fact that the stresses in the outside columns due to bending with the building only partially loaded are sometimes far greater than with the building fully loaded with axial loads, this is of extreme importance.

The amount of the reactions which occur with continuous beams, and the increase over the ordinary assumptions of free supports is dealt with fully, and the author clearly shows the extreme importance of considering continuity in determining the loads to be allowed for in calculating columns and beams, as in certain cases this increase can be as much as 62 per cent.

In order to make reference easy, tables are prepared from the diagrams expressing the bending moments in terms of percentages of the simple bending moment for similar detached spans. They also possess the advantage that the difference in bending moments between any two points in a span is easily obtainable, and from this the correct spacing of stirrups or binding can be derived.

The case of the end supports of a series of continuous beams being fixed is discussed, and a treatment of this unknown quantity in a practical way is given. The assumptions are reasonable, and further diagrams and tables are given on similar lines to the previous ones.

The question of the subsidence of supports previously assumed rigid is discussed, with worked examples, and recommendations made as to permissible deflections in beams in order to keep the effect of subsidence within safe limits.

The author does not apparently attach much importance to the tests usually carried out on completed works, and there is justification for his remarks. A useful comparison of results obtained from the tables and diagrams is made with results obtained from tests of completed buildings in America.

Worked examples of the application of the tables and diagrams are given, and it should be noted that the numerous diagrams are well drawn and lettered, and excellently reproduced. The book is clearly written, and admirably got up generally, and the author may be congratulated upon having compiled a work of reference which is as original as it is practical. It should certainly find a place on the

* Any of the publications reviewed, or referred to as received, will be forwarded by the St. Bride's Press, Limited, on receipt of published price.

bookshelf of everyone engaged in the design of reinforced concrete construction—whether engineer, architect, contractor, or student—and we should be surprised if it does not take a permanent place as the standard work on the particular section of reinforced concrete construction with which it deals.

COMMERCIAL MOTOR USERS' ASSOCIATION.

THE WHIT MONDAY PARADE.

The Commercial Motor Users' Association held their seventh annual parade in Grosvenor-road on Whit Monday, and it was evident from even a casual inspection of the vehicles that the business of producing them is a highly progressive one. This progressive spirit is likewise the characteristic of the association itself, for whereas the entrants at the first parade in 1907 numbered only twenty-six, there were no fewer than 372 on the present occasion. Design and constructional methods have been vastly improved of late years, and the efforts of the association have doubtless had a not unimportant share in achieving these ends. The main object in view is the encouragement of drivers, by means of money prizes and other awards, to take a personal interest in the driving and condition of their vehicles, and to run them without accident. The new features of this year's parade are the parcel car section, in which special prizes were awarded to drivers, and the vehicle section, in which a number of silver cups were offered for competition among owners of vehicles delivered from the works after February 28, 1913.

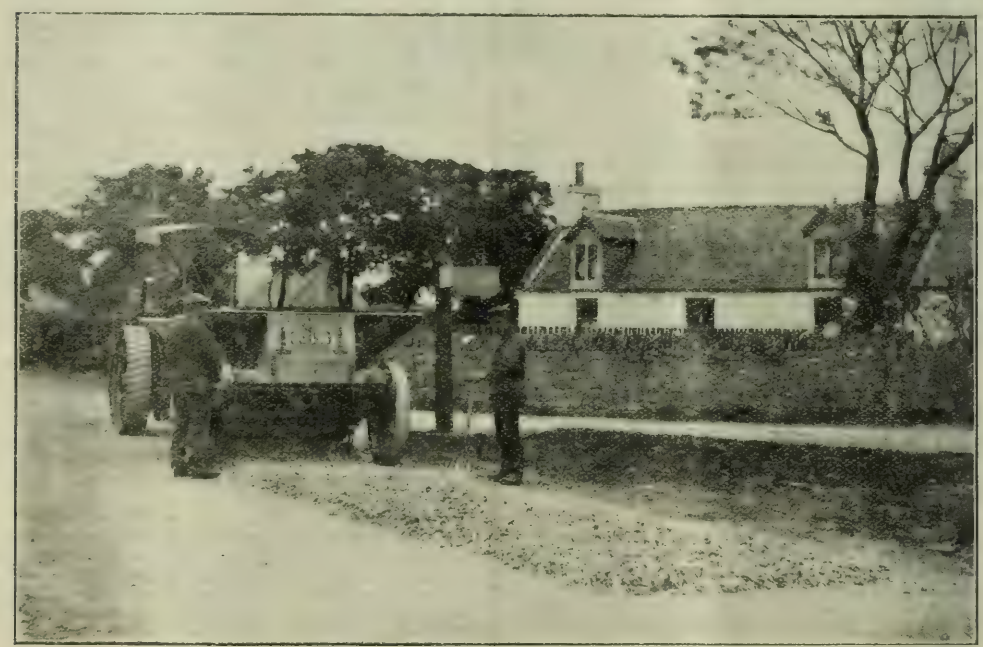
The *Commercial Motor* Challenge Cup is the chief trophy of the team section—for the best collection of six vehicles—and this was won by Messrs. Cannon & Gage, Limited. The technical examination of drivers, which is conducted by Mr. George W. Watson, M.I.MECH.E., M.I.A.E.—who praises highly the quality of the papers by the candidates—resulted in the prize (petrol) of £10 being awarded to A. C. G. Hughesdon, in the service of John Walker & Sons, Limited, the second of £5 going to E. Grover, G.P.O. Stores Department. The first prize of £10 for steam vehicles was taken by H. B. White, the Rickmansworth and Uxbridge Valley Water Company, and the second award of £5 by A. C. G. Hughesdon, who thus won a "double event."

The municipal exhibits included twenty vehicles belonging to the Westminster City Council, and the special prize offered to loading mechanics was won by Fitter W. Carr, in the employ of that authority.

The prizes were handed to the successful competitors by Colonel Crompton, consulting engineer to the Road Board, and chairman of the association, who presided at the luncheon after the parade, which was served at the Royal Automobile Club. In the course of the proceedings Colonel Crompton, replying to the toast of "The Association," remarked that the work the association was engaged in was distinctly useful in the national sense. In case of invasion—in which he did not believe—their services would be invaluable. He thought that a mistake was being made in lauding internal combustion engines and deprecating steam. They must not forget that the supply of liquid fuel was limited, and if railways ran their branch lines with internal combustion engines, and other big consumers used them for similar purposes, the price of liquid fuel would go up enormously, for it constituted less than 10 per cent of the fuel supply of the world, and the effect on the industry must be disastrous.

MACADAM DISTRIBUTING WAGON.

This wagon, which is the invention of Mr. Alexander Hogg, county road surveyor, Elgin, is specially designed for laying coatings of metal.



Road Metal Distributing Wagon at Work.

Four years ago the County Council of Elgin empowered Mr. Hogg to arrange for the construction of two wagons. The vehicles are worked by a tractor, one wagon being loaded while the other is being discharged, and the increased travel of the tractor enables more work to be done than can be executed by a traction engine hauling four wagons two out and two in.

It is claimed that the wagon possesses several advantages over most wagons used for road materials. It is easily loaded, being only 4 ft. 9 in. high; it can be placed under the delivery shoot of a stone-breaker; and the metal can be laid on to the road surface to a width of 5 ft., and to any thickness from 3 in. to 1 ft.

The delivery of the metal from the wagon as it is hauled along is such that deeper hollows in the surface get, automatically, a greater quantity discharged into them, so that the surface of the new coating is left perfectly smooth and ready for rolling. Four parallel discharges give a width of coating of 19 ft. The load is 6 tons, and the time taken to discharge from the moment the wagon arrives until it starts on the return is ten minutes.

Since the wagons were made, four years ago, they have been constantly at work on the county roads.

LOCAL GOVERNMENT BOARD INQUIRIES.

The Editor invites the co-operation of SURVEYOR *readers with a view to making the information given under this head as complete and accurate as possible.*

INQUIRIES HELD.

Blackrock (Co. Dublin) U.D.C. (May 6th. Mr. A. D. Price).—£1,600 for the purpose of providing a recreation ground at Sweetmans'-avenue, Blackrock.—The town clerk (Mr. Finlay Heron) stated that when the matter of providing a playground for children was first suggested as a permanent memorial in connection with the King's first official visit to Blackrock in July, 1911, a very modest scheme was proposed for the purpose. Subsequently a scheme on more ambitious lines was determined upon, by extending the site for the playground as far as Temple-road, and taking in some of the houses abutting thereon. The amount which the Blackrock Reception Committee agreed to contribute would amount to about £265.

Cardiff T.C. (May 8th. Mr. H. R. Hooper).—£35,000 for relaying the tramway track and wood paving in Queen-street, Newport-road, &c.; £19,200 for lands, mains, &c., in connection with the Llwyn On reservoir; and £8,000 for the purchase of Grove House.—The inspector stated that the Local Government Board had reduced the original application from £35,533 to £30,000, and had asked the corporation to consider the comparative cost of hard and soft wood. The inspector's suggestion recalled the keen controversy which was waged in Cardiff fifteen or more years ago over the different kinds of woods to be used for wood paving the streets. The city engineer (Mr. W. Harpur) said the price of Jarrah wood had gone up 6d. per square yard since the present wood blocks were laid, and the cost of labour had increased. For creosoted soft wood paving his estimate was £28,000. The inspector observed that in London Jarrah wood blocks had been taken up and soft wood substituted. Mr. Harpur's estimate was 8s. 6d. for soft wood, as compared with 12s. for Jarrah. The cost in London, where labour was dearer, was only 7s. 3d. per square yard for soft wood. There was a difference of 5s. per square yard between the cost of hard wood and soft wood, and this, on a total of 49,205 sq. yds., was £12,300. Did Mr. Harpur think, as an engineer, that he would be justified in putting the city to the extra expense of £12,000, and that he would get the extra value of £12,000 by using hard wood, in view of the evidence he had had of forty-seven towns being in favour of soft wood, as against half that number in favour of hard? Mr. Harpur said he thought the corporation would be justified in going in for the hard wood, for the reason that it could be dug up after many years' usage, refaced with a machine, and used again. He did not think this could be done with creosoted blocks. The inspector remarked that, by having their own creosoting plant, the corporation could still put down soft wood at £10,000 less than for the hard. Was it not worth saving that sum if it could be done? Mr. Harpur still maintained that Jarrah wood would prove the most efficient and economical material. With respect to the application for £19,200 in respect of waterworks the inspector pointed out that the board required to know what portion of the £8,000 set down for mains, new services and meters represented wages of the permanent staff. They had, he said, formed the definite opinion that wages of employees should not be paid out of capital raised by loan, but out of revenue, and that policy had been endorsed by sound financiers.

Dungannon U.D.C. (April 29th. Mr. P. C. Cowan).—£1,500 for the purpose of improving the water supply.—The proposed work, it was explained, consisted of scraping the old main and laying a new line of pipes. The inspector said he was afraid scraping was maintenance only, and not new work. They might as well ask for a loan for a year's wages. Mr. Robert Newton stated that the reason the £1,500 was applied for was not that it was required for scraping, but that part of it could be used now, and the remainder kept for future contingencies, so as to save additional applications.

Easingwold R.D.C. (May 9th. Mr. F. O. Stanford).—£8,657 for the purpose of a water supply to Coxwold, Crayke, Easingwold, Newburgh, Oulston, Stillington, and Thornton-on-the-Hill, including the construction of a reservoir to hold 120,000 gallons in the village of Oulston, and the execution of other works in the township of Byland-in-Wass. It was stated that springs had been secured at Byland-in-Wass, the terms of the lease, which was for sixty years, being that the council should pay a yearly rental of £30 to lay a pipe from the delivery main and connect the same to the water supply at Newburgh Priory (the residence of Sir George Wombwell). Mr. C. E. Fairbank, of Messrs. Fairbank & Co., civil engineers, York, whose firm designed the proposed scheme, gave statistics of the yield of the three Wass springs, which in all amounted to 154,612 gallons per day, though two of the springs would only be utilised except in cases of emergency, such as a very dry season. The total required per day for the area concerned was 61,250 gallons. The water from the springs had been examined and found of excellent quality.

Haltwhistle R.D.C. (May 7th. Mr. F. O. Stanford).—£7,000 for water and sewerage schemes.—In the course of the proceedings, Colonel Clark, Bellister Castle, said he thought the water scheme inadequate for the probable increase in the population. He was now busy with a scheme for building 100 more houses.

Horsham U.D.C. (May 9th. Mr. Edgar Dudley). £1,600 for the widening and improvement of North-street.—North-street, it was explained, was one of the most important roads in Horsham, leading as it did from the town to the railway station, and also being a part of the through road from Crawley, East Grinstead, and the north-eastern part of Sussex to the western part. The present roadway was very narrow for so important a thoroughfare, and quite inadequate to meet the requirements of present-day traffic. The road was also narrowest where it should be widest—just above the junction with Park-street. The details of the work were laid before the inspector by the surveyor, Mr. R. Renwick.

Lewes T.C. (May 2nd. Mr. M. K. North).—£3,000 for the purchase of property in Fisher-street, and the erection of municipal offices on the site. The town clerk, Mr. M. S. Baker, stated that the need for additional office accommodation had always been felt and that need had been accentuated latterly by the increased work thrown on the corporation. For instance, there was the Education Act and the recent amalgamation of the Lewes parishes, under which it would be necessary to find accommodation for the meetings of the overseers, collector of rates, &c. The corporation now constituted the Burial Board, and they would require office accommodation. It was not always convenient to hold committee meetings in the council chamber.

Meltham (Yorks) U.D.C. (April 21st. Mr. C. H. Eyles).—£6,000 for the purposes of a scheme under Part III. of the Housing of the Working Classes Act, 1890, for the purchase of land, and for the erection of twenty-two working-class dwellings.—Mr. Frank Abbey, architect and surveyor (Messrs. J. B. Abbey & Son, Huddersfield), said he had been instructed by the council to prepare plans, &c., for the proposed twenty-two houses on a site at Broadlands, with a view to the dwellings being let at 4s. or 4s. 3d. per week, and at the most at 4s. 6d. He thought 10s. per house per year would be sufficient for the repairs and maintenance. The houses would be of stone and brick. He considered the site acquired a model one, and that the houses could be built for £230 per house. Each dwelling would be 14 ft. 6 in. by 13 ft. 4 in., with three bedrooms, living-room, scullery and bathroom, with space for gardens.

Northwich U.D.C. (May 1st. Mr. A. A. G. Malet).—£11,732 for public baths in Victoria-road.—Mr. J. A. Cowley, clerk to the council, stated that the old baths, which were a gift, had to be demolished owing to subsidence. They had been very successful. A large number of visitors took brine baths, which had great curative properties. The council set out with the idea of building new baths at a cost of £7,000, but an increase of 10 per cent in materials, an addition of £500 for foundations owing to water, and £500 for electrical generating plant and retaining walls had had to be added to the original estimate. The opposition contended that the baths were far in excess of the needs of the district, and that a large portion of the cost was on provision for brine bathers such as football clubs.

Stratford R.D.C. (April 29th. Mr. A. G. Drury).—£1,000 for the purpose of sewerage and sewage disposal for Henley-in-Arden and Wootton Wawen.—It was mentioned that the scheme had been practi-

cally completed, and that the original tender of Messrs. A. Hill, of Kidderminster, to carry out the works for £5,192 was accepted. The total amount due to the contractors, including extras and extensions as ordered and claimed, was £5,559. The contractors had not been fully paid up, but Mr. S. C. Warden (clerk to the council), replying to Mr. Drury, explained that they had actually received £5,310 on No. 1 contract, and on No. 2 contract for house connections £80, making a total of £5,390. The extras necessitating the additional expenditure over the estimate were explained in detail by Mr. Willcox (of Messrs. Willcox & Raikes, engineers), including the Stratford-road extension, easements, osier beds, legal and engineering, land, alteration of sewer, extra manholes and lamps.

Sunderland T.C. (April 22nd. Mr. H. Shelford Bidwell).—£4,500 for the construction of a new street as a continuation of St. Mark's-road, between Ogden-street and Hylton-road.—The acting town clerk, Mr. G. D. Duncan, said it was proposed to cut through a property known as McNay's Buildings, fronting on to Hylton-road, and taking in part of St. Andrew's Vicarage grounds. It was proposed to make the road 45 ft. wide. Hylton-road and Chester-road were main thoroughfares leading into the centre of the town. On the Deptford and Pallion side of Hylton-road were a number of large shipbuilding yards and forges, to and from which heavy forgings, plates and other shipbuilding material had to be conveyed, and it was desirable that this proposed road should be constructed in order that this heavy traffic should have provided for it a good level road to the east end of the town, where the testing works were situated.

APPLICATIONS FOR LOANS.

Birmingham T.C.—£11,820 for a new fire station at Aston.

Bristol T.C.—£2,550 for street widenings, and £2,070 for cemetery extension.

Carnoustie T.C.—£1,350 for works on the golf courses and recreation grounds.

East Sussex C.C.—£1,200 for a new school site at Portslade.

Falmouth T.C.—£8,928 for the provision of working-class dwellings.

Frome U.D.C.—£284 for works of sewerage.

Larne U.D.C.—£2,000 for the construction of footpaths.

Mansfield Woodhouse U.D.C.—£140 for sewerage works.

Peterborough R.D.C.—£5,700 in respect of the housing scheme.

Salop C.C.—£1,300 for road widening works.

Southwick U.D.C.—£670 for sewer extensions.

Spalding R.D.C.—£14,000 for a water supply scheme.

Stockport T.C.—£650 for a shelter and tennis pavilion.

Swaffham R.D.C.—£3,189 for a housing scheme.

Tendring R.D.C.—£1,000 for workmen's dwellings.

Woolwich B.C.—£21,300 for paving work.

LOANS SANCTIONED.

Downham Market U.D.C.—£4,892 for sewerage and sewage disposal works.

Erpingham R.D.C.—£364 for road improvement purposes.

Hampstead B.C.—£4,100 for electricity mains and plant.

Harwich T.C.—£8,100 for new schools.

Hereford T.C.—£600 for electrical pumping plant at the waterworks.

Hinckley U.D.C.—£7,040 for a new hospital.

Horwich U.D.C.—£239 in respect of the filter material at the sewage works.

Maidenhead T.C.—£850 for re-surfacing High-street.

Poole T.C.—£355 for private street works.

Poplar B.C.—£1,567 for works of sewerage.

Scarborough T.C.—£1,079 for the erection of bungalows.

FORTHCOMING INQUIRIES.

MAY.	£
19.—**Hinckley.** For the erection of working-class dwellings (Mr. Courtenay Clifton)	2,000
19.—**Watford.** For the extension of the county offices (Mr. M. K. North) ...	1,200
20.—**Brighouse.** For street, sewage, and recreation ground purposes (Mr. P. M. Crosthwaite)	22,740
20.—**Barnstaple.** For the purchase of land for hospital purposes (Mr. W. W. E. Fletcher)	275
20.—**Birkenhead.** For electricity and water purposes (Mr. H. R. Hooper)	34,630
20.—**Coventry.** For street widening purposes (Mr. F. H. Tulloch)	3,000
20.—**Ealing.** For the extension of the town hall (Major J. Stewart)	4,000
20.—**Llanelly.** For the erection of working-class dwellings (Mr. H. Ascough Chapman)	5,670
20.—**Meltham.** For works of sewerage (Mr. A. W. Brightmore)	600
20.—**Swaffham.** For a housing scheme (Mr. W. H. Collin)	3,189
20.—**Swanage.** For private street improvement (Mr. R. H. Bicknell)	—
20.—**Tewkesbury.** For water supply purposes (Mr. A. G. Drury)	2,300
21.—**Bedford.** For works of surface-water drainage (Major J. Stewart)	3,396
21.—**Birmingham.** For street widening works (Mr. F. H. Tulloch)	13,682
21.—**Darwen.** For electricity, gas, and water purposes (Mr. A. W. Brightmore) ...	40,650
21.—**Hemel Hempstead.** For sewage disposal purposes (Mr. F. O. Stanford)	1,500
21.—**Horsforth.** For works of sewerage (Mr. P. M. Crosthwaite)	1,300
21.—**Llantrisant.** For sewage disposal purposes (Mr. A. G. Drury)	5,500
21.—**St. Helens.** For electricity purposes (Mr. H. R. Hooper)	3,700
21.—**Smallburgh.** For the provision of dwellings (Mr. W. H. Collin)	960
21.—**Southampton.** For street and wharf purposes (Mr. R. H. Bicknell)	6,320
22.—**Abertillery.** For the construction of a new road (Mr. A. G. Drury)	3,237
22.—**Balby-with-Hexthorpe.** For sewage disposal purposes (Mr. P. M. Crosthwaite)	6,811
22.—**Beaconsfield.** For sewage disposal purposes (Mr. R. G. Hetherington) ...	13,500
22.—**Bootle.** For electricity and land purchase purposes (Mr. H. R. Hooper) ...	7,730
22.—**Sheerness.** For a steam disinfector (Mr. S. Monckton Copeman)	184
23.—**Chelmsford.** For water supply purposes (Mr. F. O. Stanford)	1,940
23.—**Epsom.** For laying an electricity main (Major J. Stewart)	500
23.—**Hayton-with-Roby.** For works of sewerage (Mr. A. W. Brightmore)	1,000
23.—**Trowbridge.** For the extension of the county offices (Mr. A. G. Drury) ...	13,500
27.—**Cambridge.** For sewage and paving works (Major J. Stewart)	6,798
28.—**Bourne.** For an infectious diseases hospital (Mr. W. W. E. Fletcher) ...	6,000
28.—**North Witchford.** For water supply purposes (Major J. Stewart)	1,100

Tarred Roads and the Paris Trees.—Complaint is again heard of the alleged damage done to the trees in the Avenue de Champs-Elysées, and the Avenue du Bois, Paris, by the tar applied to the roads. The gardeners say that it is useless to plant young trees, as they do not flourish. M. Forestier, the keeper of the Bois du Boulogne, has informed the *Matin* that at his request an inquiry was made in 1910 by several eminent men of science into the effect on vegetation of the use of tar on roads, the result of which was to demonstrate conclusively that it is disastrous to plants and to most trees and shrubs. Indeed the only trees that seem to resist it are the plane and the sophora. It seems that some of the roads in the Bois itself are tarred, and that the results are equally injurious to the trees.

Municipal Work in Progress and Projected.

The Editor invites the co-operation of SURVEYOR *readers with a view to making information given under this head as complete and accurate as possible.*

The following are among the more important projected works of which particulars appear below: Buildings — £14,500, Tunbridge Wells, Whitworth; housing and town planning — Bradford, Waterford £12,964; refuse collection and disposal — Newport £10,204; roads and materials — Battersea £14,438, Llantrisant £26,300, Malvern £6,513, Sheffield £12,161, Stoke Newington £7,200, Warwickshire; sewerage and sewage disposal—Tenby £14,000; water, gas and electricity—Lampeter. Particulars of other works projected will be found on our "Local Government Board Inquiries"-pages.

BUILDINGS.

Barrow-in-Furness T.C. — Instructions have been given for the preparation of plans for a new police station, estimated to cost £14,500.

Basingstoke T.C.—A site for an electricity station has been purchased for £300.

Coventry T.C.—New slipper baths, erected at a cost of £2,000, were opened last week.

Cumberland C.C.—The council, acting on the recommendation of the Highways Committee, have decided to apply for the sanction of the Board of Trade and the Local Government Board to construct a sea wall, 500 ft. long, at Dubmill, about a mile north of Allonby, on the main road, which runs along the Cumberland coast between that place and Silloth. The estimated cost of the work is £8,300, and the committee stated in a report that if the work was not carried out this summer the present road would undoubtedly be washed away and a very large tract of land would be submerged. The county would then probably be liable for damages on account of their negligence in failing to keep up the present road, which is a natural protection against the inroads of the sea.

Edinburgh T.C.—The Wash-houses Sub-Committee recommend the reconstruction of part of the South Gray's-close wash-houses, at an estimated cost of £3,350, and the extension of the Greenside wash-houses, at a cost of £1,500.

Kearsley U.D.C. — The question of providing a mortuary is under consideration.

Middlesex C.C. — The new Guildhall, the cost of which is between £70,000 and £80,000, is rapidly approaching completion, and the county council will take possession of the building early in October.

Stoke-on-Trent T.C.—The borough surveyor, Mr. A. Burton, has received instructions to prepare detailed plans and alterations to the Burslem police station.

Tunbridge Wells T.C.—The erection of a crematorium is under consideration.

West Hartlepool T.C.—A public swimming bath, to be presented to the town by Mr. William Cresswell Gray, J.P., is to be erected on the sea banks, south of Carr House.

Whitworth (Lancs) U.D.C.—A committee has been appointed to consider the erection of new municipal offices.

HOUSING AND TOWN PLANNING.

Bradford T.C.—A decision has been come to to build 200 workmen's houses in the city. The chairman of the Health Committee, Mr. E. J. Smith, declared last week that if there was one extra house wanted in Bradford there were 5,000 wanted.

Marlborough T.C.—A scheme for the provision of sixteen working-class dwellings is to be carried out.

Selby U.D.C.—Contracts have been put in hand for building forty-two workmen's houses on the Flaxley-road site.

Swansea T.C.—The Housing Committee are giving consideration to the erection of flats similar to some of the municipal dwellings in Liverpool.

Walsall T.C. — Application has been made to the Local Government Board for sanction to the preparation of a town-planning scheme.

Waterford T.C.—Two separate housing schemes are to be carried out at a cost of £12,964.

PARKS AND OPEN SPACES.

Southport T.C.—Two new bowling greens in the South Marine-gardens were formally opened last week. The bowling greens and lawn tennis courts form part of the foreshore improvement, which is being carried out at a cost of about £18,000.

REFUSE COLLECTION AND DISPOSAL.

Aberdeen T.C.—Cairncry Quarries are to be purchased for £2,750 for the purpose of a refuse tip.

Newport (Mon.) T.C.—At the next meeting the council will consider the question of applying to the Local Government Board for £11,697 for the purpose of a refuse destructor, to cost £10,204. The annual cost will be £1,810 and the estimated total cost will amount to 1½d. in the £.

ROADS AND MATERIALS.

Argyllshire C.C.—The Road Board have made a grant to the Lorne District Committee of £1,200, and a loan of £1,500 for surfacing with whinstone sections of the roads in Oban and Ardrishaig, at an estimated cost of £3,218.

Auckland R.D.C.—The Road Board have agreed to make a grant of £333 towards the estimated cost (£1,000) of making the new road at Canney Hill, and the county council will pay one-third of the remainder.

Ayrshire C.C.—The Northern District Committee have adopted a scheme for repairing the roads at Skelmorlie, Dunlop, and Lugdon. It was explained that the works would cost £17,176. The Road Board had offered that if the district committee were prepared to spend £2,000 straight away, they would give a loan of £10,000, without interest, to be repaid in five years, and they would also present them straight away with the sum of £5,176.

Battersea B.C. — The London County Council have sanctioned the borrowing by the council of £14,438, repayable in five years, for creosoted deal paving works in Broomwood-road, Thurleigh-road, Nightingale-lane, Bellevue-road, Battersea-rise, and Albert Bridge-road. The total estimated cost of the paving is £15,565. From this sum is deducted the amount of grant promised by the Road Board—viz., £1,000—and also the value (£127) of old granite setts to be removed from channels and crossings. In addition to the grant of £1,000 towards the cost of these works, the Road Board have agreed to contribute £4,000 by instalments of £800 a year spread over a period of five years.

Belper R.D.C.—The annual estimates of the surveyor, Mr. Robert C. Cordon, for the repair of the highways amount to £5,200.

Bermondsey B.C.—In reply to the application of the council for a grant of £3,500 towards the repairs of Tower Bridge-road the Road Board point out that the work proposed is that of renewing a worn-out surface in the same material and that the particulars do not disclose any improvement towards which the board have power to contribute. The board state, however, if the council have in contemplation any more comprehensive scheme of road-crust improvement work within the borough, such as the substitution of permanent pavements for water-bound macadam, the necessity for which can be traced to the increased use of the roads by heavy motor traffic, they will be glad to consider such scheme.

Cuckfield R.D.C.—The council have approved a report by the Roads Committee stating, *inter alia*, that the surveyor, Mr. A. McArthur, attended a meeting at the County Hall, Lewes, to consider the recommendations of the Road Board for the improvement of dangerous corners on the highways by the process of removing high or dense hedges which obstructed the view and substituting open fences, and a resolution was passed to the effect that the conference approved of the suggested scheme subject to the work being carried out with the co-operation of the district surveyors. There was, however, a strong feeling that the scheme did not go far enough, inasmuch as many of the most dangerous corners had very high banks and the intended

scheme would be ineffective without excavations such as sloping or otherwise removing a portion of the bank. The committee resolved that the county council be informed that in the opinion of the council the removal of hedges at dangerous corners would be better carried out if left to the district surveyors.

Derby T.C.—Akonia is again being used for dust prevention.

Fulham B.C.—The Road Board have made a grant of £5,000 towards the cost of re-surfacing various sections of roads in the borough.

Hove T.C.—Furze-hill, on the west side, south of the entrance to the Wick, is to be widened at a cost of £140.

Llantrisant and Llantwit Fardre R.D.C.—The construction of a new road in the Ely Valley is to be proceeded with at a cost of £26,300.—Clauses have been inserted in the Rhondda Tramways (Rail-less Traction) Bill which provide that the promoters must pay the council one-third of the cost of any road widening.

Malvern U.D.C.—The surveyor, Mr. W. O. Thorpe, has had an interview with the Road Board, and announces that that authority have agreed to advance £5,200 towards the cost, estimated at £6,513, of re-making the Wells, Worcester, and Hanley main roads.

Salop C.C.—A grant of £3,600 has been received from the Road Board for the current year, and the council have determined to apply in future for a grant of £6,247, being three-fourths of the cost of proposed improvements in the county.

Sheerness U.D.C.—The Local Government Board have notified they are willing to grant a loan of £684 for the improvement of footways and £345 for kerbing and channelling, but were not prepared to grant loans for paving the back passages, as they had not been declared public highways. There was no statutory authority to charge such work on the rates, except under Sec. 15 of the Private Street Act which had not been adopted in Sheerness.

Sheffield T.C.—It is announced that the Road Board have agreed to make a grant of £10,000 towards a sum of £12,161, which it is proposed to spend upon tar-macadam roads.

Stockton R.D.C.—Alderman A. G. Rudd has agreed to give about an acre of land for the making of a new road, 40ft. wide by 340yds. long, for the straightening of the main road in the township of Elton. The gift will remove the difficulties which had for some time stood in the way of improving that very dangerous length of road.

Stoke Newington B.C.—It is intended to pave Blackstock-road with 4-in. creosoted deal wood paving on a 12-in. concrete foundation in place of the present macadam surface at a cost of £3,000. The Road Board have intimated their willingness to make a grant of £1,000 towards the cost. The council also propose to repave part of Seven Sisters-road with creosoted wood blocks, at a cost of £4,200.

Torquay T.C.—The estimate of the borough surveyor at £1,100 has been approved for the widening of Wheatridge-lane, and the work is to be proceeded with.

Warwickshire C.C.—The county surveyor, Mr. J. Wilmot, reports that the sum spent upon the county roads last year was £54,000, as against £50,000 in the previous year. The estimate for the current year is £59,000, independent of £2,975 from the Road Board. He proposes to relay forty miles of main roads, provided that a loan free of interest is advanced from the Road Board for seven years.

West Riding C.C.—The Highways Committee have made another application to the Road Board for grants under the Development and Road Improvement Funds Act, 1909. The works now proposed to be carried out are estimated to cost £78,737, and towards this sum the board have intimated their willingness to contribute £28,105. The total county expenditure will be further reduced by payments by various local authorities estimated at £10,670, leaving £39,962 to be borne by the county council. In the schedule setting forth the works it is proposed to carry out there appears an item of £20,000 for tar-spraying, of which £10,000 will be paid by the Road Board. At the meeting of the county council in January last an estimate of £7,500 was approved for this work, but in view of the offer of the board an amended estimate has been submitted to the Finance Committee for approval.

Yarmouth T.C.—A sub-committee which has visited Surbiton to inspect some steam roller and traction plant recommended the purchase of a 5-ton roller, with 1,000-gallon water tank and tipping platform, costing £546, and this the council agreed to. The borough surveyor, Mr. J. W. Cockrill, in a report, estimates that if the more permanent class of road making is adopted, an ultimate saving of not less than 30 per cent will be effected, while the annoyance caused by the repeated repairs of roads will be avoided. The ordinary water bound macadam road costs about 2s. per yard; with heavy traffic it lasts two years, and thus costs 1s. per yard per annum. If made to last longer the patching costs very nearly this sum. A bituminous-bound macadam road costs about 4s. per yard, and may reasonably be expected to last ten years; this works out at a little less than 5d. per yard. The Jarrah paving taken up in the Market-place has been found, at the end of eleven years, without any sign of decay, at the line of heaviest traffic, to have worn $\frac{3}{16}$ in. The loan for ten years allowed by the Local Government Board was repaid last year, working out at a cost of 1s. 4d. per yard per annum. A reasonable estimate for the life of this piece of road is thirty years, which reduces the cost spread over the whole period to less than 6d. per yard per annum. At the end of that time the concrete foundations will be intact and ready to carry another pavement with a similar life. The cleanliness of the surface over an ordinary macadam road is of untold advantage to the users of the road. The policy of the Stables and Roads Committee of doing a smaller length of road each year, and using a bituminous-bound material is the correct one.

SEWERAGE AND SEWAGE DISPOSAL.

Castlereagh R.D.C.—The engineer, Mr. Walter Wheeler, has been instructed to prepare a sewerage scheme for Dundonald and neighbourhood.

Elgin T.C.—Acting on a report prepared by the burgh surveyor, it has been decided to take the sewage of New Elgin at the high-level works, at a cost (to the county council) of 12½ per cent above the actual cost of treating the high-level sewage.

Hexham R.D.C.—Conditional approval has been given to a scheme for sewage treatment estimated to cost £3,500.

Lichfield R.D.C.—The surveyor, Mr. C. O. Rawstron, has prepared plans of a sewerage scheme for Burntwood, the cost of which is estimated at £7,162.

Tenby T.C.—The sewerage scheme prepared by Mr. T. J. Moss-Flower, Westminster and Bristol, has been approved. The work consists of new 4-ft. diameter outfall sewer, 500 yds. long; 6-ft. diameter tank sewer, about 400 yds. in length; new low-level main intercepting sewers, subsidiary sewers, screening chamber, penstock chambers, penstock house, and other incidental works. The estimated cost is £14,000.

WATER, GAS, AND ELECTRICITY.

Bangor T.C.—The profit on the gasworks last year was £326, a decrease of over £800 compared with the previous year, and the electricity department showed a loss of £624 as against £510 in the preceding year.

Canterbury T.C.—A water-softening plant is to be installed at a cost of £300.

Carnarvon T.C.—The gasworks earned a profit on the year of £529.

Carrick-on-Suir (Co. Tipperary) U.D.C.—Mr. James F. Reade, engineer, reports that the water scheme for the town is now complete, the work having been carried out very satisfactorily by the contractors, Messrs. Martin & Co. The total cost of the scheme, including legal expenses, land, and engineer's fees, was £10,800.

Fife C.C.—The tender of Mr. R. J. Morrison, of Kirkcaldy, at £1,307, has been accepted by the St. Andrews District Committee for the work in connection with the Guarbridge water supply scheme.

Invernesshire C.C.—The Logie water extension has been formally inaugurated. The engineers were Messrs. George Gordon & Co., Inverness, and the contractor Mr. Alexander Nicholson, Elgin.

Lampeter T.C.—A site has been secured for constructing a reservoir required for the proposed new supply of water.

Lancaster T.C.—The new filtration plant which the corporation have erected at Scotforth, Lancaster, to further ensure the purity of the water supply to Lancaster and Morecambe, has been formally opened. The plant and buildings cost £6,000.

MISCELLANEOUS.

Amble U.D.C.—Attention is being given to the question of erecting a public mortuary.

Farnham U.D.C.—Extensions to the cemetery are contemplated, at an estimated cost of £1,120.

PERSONAL.

Mr. Thomas Bonham, formerly of Wednesbury, has been appointed outdoor foreman to the Macclesfield Urban District Council.

Mr. H. C. Phillips, surveyor to the Hursley (Hants) Rural District Council, has been voted an increased salary of £35 a year.

Mr. J. Mayho, St. Helens, has been appointed engineering assistant in the Burnley borough engineer and surveyor's department.

Mr. I. F. Shellard has been promoted to the post of chief assistant in the borough engineer's office, Newport (Mon.) with Mr. G. L. Marsh as second, and Mr. D. W. Cleaver as third assistant.

Mr. J. Bowen, formerly at Castlebar, has been transferred on promotion by the Congested District Board of Ireland to Claremorris, Co. Mayo, and will have sole charge of a very large amount of building, road-making, and arterial drainage works.

Mr. R. Curtis Cordon, surveyor to the Buckingham Rural District Council, has been unanimously elected surveyor to the Hereford Rural District Council. Mr. Cordon, who has been surveyor at Buckingham 2¼ years, was formerly assistant surveyor to the Belper (Derbyshire) Rural District Council.

Mr. E. P. Richards, M.INST.C.E., chief engineer to the Calcutta Improvement Trust, is about to sever his connection with that authority, having been ordered to England on medical certificate. Mr. Richards was formerly city engineer of Madras, the trying climate of which, no doubt, rendered him unfit for the more trying climate of Calcutta.

Mr. F. E. Wilkes is recommended by the Highways Committee of Northampton for appointment as assistant borough engineer. Mr. Wilkes is at present assisting in the designing of the new town of Rosyth, where it is estimated that in 1916 there will be a civil population of 36,000, and 25,000 Marines. The Birmingham Corporation loaned his services to the Government for this work. Mr. Wilkes has also been engaged at Westminster, Nuneaton, and Hanley.

Mr. J. Corbett, borough engineer and surveyor of Salford, was last week presented with a silver salver by the staff of the department. Mr. J. T. Hall, the deputy engineer, in handing over the gift, referred to the fact that Mr. Corbett was that day celebrating his birthday, and that in a few days' time he would complete twenty-one years' service with the corporation. The staff of the department were greatly indebted to him for the sound advice he always gave, and wished him a continuance of good health. Mr. J. H. Patterson, the chief clerk, and the oldest member of the staff in point of service, also spoke of the good feeling which had always existed between the head of the department and the staff. Mr. Corbett, in reply, said the presentation had taken him by surprise, and he was pleased that the officials thought him worthy of such kind consideration. Mr. Corbett referred to the many changes which had taken place during his long connection with the borough, speaking especially of the many difficulties that had to be overcome in connection with the provision of the sewage works.

Mr. J. McKellar, whose paper dealing with Newcastle-upon-Tyne tramways extensions appears elsewhere in this issue, was articled in 1892 to the burgh surveyor of Paisley, concurrently therewith attending engineering lectures at the University of Glasgow. He was engaged on the main drainage of Paisley, and in connection with the public cemetery, public park, public baths, infectious diseases (isolation) hospital, and new streets and improvements. He joined Glasgow Corporation in 1897, and was engaged on the reconstruction of 40 miles of electric tramways just prior to the opening of the International Exhibition of 1900, also on the erection of the Pinkston power station. Mr. McKellar became chief assistant to the resident engineer of the Newcastle tramways

Mr. J. McKellar.

in 1900, and was afterwards transferred to the staff of the city engineer, being subsequently engaged on various tramways and other works in Newcastle, including many Parliamentary schemes.

FOR OTHER ADVERTISEMENTS
See End of Paper.

BOROUGH OF WIMBLEDON.
APPOINTMENT OF ENGINEERING ASSISTANT IN BOROUGH ENGINEER'S OFFICE.

The Corporation of Wimbledon invite applications for the above appointment from Candidates who have passed through an Engineering School recognised by the Institution of Civil Engineers; age not to exceed 30 years. Salary £130 per annum, rising to £150 by annual increments of £10.

Full particulars and forms of application may be obtained at the Borough Engineer's Office, Town Hall, Wimbledon. Last day for receipt of applications is Monday, 26th May, 1913.

(By order)
A. STEELE SHELDON.
Town Clerk.

Town Clerk's Office,
Wimbledon.
May 14, 1913. (452)

COUNTY BOROUGH OF NEWPORT.
JUNIOR ENGINEERING ASSISTANT.

The Newport Corporation invite applications for the post of Junior Engineering Assistant to the Borough Engineer and Surveyor. Candidates must have had previous experience in the office of a Municipal Engineer and Surveyor.

The salary will be at the rate of £75 per annum, rising by annual increments of £10 from January 1st, 1915, to a maximum of £104 per annum.

Applications, endorsed "Engineering Assistant," accompanied by copies of three recent testimonials, to be sent to the undersigned not later than 10 a.m. on Saturday, 31st May instant.

Canvassing, either directly or indirectly, will be considered a disqualification.

H. TREMELLING, ASSOC.M.INST.C.E.,
Borough Engineer and Surveyor.

Town Hall,
Newport, Mon.
May 13, 1913. (454)

CONWAY AND GLAN CONWAY RURAL DISTRICT.

ENGINEER AND SURVEYOR WANTED.

The Conway and Glan Conway Rural District Councils require the services of an Engineer and Surveyor.

Requirements: Thorough knowledge of Road-making, necessary accounts under the Highway Acts and as required by the Councils, experience in the preparation of Plans, Quantities and Estimates, Surveying and Levelling, and a general knowledge of the duties of an Engineer and Surveyor to a Rural District Council.

Candidates should hold the Diploma of a recognised Institute of Engineers or Surveyors, and a certificate of the Royal Sanitary Institute or other similar examining body approved by the Local Government Board.

The person appointed will be required to devote his whole time to the duties of his office (which will be strictly enforced), and to give such security as the Councils may require.

A knowledge of Welsh desirable.

Salary commencing at £110 per annum, rising by annual increments of £10 to a maximum of £150.

Applications, to be in Candidate's own handwriting, stating age, past experience, with copies of three recent testimonials, to reach me not later than 10 a.m. on Thursday, the 5th day of June, 1913.

Canvassing members directly or indirectly will be deemed a disqualification.

JAMES PORTER,
Solicitor, Conway,
Clerk to the Rural District Councils.

May 9, 1913. (456)

WEST RIDING COUNTY COUNCIL.

APPOINTMENT OF COUNTY ARCHITECT.

The County Council are prepared to receive applications for the post of County Architect at a salary of £500. Applicants must be thoroughly experienced in Architectural work.

Applications to be made on forms (which, with particulars of the duties, will be supplied on request), and be sent under cover, marked "County Architect," to the undersigned on or before the 7th June proximo.

Canvassing directly or indirectly will be a disqualification.

FRANCIS ALVEY DARWIN,
Clerk to the County Council.

County Hall,
Wakefield.
May 14, 1913. (455)

CANNOCK URBAN DISTRICT COUNCIL.

APPOINTMENT OF GENERAL ASSISTANT.

The Council invite applications for the above appointment. Applicants must have had experience in a Municipal Surveyor's Office, including the keeping of all the various books, and be an efficient shorthand-typist. Preference will be given to one who has had experience as a draughtsman.

The salary will be 25s. per week.

Applications, in candidate's own handwriting, stating age and qualifications, to be addressed and delivered to the undersigned, accompanied by copies of three testimonials, not later than 10 a.m. on Friday, the 30th inst., endorsed "Surveyor's General Assistant." Canvassing will be deemed a disqualification.

C. A. LOXTON,
Clerk to the Council.

Council Offices,
Cannock.
May 14, 1913. (453)

BOROUGH OF BRACKLEY.

The Brackley Town Council invite Architects to submit plans and specifications of 12 cottages to be erected in the borough. The Council do not bind themselves to accept any plan or specification, but if any plan or specification is adopted the Architect who has submitted the same will be paid fees on the usual scale.

Further particulars and a plan of the site can be obtained from

C. E. BARNES,
Town Clerk.

Brackley. (457)

ROAD ENGINEER or other competent person wanted to represent leading Asphalt Co. in London. Must be proficient in modern road construction and qualified to treat independently with local authorities.—Apply Box No. 1,251, office of THE SURVEYOR, 24 Bride-lane, Fleet-street, E.C.

BIRMINGHAM TAME AND REA DISTRICT DRAINAGE BOARD.

TO CAST-IRON PIPE FOUNDERS.

The Board invite Tenders for the Supply and Delivery of Cast-iron Pipes and Specials, ranging in size from 8-in. to 54-in. diameter.

Founders desiring to submit Tenders are requested to send application to the undersigned, when a Specification, Bill of Quantities and Form of Tender will be furnished.

Tenders, on printed forms, shall be duly signed, sealed and addressed "Tenders for Cast-iron Pipes," and shall be delivered at the office of Mr. Arnold E. Harris, Clerk to the Board, 117 Colmore-row, Birmingham, not later than 10 a.m. on Wednesday, the 21st instant.

The Board do not bind themselves to accept the lowest or any Tender, and they reserve power to subdivide the work if that course is deemed advisable. Contractors who cannot make the larger sizes are not, therefore, excluded from tendering for the smaller sizes.

JOHN D. WATSON, M.INST.C.E.,
Engineer to the Board.

Engineer's Office,
Tyburn, Birmingham.
May 14, 1913. (451)

HERTFORDSHIRE COUNTY COUNCIL.

NEW BRIDGE OVER THE STORT NAVIGATION, SOUTH MILL, BISHOP'S STORTFORD.

The Highways Committee of the Hertfordshire County Council are prepared to receive Tenders for the Construction of a New Bridge over the Stort Navigation at Bishop's Stortford.

Persons desiring to Tender for the work may see the Drawings, Specification, Agreement, &c., at the County Surveyor's Office, Hatfield, on or after Tuesday, the 13th day of May, 1913, between the hours of Ten a.m. to Twelve noon, and where a copy of the Schedule of Works (quantities) may be obtained upon payment of Two Guineas, which sum will be returned to the Tenderer upon receipt of a *bonâ-fide* Tender and the documents which have been supplied to him.

Sealed Tenders, endorsed "Tender for New Bridge, South Mill, Bishop's Stortford," must be delivered to the undersigned at his Office not later than Four p.m. on Friday, the 27th day of June, 1913. Such security for the due execution of the works as the Council may require must be given by the Contractor.

The lowest or any Tender will not necessarily be accepted.

URBAN A. SMITH, M.INST.C.E.,
County Surveyor.

County Surveyor's Office,
Hatfield, 1913. (459)

HERTFORDSHIRE COUNTY COUNCIL.

NEW BRIDGE OVER THE STORT NAVIGATION, SAWBRIDGEWORTH.

The Highways Committee of the Hertfordshire County Council are prepared to receive Tenders for the Construction of a New Bridge over the Stort Navigation at Sawbridgeworth.

Persons desiring to Tender for the work may see the Drawings, Specification, Agreement, &c., at the County Surveyor's Office, Hatfield, on or after Tuesday, the 13th day of May, 1913, between the hours of Ten a.m. to Twelve noon, and where a copy of the Schedule of Works (quantities) may be obtained upon payment of Two Guineas, which sum will be returned to the Tenderer upon receipt of a *bonâ-fide* Tender and the documents which have been supplied to him.

Sealed Tenders, endorsed "Tender for New Bridge, Sawbridgeworth," must be delivered to the undersigned at his Office not later than Four p.m. on Friday, the 27th day of June, 1913. Such security for the due execution of the works as the Council may require must be given by the Contractor.

The lowest or any Tender will not necessarily be accepted.

URBAN A. SMITH, M.INST.C.E.,
County Surveyor.

County Surveyor's Office,
Hatfield, 1913. (458)

Newcastle-upon-Tyne Tramways Extensions.*

By J. McKELLAR.

Of the 2,600 miles of electrical tramways in the United Kingdom, representing a capital expenditure of £77,000,000, the City of Newcastle's contribution amounts to 60 miles and about £1,250,000. Prior to 1899 the requirements of the citizens were served by a system of horse traction leased to a company. These lines were constructed of light rails about 65 lb. per yard, laid on the Kincaid system paved with granite, principally of single track with passing places.

In that year the corporation decided to take over the tramways by terminating the lease to the private company, and ultimately promoted a Bill in Parliament for power to reconstruct and extend the system. These powers being sanctioned, the actual work of reconstruction was begun early in April, 1900, and in December, 1901, the present electric trolley system of traction came into operation. At the opening of the service the mileage was just under 20 miles of double track, and this has been enlarged from time to time as required, the total number of miles at present amounting to over 60, measured as single track. With the exception of the first 20 miles, which were constructed by contract, all the work has been carried out departmentally under the city engineer, the gauge adopted being the standard one of 4 ft. 8½ in., the centre way being 3 ft. 6 in. for span pole construction and 5 ft. 8 in. for centre pole, where the width of street permitted the larger space to be used.

The method of construction to-day varies but little from that as originally adopted by the then city engineer, the late Mr. William George Laws, M.INST.C.E. The few changes which have been made will be treated subsequently in this short description of the permanent way. Almost the whole of the original rails and other materials are still in use, which is sufficient evidence as to the quality of the work, notwithstanding the very normal costs incurred in maintenance. The only renewals carried out so far are about 500 yds. each on two very steep gradients which had become worn out owing to the action of the magnetic brakes, and three of the original junctions. During the present year it is proposed to relay about 2 miles of route and seven junctions. The construction adopted follows the usual one of laying a concrete foundation 7 in. in thickness, the rails, after alignment, resting on a concrete packing, and paving the street surface with wood or granite. When wood paving has been laid the concrete foundation is covered with fine concrete floating for a depth of 1½ in. This floating is of equal parts of fine river ballast or crushed granite and cement.

The type of rail adopted by Mr. Laws was of the grooved girder type, weighing 101 lb. per yard, and very closely resembling the No. 4 section, which was standardised several years afterwards by the Engineering Standards Committee. The rails were principally of 45-ft. lengths, and Table 1 shows the chemical composition of that rail compared with those of more recent manufacture. The rails under review were made partly on the Open Hearth and partly on the Basic Bessemer process. The actual wearing of the rails left nothing to be desired, as may be gathered from a previous remark, as with the exception of two, or perhaps three, flaky rails, not a single fault or fracture has taken place which could be assigned to bad workmanship or material during that interval.

TABLE I.

	Per cent.
1898-1901. RAILS—ACID PROCESS.	
Carbon	0·50–0·55
Silicon Phosphorus } not exceeding ... ... Sulphur	0·06
1912. RAILS—LORAIN OPEN HEARTH PROCESS.	
Carbon	0·68 – 0·69
Silicon	0·140–0·159
Manganese	0·74 –0·785
Sulphur	0·030–0·046
1913. RAILS—SANDBERG PROCESS.	
Carbon	0·43–0·53
Silicon	0·20–0·40
Manganese	0·90 –1·40
Sulphur and phosphorus, not exceeding	0·08

The original junctions and cross-overs were almost exclusively of American manufacture, with the standard points 12 ft. long and 100 ft. radius, and in the case of very flat intersections 14 ft. points 200 ft. radius were installed. They are of specially toughened cast steel with hardened centre. An iron-bound crossing with renewable centre pieces was fitted into all the turnouts. The leads attached to points and frogs were of ordinary rolled rail curved in workshops ready to be fitted into position. It is quite the general practice now to have the complete turnout made by the one steelworks contractor, and although the Americans for a good many years had a monopoly of the contracts of this country, it is gratifying, from a national point of view, to know that the home producer is now fully alive as to his responsibilities, and has since then had his share in this, no doubt, profitable industry.

RAIL JOINTING.

The jointing of the rails, being the weakest part of the structure, has always been a concern to those responsible for the upkeep of a tramway system. Various kinds of joints have been tried to present a more or less rigid joint in the endeavour to get rid of the knocking action which very soon appears, owing to the passage of the tramcars. In this city, following the standard practice then in vogue, plain fishplates were used (73 lb. per pair). If the traffic is not too heavy, provided a good fit is obtained, it is doubtful if this can be improved on. One of the routes in Newcastle, about 3 miles long, with a five-minute service, is laid with this joint throughout, and even to-day the joints are all in very good condition, scarcely a single one having given out, although perhaps it should be mentioned that a large number of the cars used on this route are of bogie type.

Another joint very much used in Newcastle is the continuous rail anchor joint, weighing 120 lb. per pair. Many miles are laid with this joint, and, provided a good roll and fit is obtained, this joint is a most reliable one.

Of the various kinds of welded joints that have appeared from time to time during the last ten years, the Thermit welded joint has probably made the most headway. This joint has been adopted very largely by some corporations, notably Manchester and Leeds. Last year the company responsible for it were entrusted with over 800 joints on the eastern portion of our extensions, the work being executed by the Thermit Company themselves, and on its results will largely determine its future in this city. Unfortunately it requires some years to elapse before one can truly express an opinion.

Another weld of a different type—viz., the Tudor weld—has come before the public, of which favourable opinions have been expressed. This weld is somewhat more costly, but if found suitable and reliable the extra capital sum required is of secondary importance, as the maintenance on joints is a heavy one. The tie-bars were originally of wrought iron, but are now all of mild steel manufacture of 2-in. by ⅝-in. section with 2⅝-in. screwed ends, suitable nuts and washers to each, which were spaced originally at 12-ft. centres, but are now reduced to 7 ft. 6 in. centres, and weigh just over 16½ lb. each complete. The paving of tramway routes was confined to three different kinds—viz., wood blocks of Jarrah (Australian) wood, 4⅜ in. in depth, granite cubes 4 in. by 4 in. by 4 in., and granite setts 3 in. by 5 in. The granite work of all paving in this town is almost exclusively from Aberdeen, bedded on 1-in. sand grouted with whin chips and hot pitch. Drain rails are placed at convenient intervals.

MAINTENANCE.

The foregoing remarks may be taken as applying to construction in a general way, and consideration may now be given to the maintenance of the tramways based on that construction, and the impressions to be learned from them in ordinary practice. The tramways had not been long in operation, and by the end of the first winter the weakness of the sand and cement packing made itself apparent, as this was washed out by water finding its way under the rail; consequently loose paving, especially wood, with "pumping" rails, soon made it clear that some other substance, if possible, would require to be

* Paper read on Friday, 2nd inst., at the meeting of the Institution of Municipal and County Engineers at Newcastle-on-Tyne.

used. Anchors were fitted in, in many instances indiscriminately, to be found more or less serviceable.

When they can be put in at construction they may be useful, but to attempt to fix anchors with the accompanying cutting and making good of concrete foundation, and at the same time to maintain the tram service on busy thoroughfares, is almost impossible at other than about two, or at most three, months in the year, and that only if done during night time. The packing used in the attempt to meet the problem was nothing if not cosmopolitan. Trials were given to cement grout with several kinds of material as aggregate, and cement in similar materials dry or nearly so, as well as sal-ammoniac and pitch in many speciality forms. Some of them were more or less successful, depending on a number of conditions, but as climatic conditions play a not unimportant part in the north-east district, it was found that for the requirements of this city a mixture of equal parts of clean, sharp sand, whin chips, and cement just damped, could not be improved on, being convenient for nearly all weathers, and no special appliances required for fixing.

The whole material being thoroughly rammed from both sides of rail—it is a waste of money to attempt this method from one side only—the top of concrete foundation is previously cleaned with hard wire brush and scrabbled, if necessary, to receive the new packing. Faulty packing may be responsible for all loose or low paving apart from the trouble of loose rails, and this one item represents the major portion of the maintenance costs; therefore every effort should be made to have a sound job made when the cost of the removal and replacement of the setts have to be considered. All trenches are closed every night.

In two or three different points of the system wood sleeper construction has been carried out, both on the longitudinal and cross-sleeper fashion. Although it undoubtedly presents an easy-running road, it is costly to construct and more so to maintain, as the wood sleepers (either method) become loose in time when there is much traffic, and as, from their shape and position, the water cannot readily be kept out owing to their greater depth in the ground, more excavation is necessary, which means, of course, an increase in cost over that of the ordinary concrete bed. In Table II. the costs per annum of the system per car mile since its inception are given.

Table II.

Year ended.	Length in single track.			Combined cost of repair and renewals per car mile.
	M.	F.	Yds.	d.
March 31, 1902	18	2	135	0·01
,, 1903	38	4	33	0·29
,, 1904	44	7	134	0·66
,, 1905	49	6	193	0·44
,, 1906	52	4	0	0·31
,, 1907	53	0	0	0·29
,, 1908	54	1	0	0·34
,, 1909	54	1	0	0·48
,, 1910	54	1	0	0·36
,, 1911	54	1	0	0·30

The demand for improved travelling facilities between the city and the districts westward thereof, comprising Bell's Close, Lemington, Newburn and Throckley, and also better connection between the central and eastern portion of the city, resulted in an Act being obtained in 1911 giving powers to further extend the system. These extensions are as follows:—

Tramway No. 1.—This extension, which commences at the present terminus at Scotswood, 3¼ miles from the central station, extends to Throckley, a further distance of about 4 miles, and is constructed almost entirely within the urban district of Newburn. The ancient highway that wanders through the villages of Bell's Close, Lemington and Newburn is in many places so narrow that numerous street works had to be undertaken before any attempt could be made to lay even the single track upon which the corporation had decided. The greater part of the cost of these works is to be borne by the corporation, the urban district council contributing the fixed amount of £6,300. The track is a single one, with fifteen passing places spaced about ¼ mile apart. The rails used are similar to those provided for the remainder of the extensions—that is, the Newcastle section of 101 lb. per yard for the flatter portions of the route, the B.S.S. No. 5, 110 lb. per yard, in Lorain steel, for any portions of the track steeper than 1 in 30, and the B.S.S. No. 5c, 116 lb. per yard, for the inner rails of all curves quicker than 100 ft. and for the curved rails of all the passing places. With regard to the gradients, the steepest part of the track is 1 in 11, near to Lemington Station, but from Newburn village the line climbs from 20 to 255 ordnance datum. The quickest curve is one of 47-ft. centre radius at Lemington. Whenever practicable, the outer rails of the curves are super-elevated.

The track is bonded at every joint with "Forest City" bonds with cross bonds every 40 yds. apart. Respecting the bonding of points and crossings, wherever manganese steel is used a special rail is embedded in the concrete, and bonds are taken from each end to the rails. It is worthy of note that manganese steel is replaced by cast steel for the special work in the passing places and wagonways of any part of the track laid at a steeper gradient than 1 in 30, owing to the effect of the former on the electrical brakes of the cars. Regarding the street works, for the number of which this route is somewhat remarkable, several points of engineering interest arise. In many cases, owing to a change in the level of the street, it has been necessary to lower the 30-in. mains of the water company which follow the track throughout, and this work has so far been carried out without breaking or emptying the mains. This was effected by opening out the whole length of the main to be lowered and slowly jacking the main to its new level and then re-caulking the joints.

Street work No. 1 took three months to carry out. Street work No. 10 involves an entirely new bridge to carry the branch of the North-Eastern Railway. By arrangement this is to be carried out by the railway company at the cost of the corporation and the district council. In street work No. 11 the lowering of the road at this point involved the underpinning of the steel works of Messrs. Spencer & Sons for a distance of 800 ft. The walls of the works are in several places 4 ft. thick, and carry a very considerable load. This work has been successfully carried out by dealing with 3 ft. only at a time, and by leaving a distance of 9 ft. between each opening; the part opened out was then carefully built in cement-mortar and another 3 ft. opened. Although the business of the steelworks was carried on continuously during the carrying out of the work, no movement of any kind has been observed.

Work No. 11*a*, which involved the widening of the county bridge over the New Burn from 20 ft. to 40 ft., is now complete. The remainder of the tramway works, although they involved the widening of the highway for a total distance of 2,000 yds., nothing of very great engineering interest arose. The laying of the track and the carrying out of the street works (with the exception of street work No. 10) is being done by direct labour. In the supply of material, owing to the proximity of the railway and the river, it has been found to be difficult to decide rapidly from what district and by what method of transport it should be brought. Diagrams were prepared showing the price of every class of material at every point of the route, and from these it has been found possible at once to decide by what means material could be cheapest obtained on the work.

Owing to the distance of some portions of the work from the city, the corporation make an allowance of ½d. per hour to every man working up to a point 2 miles from the city boundary, and ½d. per hour to every man working beyond that point.

The construction of the track is on orthodox lines, as before described. The rails are all jointed with fishplates throughout of the continuous rail anchor type, which was decided on after mature consideration. At one time it was intended to use Thermit welds on the 101-lb. rail, but, owing to numerous colliery workings which exist in the district, it was deemed to be on safer lines if plated joints were used, so as to allow for any slight movement which might occur. The tramway is crossed by level crossings or colliery wagonways not less than eight times. These wagonways are, as a rule, crossing the tramway on a gradient, several with haulage ropes.

Tramways Nos. 2, 3, 4 and 5, which are double track throughout, present no unusual features, except perhaps that section in Benton Bank. Benton Bank is a road connecting the district of Jesmond with that of Heaton, immediately adjoining and parallel to the main road, and at a height of about 50 ft. above its lowest level is the Armstrong Bridge. This bridge, which crosses the valley of the Ouse Burn at Desmond Dene, carries vehicular traffic

up to a load of 6 tons per vehicle, but is of too light a character to carry a tramway. The original gradient on the west side of Benton Bank was 1 in 9, and in order to obtain a gradient which would be less costly to work, the level of the road has been raised in the form of an embankment. Advantage has been taken of the opportunity to widen a portion of this road and also the masonry bridge over the Ouse Burn. This bridge has a span of 30 ft., is 23 ft. in width between the parapets, and is being widened on each side so as to have a width of 50 ft. The west side of the bank will have a gradient of 1 in 12, and the east side 1 in 11. The maximum depth of filling is 12 ft., and as a consequence the existing water and gas mains, electrical cables, and underground telegraph wires have had to be replaced at a higher level for a length of about 280 yds.

The total cost of the extensions, including street works and overhead equipment, is about £103,000. The work is being carried out under the direction of the city engineer, Mr. W. J. Steele, M.INST.C.E., and the author is acting as resident engineer.

THE PROTECTION OF BUILDINGS FROM LIGHTNING.

A paper read by Mr. Ernest J. Berg before the Illinois State Electric Association contains some useful practical conclusions with regard to the protection of buildings from lightning by means of rods. Attention is drawn to the fact that, while the damage done by lightning to buildings situated in the country is considerable, the damage done by lightning in cities is relatively small. It has been found that the extensive network of overhead wires in towns, and the grounded steelwork in the modern building, afford ample protection, and it further appears that the modern sky-scraper with its vast amount of steel may be considered lightning proof.

While experience has shown beyond reasonable doubt that properly installed lightning rods afford considerable protection, it does not seem to be possible to protect any building to such a degree that absolute safety can be guaranteed. Such safety apparently exists only in the case of an all-metal building. However, that the protection afforded is valuable is shown in the case of certain buildings situated in exposed positions which formerly suffered considerable damage at different times, and which have not been struck during an extended period of time after the installation of lightning rods. Again, there is a danger to be considered in the careless use of the lightning rod, inasmuch as a rod improperly arranged, broken, having poor joints, or a high resistance to ground, may make matters worse instead of better.

PRACTICAL DETAILS.

The rod should have good joints, good ground connection, and should be mechanically secure against breaking, although its shape, metal and general dimensions are comparatively immaterial. The more rods used the better the protection afforded will be. The protection afforded may be said to be roughly proportioned to the number of earthed rods. For instance, for a house measuring in plan 100 ft. by 50 ft., half a dozen rods would not be too many, or anything unusual in good practice. These rods should be placed outside the building, and it is a question whether the rod proper should not be fixed at some distance from the wall or insulated therefrom. The rods should be kept far away from gas pipes, stove pipes, water pipes, balconies or places where persons might be during a storm. The rods may be advantageously connected, say, along the ridge of the roof, but separate branches which are not grounded are sources of danger. Heated gases coming from chimneys or shafts are themselves conductors, and it is therefore well to have a metal conductor crossing such openings. Such a conductor should be of copper rather than of iron in order to withstand the action of corrosive fumes. Each tower or projection of a building should have its separate grounded rod, which should be connected to the other rods in the system. It is sufficient if these rods project a few feet above the top of the tower. To be effective the rods should have several points.

Metal gutters should be connected to the lightning rod system, and should be connected to the ground at their lower end. High shafts need two or three rods, and the opening of the chimney should be crowned by some simple copper rod construction. Copper rods are required in cities where they are likely to be attacked by corrosive gases, but the author sees no electrical advantage in having a stranded cable; a solid rod is as efficient. There is a very slight advantage in a flat ribbon, but this advantage is very small, and the mechanical difficulties with a ribbon are greater than with a rod.

GALVANISED-IRON RODS.

Galvanised-iron rods are recommended where the corrosive gases present in the air of cities have not to be reckoned with. Galvanised iron is cheaper, and its electrical constants are, if anything, better than those of copper. "The old idea that the rod carries the electric charge to earth, and that that is the end of it is fallacious. The earth is one plate of the condenser, the cloud the other, and whatever energy is stored between them has to be consumed in some way. It is done by heating the rod and by sending out electric radiations. The higher the resistance of the rod the greater is the energy converted to heat, and thus the smaller the number of oscillations of the discharge current necessary to dissipate the energy. Iron has considerably higher effective resistance than copper, and thus has an advantage." There is therefore no advantage in copper over iron, except in the cases already mentioned. Galvanised iron has the advantage of cheapness with a possible electrical superiority.

Sharp bends in the rods should be avoided as much as possible. There is little or no advantage in using expensive rods of large diameter; a size mechanically satisfactory is likely to serve all electrical purposes. Expensive sharp points to rods offer little advantage over ordinary blunt points.

GROUNDING OF RODS.

Rods should be terminated preferably in moist soil. Salting the ground may be an advantage, but experience on this point is not sufficient to warrant its adoption, unless an occasional inspection is made. In many cases an excellent connection to earth can be made by driving a galvanised-iron gas pipe a few feet into the ground. It is doubtful whether steam or gas pipes should be connected to the roads when grounded. On the whole it seems best to leave them alone, especially the gas pipes. The water pipes, which are always grounded, may, however, be advantageously connected to the lightning rod system underground. We are also warned against the danger of standing in a draught during a storm, and advised that it is safer to keep the house closed during violent storms.

Road Board Finance.—In the House of Commons recently, Mr. Masterman stated, in reply to a question, that the sum standing to the credit of the Road Improvement Fund in the Bank of England on April 30th was £120,284. The investments held by the Road Board on the same date amounted (at cost) to £2,481,543.

Problems in Engineering, with Solutions.*—The English journal THE SURVEYOR AND MUNICIPAL AND COUNTY ENGINEER carries on a section devoted to various questions which might be put in an examination for the position of municipal engineer in an English town or city. The questions are given one week and answers provided by various correspondents given in subsequent issues. The volume noted above is the first one to be made up from these questions and answers. As is well known, the position of municipal engineer in England is one of most varied activity, so that the subject covered by the questions and answers extends through the whole field of engineering. For example, the chapter headings are as follows: Mechanics and Hydrostatics; Strength and Elasticity of Materials; Theory of Structures; Surveying and Levelling; Water Supply and Hydraulics; Sewerage; Sewage Disposal; Road Making and Tramways; Building Construction and Materials; Law and Miscellaneous. While the questions and most of their solutions are distinctly British in character, the wide range of subjects and the method of treatment make the book of some value to American engineers. There is a good deal to be said in favour of the question and answer method of instruction.—*Engineering News.*

* Being Questions and Answers reprinted from the Assistants' and Students' Section of THE SURVEYOR AND MUNICIPAL AND COUNTY ENGINEER. First Series, 1909-10. Edited by Sydney G. Turner, ASSOC.M. INST.C.E. London: St. Bride's Press, Limited. Price 5s. nett.

Sewage Treatment.*

By R. J. McKENN.

(Conclusion.)

Coming now to the question of filter beds. In any method of sewage treatment there are three methods of filtration to select from—contact beds, percolating beds and land. Seeing that land is used only in a comparatively few cases, I am dealing only with contact beds and percolating beds. Each method of filtration has its supporters, although the use of contact beds is gradually being superseded by percolating beds. Contact beds are usually constructed as primary and secondary or first and second contact, and there are cases where triple contact is adopted. The filtering medium in the first contact is, as a rule, larger than that in the second, and if a third contact is adopted the media of this bed are finer than that of the second. The depths of contact beds vary from about 2 ft. 6 in. to 4 ft. 6 in., and the capacity varies according to the strength of the sewage to be treated, under the following heads fixed by the Local Government Board: Strong, average and weak—the strong sewage to absorb oxygen from permanganate at 80 deg. Fahr., 17 to 25 parts per 100,000; average sewage 10 to 12 parts per 100,000 and weak sewage 7 to 8 parts per 100,000. These standards apply to percolating as well as contact beds. No hard-and-fast rule can be fixed as to the working of contact beds, the manager being guided by conditions; but, generally speaking, about two hours is taken in filling, about two hours is given for contact- although this may vary with the composition of the sewage—and then the beds are drained. In filling the beds care has to be taken that the liquid is distributed evenly over the whole area of the bed, thus preventing suspended matter accumulating in any one place, and the emptying of the beds should be done slowly. By opening the discharge valve or valves quickly matter is liable to escape from the beds, which would tend to render the early portion of the discharge less pure than it would be towards the close. Many works have the filling and emptying done by the men on the works. This is not a good method, for irregularities in attention are liable to occur. Such can be greatly, if not entirely, reduced by the adoption of such apparatus as the Adams'—and other firms'—automatic timing syphons. It is essential that contact beds should be designed so as to allow of efficient drainage over the whole area of the bottom of the beds, and this can be better done by having several outlet valves instead of only one. If the beds are not properly drained humus matter will tend to accumulate and help to clog the bed, thus reducing the working capacity. The loss of capacity is an important item, and may happen through various conditions, chief among them being the breaking up and solidifying of the medium, the volume treated, suspended matter contained in the tank effluent, inefficient drainage and insufficient rest. The normal working capacity of a healthy contact bed is about 35 per cent of the tank when empty of filtering medium. Given a contact bed and a percolating bed of the same cubical capacity, the percolating bed has a working capacity about double that of the contact bed.

PERCOLATING BEDS.

Dealing with percolating filters the general depths vary from 6 ft. to 8 ft., and the total capacity together with the size of filtering medium depends on the character of the sewage to be treated, as in the case of contact beds. I am of the opinion that a graded percolating bed, having a coarse medium at the bottom, gradually being reduced in size to the surface, will give better results than a bed where the medium is of common size, owing to the fact that it is in the upper layers of the bed where important changes take place in the purifying of the tank effluent. Again, it is in the layers near to and on the surface where accumulations of matter occur which are responsible for ponding occurring. When ponding occurs it is proof that thorough aëration is not taking place, and a simple method to relieve the ponding is to rake the portion affected. The matter which caused the ponding will have a better chance of escape at the base of the bed where the medium is graded than where it is of common size. Further, grading will allow of a more complete aëration, and will help very much to prevent humus matter, including mineral matter due to the disintegration of the medium, from accumulating at the base of the bed. If a bed is made up of a fine or medium size filtering medium, and any extensive ponding should occur, it would be better to remove the upper layer—the quantity removed depending on the condition of the bed—and wash it, or dry it and then riddle it to remove any dried matter, meanwhile replacing what was removed by a medium which was on hand for the purpose. If this is not done, but the whole surface raked, when the bed is again put into work the matter formerly attached to the upper layers will be washed into the bed. Some of it will escape—perhaps the major portion but there is the tendency for accumulation to take place in the interstices of the medium, thus making for a choking and consequent lack of aëration of the bed.

Many appliances are on the markets for feeding percolating beds. Some engineers adopt fixed sprays, while others use revolving and rectangular spreaders. The function of all mechanical arrangements for use on percolating beds is to obtain an equal distribution of the liquid together with a maximum of aëration. The apparatus in operation at the Heywood works is the Ames-Crosta automatic valves and spreaders. The same firm have fitted rectangular spreaders at the Chadderton works. I have here plans showing the spreaders made by Mather & Platt, Limited, Manchester, and Adams-Hydraulics, Limited, York. It will be of interest to know that Mather & Platt, Limited, have made the largest revolving spreaders in operation in the United Kingdom, which are working at the Huddersfield sewage works. There are thirteen each 207 ft. diameter, two each 120 ft. diameter, and one 104 ft. diameter, each spreader being driven by an electric motor.

Other things being equal, the percolating bed is better aërated than a contact bed, owing to the fact that the sewage, passing downwards through the bed, allows of an admission of air to the inner portions. The percolating bed is liable to be a nuisance owing to smell, which is absent, as a rule, in a contact bed, but with care this nuisance can be greatly minimised. Another nuisance is due to the numbers of small flies which nourish on and in proximity to the beds. This is serious when the works are situate close to dwelling-houses.

HUMUS TANKS.

With percolating filters it is necessary to provide some method for arresting the matter which comes away with the filtered effluent. For this purpose humus tanks are generally adopted. These tanks are simple sedimentation tanks. The matter deposited in these tanks is very finely divided, and at times is liable to escape with the final effluent. An admirable method has been adopted at the Chadderton sewage works for arresting this matter by the effluent having to pass through a fine filter or strainer prior to discharging in the river.

SLUDGE TREATMENT.

Coming now to the sludge question, this is a problem in sewage treatment, especially in large cities and towns. In towns like Bradford and similar towns, where the woollen industry is prominent, the sludge contains fats which can be extracted and sold. About six months ago a plant was fitted for the Oldham Corporation, patented by Dr. Grossman, where fats are extracted from the sludge, and the residue used as a manurial agent. This plant has been working satisfactorily for three months, night and day, without a stop, and there is a good demand for the fat and manure. There are several ways of disposing of the sludge—by lagooning, drying on beds, discharging it into the sea, and pressing it into cake. Lagooning and drying is not practical in cities and towns, and disposal at sea can only be accomplished when works are so situate that easy means of conveying the sludge are available. Manchester and Salford and other cities and towns discharge their sludge at sea; but the greater number of works press the sludge into cake, and either dispose of it to farmers as manure

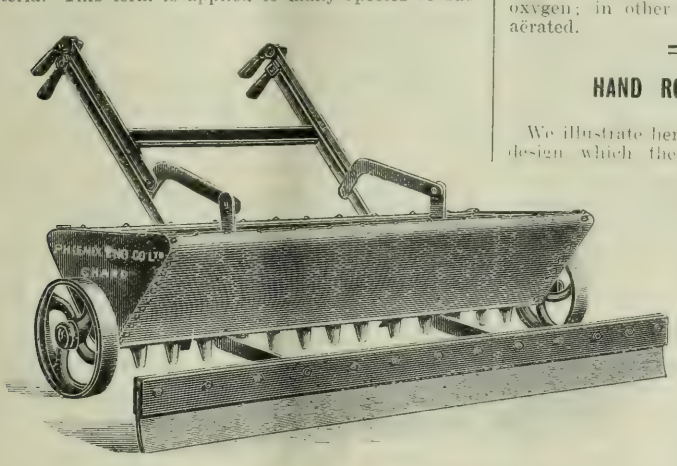
* Paper read at a district meeting of the Institution of Municipal Engineers held at Manchester on April 16th.

or dry it and burn it in refuse destructors. This latter is a somewhat costly method owing to the drying. At Heywood it is pressed, and the farmers are paid 3d. per ton for carting it away. Sewage sludge after pressing contains about 60 per cent of moisture, and while it contains small quantities of phosphates and nitrogenous matter, the bulk consists of mineral matter and cellulose (paper, &c.).

SUMMARY AND CONCLUSION.

Let us now briefly follow the general treatment of sewage at the works. It is here where the chemist is necessary, working in conjunction with the engineer, for by the chemist observing the conditions of the sewerage system and analysing the sewage it is possible that a saving may be made in the cost of tank and filter construction. Generally speaking, sewage contains, besides mineral matter, such as grit, &c., saline matter in solution and nitrogeneous and carbonaceous organic matter, the latter both in suspension and solution. The mineral matter, &c., having settled in the detritus tanks, the sewage then undergoes some method of tank treatment. If chemical treatment is in operation the quantity and kind of chemicals will vary according to the composition of the sewage. Among some of the chemicals used is alumino-ferric, lime in conjunction with ferrous sulphate (green copperas), ferrozone, &c. At some works which have to treat the waste from woolscouring works sulphuric acid is used in conjunction with alumino-ferric to neutralise the alkali. This further helps in separating fats which can be extracted from the sludge.

When the sewage passes into the tanks it undergoes changes through the action of anaërobic bacteria. This term is applied to many species of bacteria. It was once considered that these organisms could only flourish in closed tanks, but that idea has passed away, and it is now established that they can do their work in an open tank as well as a closed one. The anaërobes act on the organic matter in solution, and partly on the organic matter in suspension. Matter is deposited in the tank as sludge. Now the action of these organisms is one of decomposition and this results in the forming of gases, such as hydrogen and methane, marsh gas, &c. Another result of this decomposition is ammonia. This is caused by the urea present in the urine, which is acted on by certain organisms—viz., micrococcus urea and others and forms ammonia and carbonic acid. These unite and form ammonium carbonates. The presence of gases in excess in a tank is demonstrated by quantities of sludge being forced to the surface, due to gaseous explosions at the bottom of the tank. This shows that decomposition has gone too far, and the tank requires emptying.



"FARNHAM" HAND ROAD-TARRING MACHINE.

Leaving the tanks the effluent discharges on the beds, contact or percolating. The method of purification differs in a contact bed from that of a percolating bed. In the former case the medium acts as a strainer, and retains the colloidal and suspended matter present in the tank effluents. As the bed matures a coating forms on the medium which retains an amount of the tank effluent. This helps in a great measure towards the purification. But this is not all, for many agencies are at work, such as worms, numerous species of infusoria, and many kinds of bacteria. When the bed is emptied and resting, and the interstices of the filtering medium are charged with air, the aforesaid organisms attack the matter retained, and the ammonia which has formed is oxidised, first into nitrites and then into nitrates. When the bed is again filled the colloidal and suspended matter is retained on the medium, oxidation takes place, as the result of the nitrates present with the aforesaid matters, as well as other impurities which will be in the tank effluent.

The method of purification in a percolating bed is different from that of a contact bed. The tank effluent being discharged on the surface of the percolating bed by means of sprays or revolving spreaders, the colloidal and suspended matter is arrested on the surface or immediately below, according to the size of the medium and the volume treated. In the upper layers of a bed considerable purification takes place; many species of bacteria, besides worms and infusoria, play their part, but there are two species which must be present if the effluent is to be finally oxidised. These are named the Nitrosomonas bacter and the Nitro bacter. Neither one can complete its work without the aid of the other, and they must work in sequence. Their combined work is to oxidise the ammonium carbonate, but the Nitrosomonas bacter cannot carry the oxidation farther than by oxidising the ammonium carbonate into nitrous acid or nitrites, when the Nitro bacter takes up the work, and oxidises the nitrous acid into nitric acid or nitrates. High nitrates denote a healthy filter, and *vice versa*. So that in working a percolating bed it is of primary importance that it should receive an ample supply of oxygen; in other words, it should be thoroughly aërated.

HAND ROAD-TARRING MACHINE.

We illustrate herewith an apparatus of very simple design which the Phœnix Engineering Company, Chard, are bringing to the notice of municipal engineers. It is known as the "Farnham" hand road-tarring machine, and it is claimed for it that it is clean and easy to work, as the tar lubricates the squeegee, and large stretches of road can be covered in a short time.

The distributor being self-cleansing, any quality of tar can be used. The machine is taken to an ordinary tar-boiler for filling, or hot tar is conveyed to it by carriers, and then pulled across the road to be tarred. The amount of tar distributed on the road can be easily regulated or shut off while the machine is at work. The pressure of the squeegee, which spreads the tar on the road, can also be regulated by the operator.

Professional Charges.—At a special general meeting of the Royal Institute of British Architects, to be held on Monday next, at 8 p.m., consideration will be given to a revised schedule of professional charges and other documents connected therewith, which have been prepared by the council, and are now being submitted to the general body.

Bridge Building. Students, young engineers, and surveyors will find much useful information in "Preliminary Studies in Bridge Building," by Reginald Ryves, ASSOC.M.INST.C.E. (London: St. Bride's Press, Limited, 24 Bride-lane, E.C. Price 2s. nett.) The book is described as the "first of a series of small volumes, each complete in itself, dealing with the design of ordinary highway bridges of moderate span." Though highway bridges alone are referred to, the matter contained in this volume is largely applicable to railway bridges, aqueducts, and similar engineering undertakings. The five primary types of bridges are described, and the conditions determining the best site for each of the three types of streams are discussed in detail; while in connection with wandering streams various modes of designing abutments or approach spans are dealt with. Improvements of fords and the effect of eccentric loading of vehicles on the girder loads are among the numerous other items touched on. —*Scotsman.*

INSTITUTION OF MUNICIPAL AND COUNTY ENGINEERS.

President—Mr. R. J. Thomas, M.Inst.C.E., County Surveyor, Buckinghamshire.

SCOTTISH MEETING.

A meeting of the institution will be held in the Scottish District at Dundee on June 6th and 7th.

ROCHDALE MEETING.

A meeting of the institution in the North-Western District will be held at Rochdale on June 14th (Saturday).

LEEK MEETING.

A meeting of the institution in the West-Midland District will be held at Leek on June 28th (Saturday).

ANNUAL MEETING.

The annual meeting of the institution will be held from July 16th-19th.

Thomas Cole,
92 Victoria-street, S.W. *Secretary.*

INSTITUTION OF MUNICIPAL ENGINEERS.

President—Mr. Frank Latham, M.Inst.C.E.I., F.S.E., Borough Engineer and Surveyor, Penzance.

NORTH-WESTERN DISTRICT.

A North-Western District meeting will be held at the Town Hall, Salford, on Saturday, May 31st.

Programme.

1.30 p.m.—District business meeting.
2 p.m.—Paper, "The Sewage Sludge Problem and its Solution," by Dr. Grossman, M.A., F.I.C., to be presented for discussion.
4 p.m.—Council meeting.

COUNCIL MEETINGS.

A council meeting will be held at the Town Hall, Salford, on Saturday, May 31st, at 4 o'clock.

The following other council meetings have been arranged: June 28th, London; July 30th, London.

B. Wyand,
Secretary.

39 Victoria-street, S.W.
May 1, 1913.

ROYAL SANITARY INSTITUTE.

A sessional meeting of the institute will be held at 90 Buckingham Palace-road on Tuesday next, when an address on "London's Water Supply" will be delivered by Mr. E. B. Barnard, J.P., M.A., chairman, Metropolitan Water Board. The chair will be taken at 7.30 p.m. by Sir Alexander Binnie, M.Inst.C.E., vice-president.

On Wednesday, May 21st, a visit will be made to the King George Reservoir, Chingford.

PROVINCIAL SESSIONAL MEETING, CHESTER.

A sessional meeting will be held on Friday, May 30th, in the council chamber, Town Hall, Chester, at 7.30 p.m., when a discussion will take place on "Modern Methods for the Purification and Softening of Water Supplies," to be opened by Mr. Joseph Parry, M.Inst.C.E., chief engineer, Liverpool Corporation waterworks.

It is hoped that the following, among others, will take part in the discussion: Prof. J. Radcliffe, M.Sc.Tech., Municipal School of Technology, Manchester; Messrs. W. Matthews Jones, M.Inst.C.M.E., city surveyor and engineer, Chester; Coard S. Pain, Assoc.Inst.C.E., F.S.I., Liverpool; F. Storr, M.Inst.W.E., water engineer, Wrexham, and James Wilding, F.S.I., surveyor and water engineer, Runcorn.

The chair will be taken by Mr. H. Percy Boulnois, M.Inst.C.E., chairman of council of the institute.

On the following morning an inspection will be made of the Permutit softening plant at the West Cheshire Water Company's pumping station (Hooton). The visit to these works, it is expected, will take about two hours and a-half. Chester waterworks will be visited in the afternoon.

E. White Wallis,
Secretary.

INSTITUTION OF WATER ENGINEERS.

EIGHTEENTH SUMMER GENERAL MEETING.

The eighteenth summer general meeting of the Institution of Water Engineers will be held at Wakefield on Thursday, Friday and Saturday, June 5th, 6th and 7th, under the presidency of Mr. C. Clemesha Smith, M.Inst.C.E., corporation waterworks engineer.

By kind permission of the mayor and corporation the meetings will be held in the town hall, and at the opening of the proceedings on Thursday the institution will be welcomed to Wakefield by his worship the mayor (Councillor Edwin Lodge Hirst, J.P.).

Ladies will be cordially welcomed at the meetings and visits.

The programme will include the presentation of premiums awarded by the council for papers presented during the year 1912.

Papers and Communications.

The following papers have been promised for reading and discussion at this meeting, and advance copies will be sent out as soon as printed to members who signify their intention of attending the meeting.

(1) "The Valuation of Water Undertakings on Transfer to Local Authorities," by E. J. Silcock, M.Inst.C.E. (held over from winter meeting).

(2) "The Water Supply of Jersey," by Alfred J. Jenkins, Assoc.M.Inst.C.E.

(3) "Animal Growths in Water Pipes," by Samuel C. Chapman, M.Inst.C.E.

(4) "Reservoir Storage in Relation to Stream Flow," by W. J. E. Binnie, M.Inst.C.E., F.G.S., B.A.(Cantab.), and Herbert Lapworth, D.Sc., M.Inst.C.E., F.G.S.

The president-elect (Mr. C. Clemesha Smith) will deliver his presidential address on Thursday, June 5th, and will also supply an illustrated description of the Wakefield waterworks, which will be circulated among those present at the meeting.

A lecture on "The Underground Waters of the Lower Calder" will be delivered by Prof. Percy Kendall, F.G.S.

Visits to Works.

On Thursday afternoon, June 5th, visits will be made to the Kirkhamgate filtration works and the Ardsley reservoir of the Wakefield Corporation waterworks.

On Friday, June 6th, visits will be made to the Green Withens and Ringstone reservoirs (Rishworth Moors) of the Wakefield Corporation waterworks, and to the works of Messrs. J. Blakeborough & Sons, at Brighouse.

Social Functions.

The annual dinner will be held in the banquet chamber of the town hall on Friday evening, June 6th, when the Mayor of Wakefield and other distinguished guests will be entertained by the institution.

On Thursday evening, June 5th, there will be a reception at the town hall on behalf of the Corporation of Wakefield.

On Friday, June 6th, luncheon will be provided by the Water Committee of the corporation, and on Thursday and Friday afternoons tea will be provided (by invitation) for those taking part in the visits arranged for those days.

Percy Griffith,
20 Victoria-street, S.W. *Secretary.*

Preliminary Studies in Bridge Design.—This little book,* a reprint of articles which appeared in The Surveyor and Municipal and County Engineer, is intended as the first of a series of similar volumes which, taken together, will form a treatise on the design of ordinary highway bridges of moderate spans. This first volume goes further back in the evolution of the bridge than do most treatises, and considers the bridge in its essential elements, that is as the means of providing a crossing for man and beast across a watercourse. The bridge engineer is apt to forget this primary purpose and to consider his bridge merely as a framework or a carrier of stresses. Mr. Ryves, in a refreshingly original manner, has emphasised the necessity for studying natural and economic predispositions, one might say, of the bridge site, with a view toward producing, not the best type of bridge, but the best method of getting the river and the traffic across one another. . . . —*Engineering News*, New York.

* By Reginald Ryves, Assoc.M.Inst.C.E. London: St. Bride's Press, Limited, 24 Bride-lane, E.C. Price 2s. net.

APPOINTMENTS VACANT.

Official and similar advertisements received up to 4.30 p.m. on Thursdays will be inserted in the following day's issue, *but those responsible for their despatch are recommended to arrange that they shall reach* THE SURVEYOR *office by noon on* **Wednesdays** *to ensure their inclusion in the weekly list of summaries. Such advertisements may, in cases of emergency only, be telephoned (No. 1359 Holborn), subject to later confirmation by letter.*

SURVEYOR'S CLERK.—May 16th.—Newmarket Urban District Council. £78 per annum.—Mr. S. J. Ennion, clerk.

ROAD SURVEYOR.—May 17th.—Carrick District Committee, County of Ayr. £300 per annum.—Mr. P. Paterson, district clerk, Maybole.

QUANTITY SURVEYOR.—May 17th.—Education Committee of the Monmouth County Council. £160—£200.—Mr. C. Dauncey, secretary, County Council Offices, Newport (Mon.).

INSPECTOR OF NUISANCES.—May 19th.—Corporation of Chester. £150—£200.—Mr. J. H. Dickson, town clerk.

TEMPORARY ASSISTANT.—May 19th.—Corporation of Colne. £85 per annum.—Mr. Alf. Varley, town clerk.

SURVEYOR'S SECOND ASSISTANT.—May 19th.—Wellingborough Urban District Council. £65 per annum.—Mr. E. Y. Harrison, surveyor and water engineer.

BOROUGH ENGINEER'S CHIEF ASSISTANT.—May 20th.—Corporation of Luton. £150 per annum.—Mr. W. Smith, town clerk.

TOWN PLANNING ASSISTANT.—May 20th.—Corporation of Sheffield. £90 per annum.—City Engineer and Surveyor.

SEWAGE FARM MANAGER.—May 21st.—Wanstead Urban District Council. £120—£150.—Mr. Bruce Blewitt, clerk.

BOROUGH ENGINEER'S CLERK.—May 21st.—Corporation of Stockton-on-Tees.—Mr. M. H. Sykes, borough engineer.

SURVEYOR'S ASSISTANT.—May 23rd.—Stourbridge Urban District Council. £60 per annum.—Mr. Fredk. Woodward, surveyor.

ASSISTANT SURVEYOR.—May 24th.—Corporation of Chesterfield. £120—£150.—Mr. J. Middleton, town clerk.

SURVEYOR'S ASSISTANT.—May 27th.—Corporation of Bootle. £80—£100. Mr. J. H. Farmer, town clerk.

CLERK OF WORKS.—May 28th.—Repton Rural District Council.—Mr. C. F. Chamberlin, clerk, Union Offices, Burton-on-Trent.

INSPECTOR OF NUISANCES.—May 28th.—Llandaff and Dinas Powis Rural District Council. £107 per annum.—Mr. M. Warren, clerk, Park House, 20 Park-place, Cardiff.

WORKING ROAD FOREMAN.—May 31st.—Chertsey Urban District Council. 35s. a week.—Mr. T. E. H. Chaldecott, clerk.

SECOND ASSISTANT SURVEYOR.—June 2nd.—Burnley Rural District Council. £70 per annum.—Mr. J. S. Horn, clerk.

BUILDING ENGINEER.—June 6th—25th.—Municipality of Rangoon. 600—800 rupees per mensem.—The Secretary, Rangoon Municipality, Burmah. The latest date of despatch of letters to reach Rangoon by June 25th is by the Indian mail leaving London on June 6th.

MUNICIPAL COMPETITIONS OPEN.

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BLACKBURN.—June 2nd.—Designs for a street improvement scheme, for the corporation.—The Town Clerk.

EXETER.—June 7th.—Designs for a hostel, for the city council. Assessor, Mr. Edwin Cooper, F.R.I.B.A. —The Town Clerk.

DEVONPORT.—June 14th.—Designs for municipal buildings, for the corporation. Premiums, £350, £150 and £100.—The Town Clerk.

NEWCASTLE-UPON-TYNE.—June 19th.—Designs for laying out a portion of the Walker estate, for the corporation. Premiums, £50, £30 and £20.—The Town Clerk.

LIVERPOOL.—June 24th.—Designs for a sanatorium of 250 beds. Premiums, 150, 100 and 50 guineas. —Mr. Edward R. Pickmere, town clerk.

CHEPPING WYCOMBE.—September 1st.—Designs for town-planning the borough and an area immediately adjoining. Premiums, £25, £10 and £5.—Mr. T. J. Rushbrooke, borough surveyor, High Wycombe.

MUNICIPAL CONTRACTS OPEN.

Official and similar advertisements received up to 4.30 p.m. on Thursdays will be inserted in the following day's issue, *but those responsible for their despatch are recommended to arrange that they shall reach* THE SURVEYOR *office by noon on* **Wednesdays** *to ensure their inclusion in the weekly list of summaries. Such advertisements may, in cases of emergency only, be telephoned (No. 1359 Holborn), subject to later confirmation by letter.*

Buildings.

LANARK.—May 17th.—For extensions of the Middle Ward hospital, for the county council.—Mr. W. E. Whyte, district clerk, Hamilton.

HUDDERSFIELD.—May 17th.—For additions to council school, for the Education Committee.—Mr. K. F. Campbell, borough engineer and surveyor.

CASTLEBAR.—May 17th.—For the erection of fifteen labourers' cottages, for the rural district council.—Mr. T. M. Quinn, clerk.

MIDDLESEX.—May 17th—June 6th.—For extensions to an asylum, for the county council.—Messrs. Young & Brown, 104 High Holborn, W.C.

ST. HELENS.—May 19th.—For alterations at a school, for the Education Committee.—Messrs. Biram & Fletcher, architects, George-street.

MONMOUTH.—May 19th.—For the erection of a school, for the Education Committee.—Mr. J. Bain, County Council Offices, Newport.

LEEDS.—May 19th.—For the erection of an economiser chamber at generating station, for the corporation.—1 Whitehall-road, Leeds.

CHESHIRE.—May 19th.—For alterations and additions to an asylum, for the county council.—Mr. H. Beswick, county architect, Newgate-street, Chester.

GLASGOW.—May 19th.—For the extension of a wharf, for the corporation.—Mr. J. Lindsay, town clerk.

RATHDRUM.—May 19th.—For building a wall, for the rural district council.—Mr. T. B. Lowey, engineer.

BARROW-IN-FURNESS.—May 19th.—For the erection of an open shed, for the corporation.—Borough Engineer.

BOGNOR.—May 19th.—For the erection of twelve cottages, for the urban district council.—Mr. O. A. Bridges, surveyor.

DURHAM.—May 20th.—For the erection of a cookery centre and other works, for the county council.—Mr. W. Rushworth, Shire Hall, Durham.

KINSALE.—May 21st.—For the erection of cottages, for the rural district council.—Mr. J. Murphy, clerk.

HOVE.—May 21st.—For erecting dressing rooms and lavatory, for the corporation.—Borough Surveyor.

HAMPSHIRE.—May 21st.—For the erection of a school, for the county council.—Mr. A. L. Roberts, architect, The Castle, Winchester.

STOCKPORT.—May 21st—June 6th.—For extensions to police buildings, for the corporation.—Messrs. Halliday & Paterson, 14 John Dalton-street, Manchester.

HAILSHAM.—May 21st.—For alterations to the isolation hospital, for the rural district council.—Mr. J. Huxley, surveyor.

CHELTENHAM.—May 22nd.—For cementing a reservoir, for the corporation.—Mr. J. S. Pickering, borough water engineer.

BIRMINGHAM.—May 22nd.—For extensions to sanatoria, for the corporation.—Mr. J. Keyte, clerk to the Public Health Committee, Council House.

HULL.—May 22nd.—For alterations and additions to a council school, for the corporation.—Mr. J. H. Hirst, city architect, Guildhall.

KENT.—May 23rd.—For the erection of tool sheds, for the Education Committee.—Mr. W. H. Robinson, architect, Caxton House, Westminster.

LLANDILO-FAWR.—May 23rd.—For the construction of works of water supply, for the rural district council.—Mr. Henry Herbert, engineer, Brynmarlais, Ammanford.

CHESTERFIELD.—May 24th.—For the erection of a filter-house and valve-house, for the rural district council.—Mr. G. Frith, waterworks engineer.

SOUTHMOLTON.—May 24th.—For the erection of ten cottages, for the corporation.—Mr. H. C. E. Rayner, borough surveyor.

BUCKS.—May 26th.—For alterations to police court and erection of police cottage, for the Standing Joint Committee.—Mr. R. J. Thomas, county surveyor, County Hall, Aylesbury.

MAESTEG.—May 27th.—For the construction of river retaining walls, for the urban district council.—Mr. E. E. Davies, clerk.

WEST HAM.—May 27th.—For the extension of the technical institute, construction of underground conveniences, and private street works, for the corporation.—Mr. Fred. E. Hilleary, town clerk.

NELSON.—May 27th.—For the erection of offices and workshops, for the corporation.—Mr. W. Shackleton, borough engineer and surveyor.

HAMMERSMITH.—May 28th.—For rebuilding work and repairs, for the borough council.—Mr. H. Mair, borough surveyor.

CROYDON.—May 29th.—For the erection of a fire station and library, for the corporation.—Mr. S. Jacobs, deputy town clerk.

BRIGHTON.—May 30th.—For the erection of a nurses' home at Haywards Heath Asylum, for the Visiting Committee.—Mr. J. G. Gibbins, 43 Brunswick-road, Hove.

MARLBOROUGH.—June 2nd.—For the erection of sixteen cottages, for the corporation.—Town Clerk.

HUNSTANTON.—June 4th.—For additions to the isolation hospital, for the urban district council.—The Surveyor.

MIDDLESEX.—June 6th.—For extensions to the Napsbury Asylum, including additional accommodation for female staff, residence for an assistant medical officer, and alterations and additions to the upholsterer's shop, for the Sub-committee of Visitors.—Mr. Henry G. Armour, clerk, Napsbury Asylum, St. Albans.

HERTS.—June 27th.—For the construction of a bridge, for the county council.—Mr. Urban A. Smith, Hatfield.

Iron and Steel.

BELFAST.—May 19th.—For the supply of a circulating water pump, for the corporation.—Mr. T. W. Bloxham, city electrical engineer, East Bridge-street.

LEEDS.—May 19th.—For the extension of an engine-room flooring, for the corporation.—Mr. C. Nelson Hefford, 1 Whitehall-road, Leeds.

MANCHESTER.—May 20th.—For the supply of canopy trolley standards, steel fishplates for tramway rails, steel tiebars for tramway rails, and pitch for paving, for the corporation.—Mr. Thomas Hudson, town clerk.

BIDEFORD.—May 21st.—For the extension of the water supply, for the corporation.—Mr. W. O. Seldon, town clerk.

STOKE-ON-TRENT.—May 31st.—For the supply of cast-iron work for storm-water drainage scheme, for the corporation. Mr. A. Burton, borough surveyor.

Roads.

PRESTON.—May 16th.—For making good certain streets, for the corporation.—Borough Surveyor.

KIRKCALDY.—May 17th.—For work of making up, for the corporation.—Burgh Surveyor.

GLASGOW.—May 17th.—For work of road repair, for the corporation.—Mr. J. Lindsay, town clerk.

DORSET.—May 17th.—For tar-spraying 130,000 yds. super. during the coming season, for the county council.—Mr. W. T. Fletcher, county surveyor, County Offices, Dorchester.

PEMBROKE (co. Dublin).—May 19th.—For laying asphalt or other kindred material in three roads, for the urban district council.—Mr. J. C. Manly, clerk.

STOCKTON-ON-TEES.—May 19th.—For levelling and paving several streets, for the corporation.—Mr. Arthur B. Crosby, town clerk.

WHITLEY AND MONKSEATON.—May 19th.—For making-up work in certain streets, for the urban district council.—Mr. Augustus Whitehorn, 60 Saville-street, North Shields.

STEVENAGE.—May 19th.—For the supply of Guernsey, Leicester or other granite, clean chippings and gravel, for the urban district council.—Mr. W. O. Times, clerk.

BLACKBURN.—May 19th.—For making up certain streets, for the corporation.—Mr. W. Stubbs, borough engineer.

BRADFIELD.—May 19th.—For the supply of hand-picked field-dug flints, and gravel, for the rural district council.—Mr. J. Forrester, district surveyor, Theale, near Reading.

PLYMOUTH.—May 19th.—For work of making up and completing, for the corporation.—Mr. James Paton, borough engineer.

BRIGHTON.—May 20th.—For the supply of broken granite, for the corporation.—Mr. H. Talbot, town clerk.

RUSHDEN.—May 20th.—For the supply of granite and slag, for the urban district council.—Mr. W. B. Madin, engineer and surveyor.

LONDON.—May 20th.—For paving carriageways and footways with asphalt, concrete, stone, and creosoted deal blocks, for the City corporation.—The Town Clerk.

BUNGAY.—May 21st.—For the supply of 2-in. granite, for the urban district council.—Mr. P. J. Sprake, clerk.

WOODHALL SPA.—May 21st.—For laying limestone tar-macadam and tar painting and spraying, for the urban district council.—Mr. E. E. T. Bolton, surveyor.

STOCKPORT.—May 22nd.—For paving, kerbing, and flagging, for the corporation.—Mr. J. Atkinson, borough surveyor.

CARDIFF.—May 22nd.—For carrying out street works, for the corporation.—City Engineer.

PANTEG.—May 23rd.—For private street works, for the urban district council.—Mr. T. P. H. Watkins, clerk.

SKIPTON.—May 23rd.—For the construction of a new road, for the rural district council.—Mr. M. R. Knowles, clerk.

STOWMARKET.—May 23rd.—For the supply of broken granite, for the urban district council.—Mr. P. C. G. Hayward, clerk.

NORTH WALSHAM.—May 24th.—For the supply of granite, tar, and road rolling, for the urban district council.—Mr. J. W. Stevens, surveyor.

AXBRIDGE.—May 24th.—For the supply of 8,000 tons of granite or basalt macadam and chippings, for the rural district council.—Mr. J. Knight Dunster, district surveyor, Winscombe, Somerset.

DORKING.—May 24th.—For the supply of broken granite and hire of steam roller, for the urban district council.—Mr. W. A. Clegg, surveyor.

GRANTOWN-ON-SPEY.—May 24th.—For constructing kerbs and footpaths, for the corporation.—Mr. J. Willett, surveyor, Elgin.

RUNCORN.—May 26th.—For laying tar-macadam in certain streets, for the rural district council.—Mr. R. Garnett, Sankey-street, Warrington.

LONDON.—May 26th.—For road construction at Norbury, for the county council.—The Clerk, Spring-gardens.

WALTON-UPON-THAMES.—May 26th.—For making up a private street, for the urban district council.—Mr. P. H. Webb, clerk.

ROCHFORD.—May 26th.—For making up certain private streets, for the rural district council.—Mr. Frederick Gregson, clerk, 26 Alexandra-street, Southend-on-Sea.

WANDSWORTH.—May 26th.—For making up and paving part of Tooting Bec-gardens, Streatham, for the borough council.—Mr. Edward J. Ellis, deputy town clerk.

MONMOUTH.—May 27th.—For the supply of stone, and hauling, for the county council.—Mr. W. Tanner, county surveyor, Newport, Mon.

WOODFORD.—May 27th.—For asphalt macadam construction.—Mr. William Farrington, surveyor.

WANDSWORTH.—May 27th.—For the execution of wood paving and other works, for the borough council. —Mr. P. Dodd, borough engineer.

LEWISHAM.—May 28th.—For laying wood paving, for the borough council.—Borough Surveyor.

FRIERN BARNET.—May 29th.—For the supply of hoggin, gravel, Leicester granite, and cartage, for the urban district council.—Mr. E. J. Reynolds, engineer and surveyor.

BRIGHTON.—May 30th.—For the supply of 500 cub. yds. of hand-picked land flints, for the corporation.—Mr. Hugh Talbot, town clerk.

BURNLEY.—June 2nd.—For work of road reconstruction, for the rural district council.—Mr. H. Pritchard, engineer.

LEWES.—June 20th.—For scarifying and steam rolling, for the corporation.—Mr. Montague S. Blaker, town clerk.

Sanitary.

KIRKCALDY.—May 16th.—For works of sewerage, for the corporation.—Burgh Surveyor.

LYMINGTON.—May 17th.—For the construction of main intercepting sewers, manholes, storm overflows, screen chamber, and alterations and additions to the existing low-level pumping station, for the corporation.—Mr. J. Davis Rawlins, town clerk.

LYMINGTON.—May 17th.—For repairing and cleansing the sewer outfall, for the corporation.—Mr. J. Davis Rawlins, town clerk.

DONCASTER.—May 17th.—For scavenging privies and ashpits, for the rural district council.—Mr. G. W. Cowley, sanitary inspector, 7 St. George-gate, Doncaster.

PADDINGTON.—May 17th.—For the execution of general sewer work, for the borough council.—Town Clerk.

LYTHAM.—May 19th.—For the construction of a 30-in. concrete and cast-iron main sewers and storage culvert, for the urban district council.—Mr. A. J. Price, engineer and surveyor.

BOSTON.—May 19th.—For the roding and cotting of drains, for the Black Sluice Commissioners.—Mr. F. Sanderson-Robins, 6 Bridge-street, Boston.

BINGLEY.—May 19th.—For alterations and additions to sewage disposal works, for the urban district council.—Mr. H. Bottomley, engineer and surveyor.

KEIGHLEY.—May 19th.—For laying pot pipe drain, for the rural district council.—Mr. T. Burton, surveyor and sanitary inspector.

MAIDENHEAD.—May 19th.—For the construction of a public convenience, for the corporation.—Mr. P. Johns, borough surveyor.

ABERGAVENNY.—May 19th.—For the erection of a public convenience, for the corporation.—Mr. W. H. Hopwood, town clerk.

WARE.—May 19th.—For sewer extension, for the rural district council.—The Surveyor.

BRADFORD.—May 20th.—For emptying ashpits and cesspools, for the Cleansing Committee.—Superintendent Call, Hammerton-street depot.

BRIGHTON.—May 20th.—For the supply of glazed drain pipes, for the corporation.—Borough Surveyor.

ST. HELENS.—May 21st.—For the construction of a sewer, for the corporation.—Mr. A. W. Bradley, borough engineer.

SPILSBY.—May 21st.—For the construction of sewers and manholes, for the rural district council.—Mr. G. B. Walker, clerk.

BRIERLEY HILL.—May 21st.—For cleansing ashpits and privies, for the urban district council.—Mr. J. Yorke, sanitary inspector, Town Hall.

HETTON-LE-HOLE.—May 21st.—For work of scavenging, for the urban district council.—Mr. J. Harding, sanitary inspector.

HARPENDEN.—May 23rd.—For the provision and erection of sewage pumping machinery, for the urban district council.—Mr. Chas. S. Tuckey, clerk.

UXBRIDGE.—May 23rd.—For the construction of a stoneware sewer, for the rural district council.—Mr. J. W. Harrison, engineer and surveyor.

BOOTLE.—May 23rd.—For relaying a drain, for the rural district council.—Mr. W. Britton-Jones, sanitary surveyor, Millom.

FINCHLEY.—May 26th.—For the construction of 456 yds. of 15-in. and 9-in. surface-water sewer, part under highways and part under open land, for the urban district council.—Mr. E. H. Lister; clerk.

WHITSTABLE.—May 27th.—For the construction of a brick and concrete tank sewer, concrete tube sewers, stoneware pipe sewers, cast-iron rising main, cast-iron outfall sewer, manholes, pumping station, tanks, cottage, and percolating filters, for the urban district council.—Messrs. Strachan & Weekes, civil engineers, 9 Victoria-street, Westminster.

WOKINGHAM.—May 28th.—For the construction of stoneware sewers, manholes and ejector chamber, and supply of cast-iron pipes, for the corporation.—Mr. C. W. Marks, borough engineer and surveyor.

YEOVIL.—May 29th.—For the construction of sewerage and sewage disposal works, consisting of about 4,000 yds. of 9 in. and 6 in. sewers, with manholes, ventilators, septic tanks, trickling filters, and appurtenances, for the rural district council.—Mr. J. E. Rodber, clerk.

SHORT HEATH.—May 30th.—For the construction of sewage disposal works, for the urban council.—Mr. Litchfield Meek, clerk, 33 Market-place, Willenhall.

OAKENGATES.—May 31st.—For sewerage and sewage disposal works extension, for the urban district council.—Messrs. Berrington, Son & Watney, Prudential Chambers, Lichfield-street, Wolverhampton.

Stores.

WALSALL.—May 19th.—For the supply of stores for the gas department.—Mr. H. Lee, town clerk.

BRADFORD.—May 20th.—For the supply of iron castings, bolts, nuts, street-sweeping machine brushes, brooms and shovels, for the corporation.—Superintendent Call, Hammerton-street depot.

CLECKHEATON.—May 24th.—For the supply of granite, dross, lime, cement, stoneware pipes, kerbs, setts, tar, pitch, and oil, for the urban district council. —Mr. John H. Linfield, clerk.

GREENOCK.—May 26th.—For the supply of coal, cement, lime, fireclay pipes, pavement, whinstone setts, road metal, pitch and oil, and cartage, for the corporation.—Master of Works.

Miscellaneous.

TORONTO.—May 28th.—For the removal of 35,000,000 cub. yds. of material by hydraulic dredging, for the Toronto Harbour Commissioners.—Mr. E. L. Cousins, chief engineer.

MADRAS.—July 2nd.—For the supply of one first-class lathe, and two first-class lathes, for the corporation.—Mr. James R. Coats, engineer.

TENDERS FOR MUNICIPAL WORKS OR SUPPLIES.

The Editor invites the co-operation of SURVEYOR *readers with a view to making the information given under this head as complete and accurate as possible.*

* Accepted. † Recommended for acceptance.

ALDERSHOT.—Accepted for the supply of materials, for the urban district council:—

Granite Kerbing.—United Stone Firms, Limited, Dartmoor, 12 by 4, flat, 1s. 5d.; edge, 1s. 4d.; 10 by 4, flat, 1s. 3d; edge, 1s. 3d.

Blue Pennant Channelling.—United Stone Firms, Limited, 12 by 3, 8d.; 12 by 6, 1s. 4½d.; 6 by 12, 1s. 1½d.; 12 by 4, 1s. 1½d.; 4 by 12, 10½d.; 12 by 5, 1s. 3d.; 5 by 12, 1s. 1d. Tytherington Stone Company, 12 by 3, 8d.; 12 by 6, 1s. 0½d.; 12 by 4, 9d.; 12 by 5, 10½d.

Granite.—Johnson Brothers, 2-in. slag, 10s. 3d.; 2-in. basalt, 12s. 10d.

Carting Gravel.—Lamport & Son.

Footway Tar-paving.—Read & Son, 1½, 16s. 5d.; ⅜, 17s. 5d.; grit, 8s. 8d.

Tar-macadam.—Tarmac, Limited, 2¼, 17s.; 1½, 17s.

Bituminous Asphaltic Binder.—Premier Bitumen Company, 6d. per gallon; Canadian Rubber Company, 9½d. per gallon.

BARNSTAPLE.—For the execution of drainage work, for the corporation.—Mr. E. V. Saunders, borough surveyor:—

W. Slee & Son, Bear-street, Barnstaple	£13
J. W. Barwick, Vicarage-street, Barnstaple	12
W. Gammon & Sons, Vicarage-lawn, Barnstaple	10

BILLERICAY.—For the construction of a timber bridge, for the rural district council.—Mr. R. J. W. Layland, surveyor:—

A. T. Catley, Lloyd-square, W.C.	£91
Fordham & Gibbons, Laindon	85
Harris Brothers, Billericay	85
May & Butcher, Maldon	67
W. Lingwood, Romford	65
W. Boardman & Son Ingrave*	65

CHELMSFORD.—For the erection of a wooden pavilion, for the corporation.—Mr. P. T. Harrison, borough engineer:—

F. J. French, Chelmsford	£53
Catherwood Brothers, Hornchurch, Romford	49

CHISWICK.—For making up Horticultural-place, for the urban district council.—Mr. E. Willis, engineer:—

G. Wimpey & Co., Hammersmith	£150
F. G. Brummell, Willesden	146

Engineer's estimate, £138.

EASTLEIGH AND BISHOPSTOKE.—For laying storm-water sewers, for the urban district council.—Mr. W. Wallace Gandy, surveyor:—

HIGH-STREET SEWER.

Saunders & Co., Bournemouth	£1,901
F. Osman & Co., Southampton	1,429
G. Porter, London	1,399
Wort & Way, Salisbury	1,372
J. Douglas, Southampton	1,239
Grounds & Newton, Bournemouth	1,210

SPRING-LANE SEWER.

Wort & Way, Salisbury	£258
Saunders & Co., Bournemouth	240
G. Porter, London	237
F. Osman & Co., Southampton	236
Grounds & Newton, Bournemouth	192
J. Douglas, Southampton	183

FAVERSHAM.—The following tenders have been accepted by the corporation:—

Cement.—Associated Portland Cement Manufacturers, 35s. per ton.
Crushed Shell.—J. Horsfood & Co., 7s. 9d. per cubic yard.
Team Labour.—C. F. Knowler, 8¾d. per hour for man, horse, and van; 7¾d. for horse and man; 6d. for horse only.

GRIMSBY.—For the construction of culverts in Clee district, for the corporation.—Mr. H. Gilbert Whyatt, borough engineer:—

	Brick-work.	Reinforced concrete.	Concrete tubes.
J. J. Shardlow, Leeds	£7,240	£6,300	£10,100
Ward & Tetly, Bradford	6,828	—	8,085
Parker & Sharp, York	6,457	4,716	7,720
C. Greenwood, Hull	5,970	—	—
Wellerman Brothers, Sheffield	5,832	—	—
Quibell, Son & Greenwood, Hull	5,700	5,900	—
Wilkinson & Houghton, Cleethorpes	5,663	5,138	—
British Improved Construction Company, London	—	—	7,848
Yorkshire Hennebique Company, Leeds	—	8,670	—
P. T. Kettlewell, Hull	—	5,180	—
H. Langton & Son, Hull	—	4,760	—

HACKNEY.—For a heating installation at Oldfield-road school, for the London County Council:—

T. S. Knight & Sons, Great Portland-street	£1,369
G. & E. Bradley, Lever-street	1,259
Palowkar & Sons, Queen-street	1,248
W. G. Cannon & Sons, Limited, Southwark	1,207
J. & F. May, Lincoln's Inn-fields	1,177
Cannon & Hefford, Peckham	1,166
Tilley Brothers, Kingsland-road	976

Architect's estimate, £1,010.

HACKNEY.—For the enlargement of Sigdon-road school, for the London County Council:—

Todd & Newman, Hackney	£10,083
W. Shurmur & Sons, Limited, Upper Clapton	9,954
Rowley Brothers, Wood Green	9,812
W. Johnson & Co., Limited, Wandsworth-common	9,600
G. Godson & Sons, Kilburn-lane	9,442
Ashby & Horner, Aldgate	9,400
J. Chessum & Sons, South-place	9,217
J. & C. Bowyer, Limited, Upper Norwood †	9,197
R. A. Lowe & Co., Chislehurst (tender withdrawn)	8,850

Architect's estimate, £9,240.

MARCH.—For the supply of broken granite and gravel, for the urban district council:—

Bardon Hill Granite (H. Bond, March), 400 tons at 11s. 11d.
Groby Granite Company, Groby, near Leicester, 200 tons at 11s.
Jees Hartshill Granite Company, Hartshill, near Atherstone, 300 tons at 10s. 7d.
Mountsorrel Granite Company (Lavender & Bateman, Sutton Bridge), 200 tons at 10s. 11d.
Penlee Stone (Lavender & Bateman, Sutton Bridge), 300 tons at 13s. 10d.
Budle Crag (Sommerfeld & Thomas, King's Lynn), 300 tons at 13s.
Cliff Hill (J. Collett, Wisbech), 300 tons at 13s.
Wymondham Gravel (C. Ayton, Wymondham), 300 tons at 6s. 8d.
Mildenhall Gravel (W. Godfrey, Mildenhall).

SELBY.—For building forty-two cottages in Powell-street, Flaxley-road, Selby, for the urban district council:—

Thompson & Sons, Leeds	£7,634
Lough & Co., York	7,156
C. Brown & Co., West Hartlepool	6,953
T. Foster & Son, Selby	6,902
T. Reed, Selby	6,840
J. H. Carr & Son, Selby	6,594
Lister, Brook & Co., Brighouse	6,470
C. Brooks, Filey	6,250

SELBY.—For making road and sewer, Powell-street, Selby, for the urban district council:—

W. Keighley, Leeds	£747
Edwards & Co., Doncaster	700
Thompson & Sons, Leeds	636
— Martin, York	550
Lister, Brook & Co., Brighouse	541
T. Farley, Lye, Stourbridge	516
J. Puller, Northwich	510
J. H. Carr & Son, Selby	478
W. R. Pickthall, Leeds	466
C. Brooks, Filey	449

MEETINGS.

Secretaries and others will oblige by sending early notice of dates of forthcoming meetings.

MAY.

19.—Institute of Sanitary Engineers: Dr. H. R. Kenwood on "Micro-Organisms and Public Health." 8 p.m.
19.—Royal Institute of British Architects: Special General Meeting. 8 p.m.
20.—Royal Sanitary Institute: Mr. E. B. Barnard, chairman, Metropolitan Water Board, on "London's Water Supply." 90 Buckingham Palace-road, S.W. 7.30 p.m.
21.—Royal Sanitary Institute: Visit to King George Reservoir, Chingford.
21-24.—Institution of Electrical Engineers: Meeting in Paris.
23-24.—Surveyors' Institution: Meeting at Oxford.
24.—Association of Managers of Sewage Disposal Works: Meeting at Kettering.
24.—Junior Institution of Engineers: Visit to King George Reservoir, Chingford. 3 p.m.
26.—Royal Institute of British Architects: Mr. Thomas Hastings, New York, on "Modern Architecture." 8 p.m.
30-31.—Royal Sanitary Institute: Sessional Meeting at Chester. Discussion on "Modern Methods for the Purification and Softening of Water Supplies." Visit to Waterworks.
31.—Institution of Municipal Engineers: Dr. Grossmann, M.A., F.I.C., on "The Sewage Sludge Problem and its Solution." Salford Town Hall. 1.30 p.m.

JUNE.

4.—Royal Institute of British Architects: Annual Dinner, Whitehall Rooms
5-7.—Institution of Water Engineers: Summer General Meeting at Wakefield.
6-7.—Institution of Municipal and County Engineers: Meeting at Dundee.
14.—Institution of Municipal and County Engineers: Meeting at Rochdale.
23-28.—International Road Congress in London.
28.—Institution of Municipal and County Engineers: Meeting at Leek.

TENDERS WANTED.

Official and similar advertisements received up to 4.30 p.m. on Thursdays will be inserted in the following day's issue, *but those responsible for their despatch are recommended to arrange that they shall reach* THE SURVEYOR *office by noon on* **Wednesdays** *to ensure their inclusion in the weekly list of summaries. Such advertisements may, in cases of emergency only, be telephoned (No. 1359 Holborn), subject to later confirmation by letter.*

TOTTENHAM URBAN DISTRICT COUNCIL.

TO CONTRACTORS.

The Council invite Tenders for making up—

Hale-road,
Seymour-avenue (2nd section),
Rusper-road (1st section).

The Plans can be seen, and Forms of Tender and other particulars can be obtained, on application to Mr. W. H. Prescott, M.INST.C.E., Town Hall, Tottenham.

The sum of Half-a-Guinea for each Road will be charged for the Quantities, which will be returned on receipt of a *bonâ-fide* Tender accompanied by the Conditions, Specification and Quantities, otherwise the deposit will be forfeited.

Persons tendering will be required to deposit with the Treasurer, when handing in their Tenders, in a Bank of England Note, or cash, the sum of £5 for each Road, which will be forfeited by the person whose Tender is accepted if the Contract be not executed within seven days from the date he is informed it is ready for signature, otherwise it will be repaid. This deposit will be repaid, and the Bills of Quantities returned to the parties tendering who are unsuccessful.

The Contractor will be required to pay all workmen on the Council's work the recognised Trade Union rate of wages. A Schedule of such wages will be inserted in the Contract, and a copy of the Schedule must be exhibited on the Pay Office at the Works.

Sealed Tenders, on the form supplied, endorsed "Tender for Making up Hale-road, Seymour-avenue (2nd section), Rusper-road (1st section)," to be delivered to me by Twelve o'clock noon on Tuesday, 27th May, 1913.

No other form of Tender will be received.

Security will be required for the due performance of the Contract.

The Council will not be bound to accept the lowest or any Tender, and reserve the right to accept a part only of any Tender received.

(By order)
E. CROWNE,
Clerk of the Council.

Tottenham.
May 10, 1913. (450)

(Continued on p. xx.)

The Surveyor

And Municipal and County Engineer.

Vol. XLIII. MAY 23, 1913. No. 1,114.

Minutes of Proceedings.

Oil-Mixed Concrete.

In our issue of March 21st (page 507) we published a letter in which Mr. Logan Waller Page, Director of the United States Office of Public Roads, courteously drew our attention to our comments on a paper read before the Concrete Institute by Mr. W. L. Gadd; the main point of Mr. Page's letter being that Mr. Gadd's experiments relating to the effect of oils on concrete seemed to have given results which are at variance with the series of tests carried out by Mr. Page himself. It is important to remark that we did not, as a passage in Mr. Page's letter would seem to imply, endorse the statement that "oil-mixed concrete is not rendered more waterproof." What we said was (January 3rd, page 3): "The conclusions that Mr. Gadd drew from the theoretical and experimental data before him were . . . . and that oil-mixed concrete is not rendered more waterproof." Now, the heading of the "minute" in which the passage occurs is "The Action of Acids on Concrete," and in it references will be found to mineral acids and fatty acids, the underlying idea being that the attack which an oil, grease, or fat makes upon concrete is in virtue of an acid action upon the relatively alkaline materials of the concrete. If, therefore, the oil in question has no acid reaction, this effect will not take place, or if its acidity is small, and is neutralised in the early stages of the setting of the mortar, the weakening effect will be correspondingly small. It is very important, then, that those who are interested in this subject should realise that the oil used by Mr. Page in his experiments and service tests was a residual petroleum, the specification of which is given, practically *verbatim*, on page 640 of our issue of November 8, 1912. Mr. Page's experience of mineral oils, particularly the asphaltic residual oils, is that they have no more weakening effect on concrete than any of the materials used in waterproofing.

We made, in our issue of January 3rd, a very clear distinction between the effects, as definitely ascertained, of "the whole series of higher fatty acids" on the one hand, and mineral oils on the other hand, and we said: "As regards the mineral acids, the most usual case in which these are brought into contact with concrete is through the atmosphere of towns in which sulphurous acids become oxidised to form sulphuric acid, which acts on the buildings." It may here be pointed out that, as has been noted in our own pages, certain American investigators have concluded that the "free carbon" of some bituminous materials may consist in part of sulphur compounds, but in small proportion (see our issue of September 15, 1911, page 334). Mr. Prévost Hubbard and Mr. C. S. Reeves found 0·50 to 1·78 per cent of sulphur in the residue classed as "free carbon," derived from refined coal tar; and if the higher of these figures be taken for the sake of argument it is clear that the percentage of sulphur in Mr. Page's residual oil would be very small indeed. Probably a test which would satisfy chemists and engineers alike could be devised to show what is the total possible acid reaction of a given oil in contact with substances such as those included in the mass of a Portland cement mortar. Our abstract of the paper referred to is considerably shorter than the paper itself, but the amount of space which we devoted to this apparently small point will show that we did not fail to appreciate its significance. In the present connection, however, it is a minor point, since the whole effect of such sulphur compounds in disturbing the settling of Portland cement mortar must be very small, if indeed it be appreciable.

In our footnote to Mr. Page's letter (March 21st) we expressed regret that our remarks relating to American opinion had been somewhat cursory. We did not, in fact, do justice either to Mr. Page or to ourselves, for we omitted to point out that we had given the main points of Mr. Page's report (bulletin No. 46, U.S.A. Office of Public Roads) in our issue of November 8th, or that our own comments on this report included the statement: "The experiments seem to have been very successful, and fully to have established the particular oil used as a material which may be employed in order to make concrete waterproof" (page 630). The "minute" in which this sentence occurs is one in which, after separately treating of "Concrete and Moisture," we dealt with this subject of "Waterproof Concrete," and it seems reasonable to point out that there is a distinction to be drawn between the setting forth of accepted facts and our own opinions, and, on the other hand, an attempt to give an impression of the views put forward by an individual experimenter. Taking the expression "oil or fat" as referring principally to fats and to oils of a nature in many respects similar, we trust that Mr. Gadd did "dispose very effectively" of proposals to use such materials for waterproofing concrete; but we should, of course, have pointed out that Mr. Page's tests did not fall into this category. Our own view is that, although there may be cases

in which it is advantageous to make concrete waterproof by mixing with it a proportion of a *suitable* oil, the number of such cases is likely to be somewhat small in practice for two reasons. First, the competition of other methods such as special proportioning and special ways of making the concrete; and secondly, as suggested in our "minute" of November 8th, the consideration that the proportion of oil, say 5 to 10 per cent, is sufficiently high to point to the possibility of competition being brought in in another way—namely, the application of the bituminous material in the form of a sheet or layer. Ten per cent of the thickness of a 5-in. wall is ½ in., and it is easy to calculate whether the equivalent thickness of a material of the same cost would be sufficient for the purpose.

In another part of this issue we give in full the appendix to Mr. Page's report, embodying the main results of his tests and his "summary of conclusions."

* * *

Tall Chimney Construction.

Some very cogent criticisms of the regulations which at present govern the construction of tall chimney shafts were made by Mr. Harold Cane at the last meeting of the Concrete Institute, in the course of a very able and interesting paper on "The Stability of Brick Chimneys." It appears that except in the Metropolis there is no statutory enactment which definitely lays down any rules of construction; but, in the vast majority of cases, those towns in which by-laws have been made have not taken advantage of their freedom, but have adopted provisions modelled on sec. 65 of the London Building Act, 1894, which were demonstrated by Mr. Cane to be quite illogical and inadequate to secure stability or economy. In many industrial towns no regulations in regard to this matter are in force at all, each individual case being judged on its merits. It is interesting to observe that prior to the passing of the Act of 1894 this was the case in London, tall chimney construction being within the purview of sec. 56 of the Metropolitan Building Act, 1855, which provided for the sanction of the Metropolitan Board of Works being obtained to all buildings to which the general rules of the Act were inapplicable. The attempt which was made in 1894 by the Legislature to stereotype rules for the construction of chimney shafts by proportioning the thickness of the walls and the diameter of the base to the total height has not resulted in economical or sound construction, and may therefore be said to have failed in its object.

Mr. Cane's investigations show that a chimney 100 ft. in height, and constructed according to the regulations laid down in the Act, would only safely withstand a wind pressure of 23 lb. per square foot — which of course is frequently exceeded in practice. The stability of the regulation shaft increases with the height, until at 200 ft. the safe wind pressure rises to 42 lb. per square foot. At this height, however, Mr. Cane shows that it is possible to design a shaft having a stability practically 20 per cent greater than that of the regulation chimney, and having at the same time a weight 20 per cent less. An economical distribution of the material therefore enables greatly increased stability to be obtained by the use of considerably less material than is permitted by the regulations. We entirely concur in Mr. Cane's conclusion that an amendment of sec. 65 is desirable, and that new regulations should not specify minimum diameters, batter, or thicknesses of walls, but that design should be based upon the capability of withstanding a specified wind pressure without producing tension in any bed joint, and upon a specified maximum intensity of compressive stress. It should be observed that by the terms of sec. 65 the London County Council are empowered to permit the erection of chimney shafts which do not accord with the regulations, so that they *may* sanction steel or reinforced concrete shafts, although they are not bound to do so. Mr. Cane's paper, some extracts from which will be found in another column, also dealt with the methods of determining the moment of stability of brick chimney shafts, and with the question of wind pressure, and contained some interesting examples of existing chimneys.

* * *

The Last Step in a Big Improvement.

An important item in a recent report of the Improvements Committee of the London County Council deals with the last step in the great Holborn-to-Strand improvement. Persons who can bring their minds back to the time when the London County Council Improvements Bill, 1899, was before Parliament will remember the controversy which then arose on the question of "betterment." Finally, the promoters of the Bill were successful in defeating the opposition, and the Bill as passed gave the County Council power to schedule the property in the neighbourhood of the new street from Holborn to the Strand, and, on the completion of the street works, to levy an improvement charge of 3 per cent on one half the enhanced value of such property. The time has now arrived when this charge may be levied, and it is of interest to see to what extent the burden of the cost of the improvement is likely to be lightened by this charge on neighbouring property which has appreciated in value. The figures given in the Improvements Committee's report show that the estimated total of this annual improvement charge is somewhere about £1,500. If this is capitalised at the fairly high figure of thirty years' purchase, it will be seen to amount to £45,000. When this is compared with the sum of five millions odd, which is generally quoted as representing the cost of the improvement, it will be seen that it is a mere bucketful out of the small ocean of expenditure.

Now that so much is being proposed in the way of street improvements, these figures make interesting reading, particularly for municipal engineers who have to prepare estimated profit and loss accounts on proposed new schemes. It is often alleged by ardent advocates of an improvement that the scheme will be bound to pay for itself in the long run, if only a sufficient amount of property is acquired by the local authority. We fear that these optimistic views are rarely justified in the result, and a local authority, by purchasing on too wide a scale, may sometimes run the risk of incurring a big loss. The County Council, by obtaining the right to charge a rate on the enhanced value, of course incurred no risk, but if it had decided to purchase the neighbouring property, instead of merely scheduling it, in all probability, from the figures which are now before us, it would have shown a balance on the wrong side in regard to this expenditure. No business firm expects to get a valuable improvement in its administrative system without incurring an expenditure in reasonable proportion to the benefit obtained, and, in the same way, the authorities of a town cannot justly hope to obtain big street improvements without cost. Advocates of any such improvements will be well advised to deal with the great advantages which will result from the improvements, rather than to take up a stand on the very shaky platform of "something for nothing" in street improvements.

Ireland and the Road Congress.

Apropos of the forthcoming International Road Congress, we note that the *Freeman's Journal* sets up a strong plea for the adequate representation of Ireland at that gathering. An occasion which attracts the representatives of thirty-six countries must, the Dublin journal thinks, have an exceptional interest for Ireland, and it adds with cogency that there is much to be learned not merely in regard to the latest methods of road construction, but also administration. The practical suggestion is made that as a preliminary to the congress a meeting of all interested in the roads question should be held in Dublin, with a view, we presume, to obtaining something like unanimity as to the line to be adopted for the furtherance of road improvement in Ireland. Even if this point be not gained in the full sense, such a conference would undoubtedly concentrate attention upon the subject, and afford a much-desired opportunity for the interchange of views among those entitled to speak both for the public authorities of Ireland concerned with road administration, and the officials who are professionally joined with them in road construction and maintenance. The *Freeman's Journal* expresses the view that the grants at the disposal of the Road Board have created a situation which calls for special consideration. Roughly, it appears, only one-third of the sum available for road improvement in Ireland has been utilised. There is need for the money, the roads in several counties being "deplorably bad." "Why," the question is asked, "should not full advantage be taken of the resources of the Road Board?" Then, again, the suggestion has been made by Mr. P. C. Cowan, chief engineering inspector of the Local Government Board, and others, that the control of the main roads in Ireland should be entrusted directly to the county councils, as in England and Wales. These and cognate topics might be usefully discussed at the proposed conference, and the ground thus cleared, as far as may be possible, for the presentation of the case for Irish road administration at the International Congress in terms which will be alike unambiguous and authoritative.

* * *

Another Standard Specification.

The sixty-first report of the Engineering Standards Committee, which has just been issued, consists of a standard specification for copper tubes and their screw threads. The tubes dealt with are those which are used primarily for domestic and similar work, and are intended for hot and cold water and low-pressure steam. As regards the tubes themselves, the specification provides for a chemical analysis and certain mechanical tests. Thus, they must be capable of being drifted without crack or flaw until the diameter of the drifted end measures 25 per cent more than the original diameter; and they must also be capable of being flattened and doubled over through an angle of 180 deg., either cold or at a red heat. The outside diameters of the tubes are specified in tables, but certain "tolerances"—*i.e.*, differences in the dimensions prescribed in order to tolerate unavoidable imperfections of workmanship—are allowed. With regard to the screw threads, the specification stipulates that the Whitworth form of thread shall be employed on all pipe ends and in all connections, and that the screws shall be conical, being coned $\frac{1}{16}$ in. measured on the diameter per 1 in. of length.

The specification is of the same degree of excellence, and will prove as useful as any of its predecessors, and it is a melancholy fact that Mr. Henry Lea, the late chairman, did not live to see the conclusion of the sub-committee's labours. It should be recorded also that in drawing up their recommendations the sub-committee availed themselves of the information previously obtained by the Joint Committee on Screwed Copper-Pipe Standards, appointed by the Institution of Heating and Ventilating Engineers and the National Association of Master Heating and Domestic Engineers.

* * *

Damage by Floods.

The extraordinary floods which devasted Norfolk in August last year have had several sequels in the Courts, not the least interesting of these being the case of *Walker and Walker* v. *The Canal Company* (North Walsham and Dilham), heard on Monday last in the Norwich County Court. It appears that one of the plaintiffs owned, and the other occupied as a dairy farm, a number of meadows adjoining the North Walsham and Dilham Canal. During the floods a portion of the bank of the canal gave way, in consequence of which a considerable quantity of material was scoured over the meadows in question. Moreover, a fortnight after the flood, the defendants made a deep artificial cutting in the canal bank, and thereby passed accumulated water from their canal to a spot where it overflowed upon the plaintiffs' meadow. The learned judge gave judgment for the plaintiffs in respect of both of these heads of damage, in spite of the defendants' contention in regard to the giving way of the bank that this was an "Act of God." He pointed out that the canal had been constructed in pursuance of a special Act of Parliament, which amounted to a statutory bargain or contract between the canal company and the riparian proprietors, which contained no exception as to damage caused by "Act of God," and that therefore the contention of the defendants must fail. The case is of interest as illustrating the principle that certain provisions of special Acts of Parliament have often the force of contracts upon which the promoters will be held liable to parties in whose interest they have been inserted in the Act, in case of breach.

* * *

Steel Section Manufacture.

The students of the Institution of Civil Engineers have been privileged recently to hear some lectures delivered by Mr. A. T. Walmisley, M.INST.C.E., on "The Production of Steel Sections and their Application," in the course of which there occurred some observations regarding the introduction of metal into concrete, and the employment of the reinforced concrete specialist. Mr. Walmisley expressed disapproval of the policy often adopted of employing reinforced concrete purely for economical reasons, and selecting the cheapest from competitive types submitted by tender, each firm offering to accept complete responsibility for the construction. He pointed out that reinforced concrete requires expert supervision during its formation, and that in any given case the strength and enduring qualities must depend upon good workmanship. Dealing with the use of steel in structural work, Mr. Walmisley enlarged upon the advantages of that material on account of its strength, ductility and comparative cheapness of production, although there are still special kinds of work for which wrought-iron is preferred — for example, pipes, tubes, chains, and the frames of railway wagons. In comparing the two materials, however, it must generally be remembered that while wrought iron has been puddled and is fibrous, steel has been made from a cast ingot, homogeneous in character and subsequently rolled down by machinery to a final section usually more uniform in quality than wrought iron.

Superelevation at Bends on Roads.

THE LIMITS OF ITS SAFE AND USEFUL EMPLOYMENT.

By REGINALD RYVES, M.CONS.E., ASSOC.M.INST.C.E.

When a vehicle runs round a curve the centrifugal force developed tends to pull it outwards. This force acts through the centre of gravity of the vehicle, and it is resisted by the wheels at the surface of the road. If it be resisted sufficiently the centrifugal force produces a toppling moment, the amount of which depends on three factors: (1) the radius of the curve, (2) the speed of the vehicle, and (3) the height of the centre of gravity. The force itself depends on the radius and the speed—that is, the force per unit mass depends on these factors—and the moment is this force multiplied by its arm, namely, the height of the centre of gravity. The higher the centre of gravity the greater is the toppling moment. The resistance of the friction of road wheels on a road crust is sometimes sufficient to cause a vehicle to topple over, and such accidents occur now and then. On railways this has probably never occurred in the case of a regular train, as the speed would have to be very great indeed for such a thing to happen even on the sharpest of ordinary railway curves. Instead of there being any danger in a fairly high centre of gravity it has been found, on the contrary, that high wheels and a high centre of gravity tend to reduce the liability of the train to leave the rails at a curve; at any rate, this applies to the locomotive. This is partly because, the moment being larger, and having to be balanced by an equal moment, the actual force with which the rail presses upwards against the outer wheel is greater and the rail holds the wheel better.

A similar effect may take place on a road. This may be due to either or both of two causes. First, the load on the inner wheel being reduced to an amount which will not prevent sideslip, the whole resistance to sideslip is asked of the outer wheel. When once we have got to this point the greater the load upon the outer wheel the greater will be the frictional resistance, which is the product of the load and the coefficient of friction. Secondly, the greater the load upon the outer wheel the deeper will be the elastic or plastic (or partly both) indentation which it makes in the crust, and the less will be the tendency for the wheel to slip out of its temporary groove. Therefore, up to a point well short of the production of a moment sufficient to produce actual over-turning, a high centre of gravity is usually a decided advantage on curves, unless the vehicle be so sprung that the amount of sway is actually inconvenient or likely, if aided by slight inequalities in the road, to lead up to accumulative swaying sufficient to produce toppling over. Pine trees, well rooted, are seldom if ever broken off by the strongest of the single gusts of a gale, but their trunks may be snapped off near the root as the result of a series of gusts which come at intervals suiting the natural sway of the tree.

Now, ideal superelevation is that tilting of the road which introduces the exact amount of force needed to balance the centrifugal force. This depends on the speed and the radius of the curve, and with these given can be measured in terms of the mass of the vehicle, which is a constant and does not affect the equations, since it appears on both sides. The superelevation which is right for a heavy vehicle is therefore right for a light vehicle travelling round the same curve at the same speed, and will, for both vehicles, destroy any tendency to sideslip, as regards which the vehicles will be effectively in the same position as though they were on a straight, flat road. Next, as regards the moments, we have a toppling moment depending upon the height of the centre of gravity. The moment which balances this is the product of an upward force and its arm, the force being exerted at the tread of the outer wheels and the arm being the wheel gauge. The greater the wheel gauge, therefore, the greater is this arm, and the less accordingly is the force. Strictly, there are two couples, but for calculation we may take one force and the whole arm in each case. It does not follow that the wider wheel gauge is necessarily the better in this respect, since the same reasoning which pointed to the advantage of a reasonably high centre of gravity may be applied in this case. The wider the wheel gauge the less will be the actual amount of the force with which the outer wheel presses on the road. Correct superelevation eliminates toppling moment. There are other considerations connected with this part of the subject which seem to be wholly ignored by the designers of motor vehicles. These considerations profoundly affect the behaviour of vehicles in service, but cannot be entered into here.

THE OBJECTS OF SUPERELEVATION.

Before we consider the application, or the impossibility of application, of the principle of superelevation to bends on roads, we must realise that superelevation may be given to a curve for either of two objects. First, we may give such a superelevation as will counteract the centrifugal force of a vehicle running at the highest speed which can possibly be attained on the curve. In this case the possibility of slow vehicles slipping inwards towards the centre of radius of the curve is either unimportant or is accepted as the lesser evil. The interference with the conditions governing the amounts of clearance required on a normal road may, however, be a serious matter on some highways. Short of giving the actual

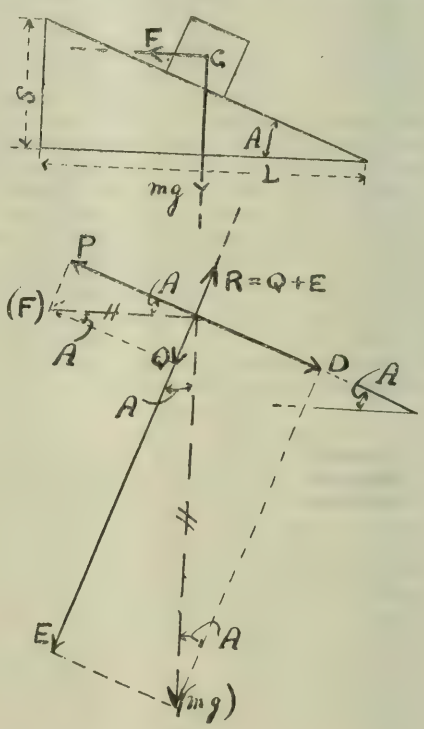


Fig. 1.

maximum superelevation, we may make this such as will leave only an unimportant margin of unbalanced centrifugal force and unbalanced toppling moment, and this margin of danger may be a matter of the improbability of an accident occurring at the highest speeds, or the improbability of any vehicle actually exceeding the lower speed. Secondly, superelevation sufficient to balance forces in the case of the swiftest vehicle may not be necessary, and the amount of superelevation given may be that required to balance forces at the most usual speed, so as to ensure smooth running at that speed.

SUPERELEVATION AT BENDS ON HIGHWAYS.

Turning now to the application of the principle to highways, it must be most emphatically stated that it is only to a very small extent indeed that such an application can be made, and it must be further noted that any attempt to apply the principle throughout

its theoretical range of application would be highly dangerous, and as regards the higher speeds at sharp bends would be grotesque.

The theoretical superelevation is inversely as the radius of the curve and directly as the square of the velocity. There is, of course, no question of measuring superelevation absolutely in inches in the case of a road, this being done on a railway only because the slope to be given is always reckoned with the gauge of the railway as its denominator. Superelevation is calculated as a slope, and may be expressed by different amounts in inches for different widths in feet. It is found as follows:—

m = mass in pounds (not pounds weight, but pounds weight divided by 32·2);
v = velocity in feet per second;
r = radius in feet.

Then it can be shown that the centrifugal force F is equal to $\frac{mv^2}{r}$. Let S equal the superelevation for a width of roadway equal to L—that is, let $\frac{S}{L}$ or tan A be the measure absolutely, and without regard to any particular width of the superelevation. The force, and call this the parallel pull of the centrifugal force.

P must be equal to D.
Now, D equals $mg \sin A$, and P equals $F \cos A$.
So the condition is:—
$F \cos A = mg \sin A$.
Or, $F = mg \tan A$.

To find A, then, we equate $\tan A$ to $\frac{F}{mg}$.

But $S/L = \tan A$.
Therefore $S = L F/mg$.
Now $F = mv^2/r$.
Therefore S must equal $L \times mv^2 \div mgr = L v^2 \div gr$.

For a bend of 100-ft. radius and a roadway width taken, for convenience of calculation, as 16·1 ft., we get the following superelevations:—

For 7½ miles an hour S = 7½ in.
For 15 miles an hour S = 2·4 ft.
For 20 miles an hour S = 4·3 ft.
For 30 miles an hour S = 9·7 ft.
For 40 miles an hour S = 17·2 ft.
For 60 miles an hour S = 38·7 ft.

It is clear that on a bend of 100 ft. radius the useful

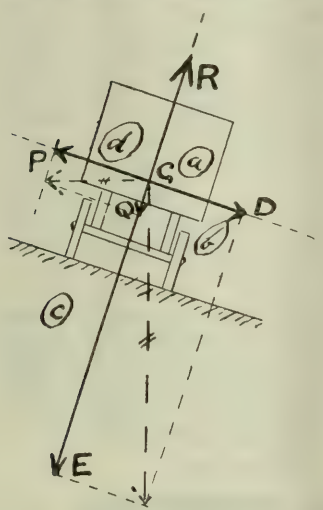
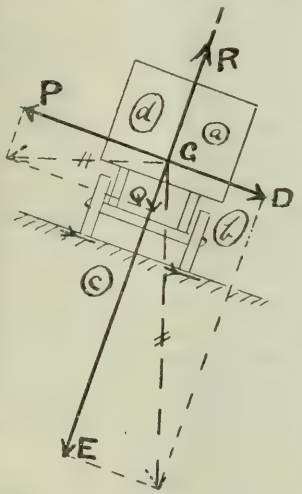
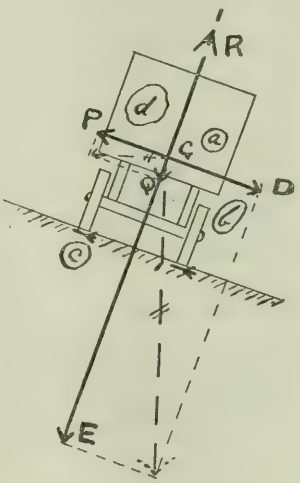


FIG. 2.





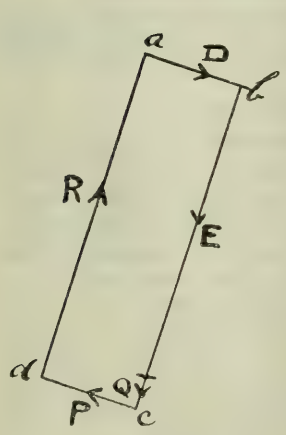


FIG. 3.

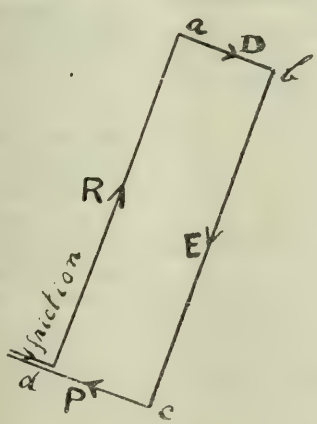


FIG. 4.

weight of the vehicle or other body moving round the curve is resolved in two directions: E normal to the surface of the road and D parallel to it; its amount is mg.

Similarly, the centrifugal force F is resolved into two components, one Q normal to the surface of the road and one P parallel to it.

The condition of equilibrium is that the parallel component of the weight must be equal to the parallel component of the centrifugal force.

Let D be the component of the weight parallel to the road, and call this the inward drag of the weight; and let P be the parallel component of the centrifugal

limit of superelevation is reached when we have provided enough for horse-drawn vehicles travelling at cautious speeds, or cyclists taking bends at speeds much lower than those which, apparently with the sanction of a special providence, they regard as suitable at such places. The same amount of superelevation has some further use as tending to steady vehicles travelling up to about 9 miles an hour, but it is only about a quarter of that needed to balance forces at 15 miles an hour. It is most important that all who are concerned with the alteration of roads with a view to their improvement should grasp the plain fact that the application of the principle of superelevation

to ordinary roads can only be carried a very little way. It is quite clear that the best policy is to allow only such superelevation as is correct up to some low and definitely fixed speed limit. In view of the fact that it is undesirable, for many reasons (especially on account of scour), to give a greater superelevation than about 7 in. on a 16-ft. road, or 14 in. on a 32-ft. road, some such limit should be adopted. It remains to be considered whether we are to make this limit absolute in inches, as well as in inches per unit width, or whether on the other hand we may take into consideration sharper bends than those of 100 ft. radius. There are many such, and it is clear from the above figures that the superelevation would be excessive even for moderate speeds. For a radius of 50 ft. and a speed of 15 miles an hour, a superelevation of nearly 5 ft. would be needed for a 16-ft. roadway, while even for a speed of $7\frac{1}{2}$ miles an hour the superelevation would be over 14 in.

If we adopt a superelevation calculated for some speed between 6 and 8 miles an hour, and for a curve of 100 ft. radius, we may make this the limit, and the true superelevation can be adopted whenever it is less, it being clearly understood that the speed for which the superelevation is calculated will never be greater than some definite limit. Thus, drivers of vehicles approaching a curve will know two things: first, that if the curve is of 100 ft. radius or more, the superelevation will suit a speed of 7 miles an hour, while higher speeds will develop a sliding force and a toppling moment. In the second place, the driver will know that if the curve is less than 100 ft. in radius the superelevation will only be sufficient for some lower speed, the proper reduction of speed being proportionate to the reduction in the radius. The position is really this: drivers will use their judgment precisely as heretofore, but from a different starting point, or, as it may be termed, a different datum line.

No attempt should be made to give different degrees of superelevation for different parts of a cross-section of the road. It would be difficult to maintain the surface of the road in the form determined on, and there would be a tendency for the drivers of vehicles to use the portion having the most suitable superelevation, and to disregard the rule of the road. It should clearly be understood that the tilting of bends of highways cannot be done so as to give even the smallest advantage to the drivers of swift vehicles, beyond the slight convenience which, at much reduced speeds, they will share with others, nor can it be too emphatically pointed out that the amount of tilt for a low speed is only a very small proportion of that which balances forces at a considerably higher speed; and, taking everything into consideration, this amount of superelevation cannot be regarded as of any importance at all at such higher speeds.

Students will find that a ready way of checking calculations for superelevation is provided by the formulæ used by railway engineers, and given in books of reference such as Molesworth and Kempe.

Take for instance the following:—

$$s = \frac{V^2}{r} \times 3{\cdot}77 \text{ for a 4 ft. } 8\tfrac{1}{2} \text{ in. gauge,}$$

V is the speed in miles per hour,
r the radius in feet,
s the superelevation in inches.

Take our example with a speed of 30 miles an hour for a curve of 100 ft. radius, which gave us 9·7 ft., or 116 in., nearly.

The railway formula gives:—

$$s = \frac{(30)^2}{1{\cdot}00} \times 3{\cdot}77 = 33{\cdot}93.$$

This is for a gauge or road width of 4 ft. $8\frac{1}{2}$ in., and the superelevation for a road 16·1 ft. wide will be:—

$$33{\cdot}93 \times \frac{16{\cdot}10}{4{\cdot}71} = 116 \text{ in.}$$

The above study by no means exhausts the subject. There are a number of considerations which must be taken into account in the matter, and most of them point to further restrictions of the limitation already indicated as desirable rather than to any modification of procedure or extension of the principle. One such may be mentioned. If a vehicle laden up to a height of 16 ft. be going round a bend of 100 ft. radius at a very slow speed, such as 2 miles an hour, it will tilt almost in conformity with the tilt of the road, and if it be provided with springs it will tilt a good deal more. If the superelevation of the road be that designed for a speed of 15 miles an hour on a radius of 100 ft., the top of the load will lean over more than 2 ft. relatively to the wheel tracks. Suppose now that this vehicle, bending round to the right and travelling therefore near the outer margin of the bend, meets a vehicle also laden up to a height of 16 ft., but travelling at a speed of 15 miles an hour in the other direction. This vehicle will stand normally to the road, and in order to clear the first vehicle it must be taken 2 ft. or more further to the left than was necessary when earlier in the day it met the same vehicle on a straight level road. If the second vehicle be travelling at 20 miles an hour, the amount of clearance will be further reduced, and generally the consideration that vehicles travelling more slowly than the proper speed suited to the superelevation will lean inwards, while vehicles travelling at speeds higher than the proper speed will lean outwards, shows that after we have eliminated the few cases when speeds are equal, there will be a tendency on half the remaining encounters at curves for the clearance between vehicles to be reduced much or little.

Figs. 2, 3, and 4 show the three cases of equilibrium of a vehicle travelling round a bend. Fig. 2 is the case in which the pull of the centrifugal force parallel to the surface of the road balances the component of the weight parallel to the road. Fig. 3 is the case in which, at a higher speed, the polygon of forces does not close unless we introduce a new force—namely, the resistance of friction to motion up the slope. Fig. 4 is the case in which the speed is lower than in the case of Fig. 2, and the polygon of forces is now completed by a line representing the friction resistance to motion down the slope. In Figs. 3 and 4 the polygons do not quite accurately represent the distribution of the forces, since there is a turning moment, due to the resistance of friction being not in the line passing through the centre of gravity, and this moment is balanced by an equal and opposite moment resulting from a reduction of the load on one wheel, and an increase in the load on the other. In the case of Fig. 3 there is a counterclockwise couple, the two forces being (*a*) the difference between the parallel component of the pull of the centrifugal force and the parallel component of the weight and (*b*) friction at the wheel treads; and a clockwise couple, the forces being (*c*) an increase in the outer wheel load, and (*d*) a decrease in the inner wheel load. In the case of Fig. 4 this is reversed, the difference in wheel loads giving a clockwise couple.

THE LOCAL GOVERNMENT BOARD.

NEW CHIEF ENGINEERING INSPECTOR.

The President of the Local Government Board has appointed Mr. Herbert Henry Law, M.INST.C.E., as chief engineering inspector to the board, in succession to Mr. George Waller Willcocks, C.B., retired.

Gas Hot Water Circulators.—At a recent meeting of Glasgow Corporation it was resolved (the *Glasgow Herald* states) that gas hot water circulators should be let out on the hire purchase system. Having welcomed free cookers and the hire system of gas fires, it is expected that residents will be eager to avail themselves of the further advantage of obtaining hot water without the trouble of maintaining coal fires.

Damage to Roads.—With regard to the use of skid-pans and the damage done by them to the main roads, the clerk of the East Sussex County Council recently reported to the Roads and Bridges Committee that the by-laws only referred to the use of skid-pans on horse-drawn vehicles, and so far as he was aware there was no authority under which laws could be made with reference to the use of skid-pans on motor-drawn vehicles. In the committee's opinion power should be given to the local authorities to make such by-laws. It was also resolved that the County Councils Association should be asked to support this resolution. The committee also recommended that, in view of the damage done to roads by the motor lorry traffic, legislation should be passed whereby the wheels of the engines and vehicles should be of a width varying proportionately to their tonnage and the tonnage drawn by them. By this, much of the evil now wrought to the roads would, it was thought, be averted. These recommendations were duly confirmed by the county council at their meeting held last week.

Physical Tests of Oil-Mixed Portland Cement Concrete.

By LOGAN WALLER PAGE, Director, United States Office of Public Roads.

[The subjoined matter forms the appendix to a report of Mr. Page dealing with an elaborate series of experiments on the subject of oil-mixed Portland cement concrete upon which he has been engaged during the past three years, and embodies the main results of his investigations and his summary of conclusions in connection with the question—as to which a letter from Mr. Page appeared in our correspondence columns of March 21st last.]

In order to investigate the physical properties of oil-mixed Portland cement concrete, the following physical tests were conducted in the testing laboratory of the Office of Public Roads: (1) Tensile strength; (2) crushing strength; (3) time of setting; (4) toughness or resistance to impact; (5) stiffness or modulus of elasticity; (6) absorption; (7) permeability; and (8) bond tests.

The materials used consisted of Portland cement, river sand, crusher-run gneiss, and various kinds of petroleum residuum oils.

The mechanical analysis of the sand and stone used is given below:—

TABLE No. I.
Mechanical Analysis of Sand and Stone.

Sand.		Stone.	
Sieve No.	Per cent retained.	Sieve No.	Per cent retained.
Inches.		Inch.	
	3	¼	28·4
	11	⅜	66·3
10	17	½	92·1
20	42	¾	98·4
30	66	1	—
40	87	—	—
50	93	—	—
80	96	—	—
100	99	—	—

There were 37 per cent of voids in the sand, and 43 per cent in the stone.

The cement passed the specifications of the American Society for Testing Materials.

Various types of oils were used, and these are described in the following table:—

moulded 6 in. in diameter and 6 in. high. They were bedded in plaster of Paris or blotting paper, and were crushed at a speed of 0·152 in. per minute.

Table No. IV. gives the crushing strength obtained, and the results are plotted on Figs. 2 and 3.

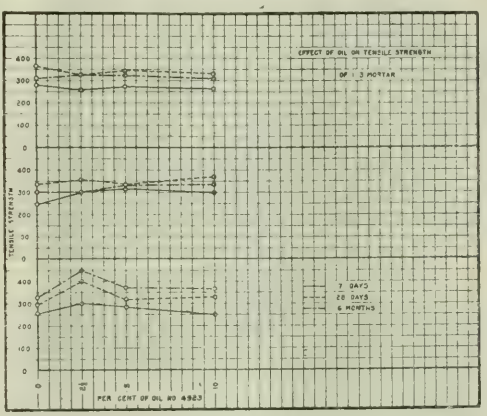


FIG. 1.—EFFECT OF OIL ON TENSILE STRENGTH.

It will be noted that the crushing strength is decreased by the addition of oil, but that the decrease is not serious when the amount of oil does not exceed 10 per cent. It will also be noted that oil-mixed cement concrete gains in strength with time in the same manner as untreated concrete—a fact which indicates that the addition of oil to the mixture in small amounts has no disintegrating effect on the cement.

TABLE No. II.
Analysis of Oils used in Oil-Cement-Concrete Mixtures.

Sample No.	4145	4146	4147	4149	4170	4923	4981	5053
Type	(1)	(1)	(1)	(1)	(2)	(1)	(1)	(1)
Character	(3)	(3)	(3)	(3)	(4)	(3)	(3)	(3)
Specific gravity at 25°/25°C.	0·924	0·910	0·926	0·923	—	0·945	0·893	0·924
Per cent of loss at 163° C., 5 hours (20 grams)	6·86	12·56	7·98	7·02	18·38	1·35	27·17	3·70
Character of residue	(5)	(6)	(7)	(7)	(7)	(8)	(7)	(7)
Per cent of bitumen soluble in CS_2; air temperature	99·99	99·99	99·93	99·95	99·81	99·96	99·95	99·90
Per cent of organic matter insoluble	·01	·01	·07	·05	·13	·04	·02	·07
Per cent of inorganic matter insoluble	·00	·00	·00	·00	·06	·00	·03	·03
Total (per cent)	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00
Per cent of total bitumen insoluble in 86° B. paraffin naphtha	2·23	6·82	10·16	2·24	16·87	3·16	1·00	4·12
Fixed carbon	2·41	3·36	5·11	1·98	—	1·18	1·77	2·82
Specific viscosity, Engler, 50° C.	14·2	6·4	18·2	20·2	—	65·1	2·5	17·4

[1] Fluid residual oil.
[2] Cut-back oil asphalt.
[3] Fluid, greasy.
[4] Fluid, sticky.
[5] Fluid, slightly sticky.
[6] Semi-solid, sticky.
[7] Slightly granular, more viscous than original.
[8] Fluid, granular in appearance.

In the table following it will be noted that in general the specimens containing oil have a higher tensile strength than those without oil.

TENSILE STRENGTH.

TABLE No. III.
Tensile Strength (1 : 3 mortar, Ottawa sand).
[Age in days.]

Per cent of oil.	Oil No. 4923.			Oil No. 5053.			Oil No. 4981.		
	7	28	180	7	28	180	7	28	180
	256	296	326	244	331	302	283	376	312
2½	299	400	449	297	353	298	259	327	323
5	287	316	372	313	334	325	268	341	321
10	252	331	360	304	371	330	264	329	319

CRUSHING STRENGTH.

Specimens of mortar and concrete containing different percentages of various kinds of oils were

TIME OF SETTING OF PORTLAND CEMENT.

TABLE No. V.
Effect of Oil on Time of Setting.

Oil No. 4923.		
Per cent of oil.	Initial set.	Final set.
	H. m.	*H. m.*
0	1 18	3 43
2½	1 31	4 56
5	1 57	5 27
10	2 27	5 57

The time of setting is delayed with the addition of oil, as shown by the above tests, which are plotted on Fig. 4. These results were obtained with the

Gillmore needles on specimens subjected to identical conditions while hardening. Five per cent of oil delays the initial set by 50 per cent, and the final set by 47 per cent.

TOUGHNESS OR RESISTANCE TO IMPACT.

The toughness or resistance to impact was tested on the Page impact machine under the blows of a 10-kilogramme hammer falling on a 5-kilogramme plunger from successively increasing heights of 1 centimetre. The height of the last blow causing failure corresponds to the number of blows. The end of the plunger in contact with the specimen is spherical in shape, with a radius of 3 centimetres. Specimens 6 in. in diameter and 6 in. high were tested

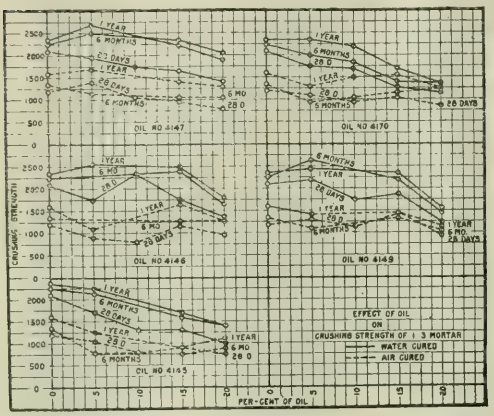


FIG. 2.—EFFECT OF OIL ON CRUSHING STRENGTH OF 1:3 MORTAR.

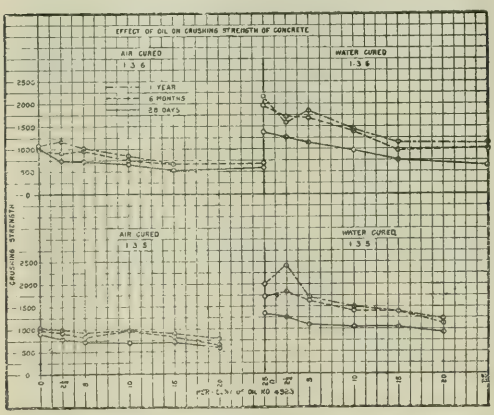


FIG. 3.—EFFECT OF OIL ON CRUSHING STRENGTH OF CONCRETE.

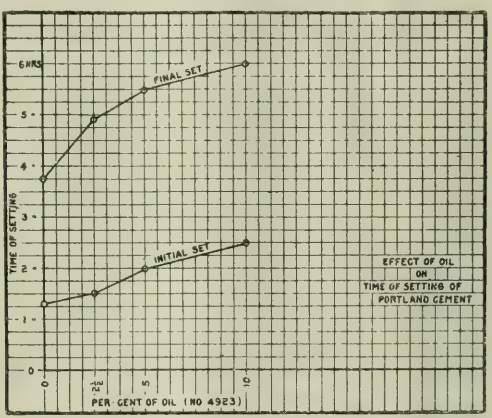


FIG. 4.—EFFECT OF OIL ON TIME OF SETTING OF PORTLAND CEMENT.

after first bedding them in plaster of Paris before mounting on the anvil of the machine. The following results show that the toughness of concrete is very little influenced by the addition of a small amount of oil to the mixture:—

TABLE No. VI.
Number of Blows required to produce Failure.

Per cent of oil. No. 4923.	1:3:5 concrete		1:3:6 concrete.	
	Air-cured.	Water-cured.	Air-cured.	Water-cured.
0	18	15	15	21
2½	15	33	14	18
5	23	20	15	20
10	13	20	12	21
15	14	20	13	16

A view of the impact machine with a specimen under test is shown.

STIFFNESS OR MODULUS OF ELASTICITY.

For testing the effect of oil on the stiffness of concrete specimens 8 in. in diameter and 16 in. high were

TABLE No. IV.

TESTS OF OIL-MORTAR AND OIL-CONCRETE CYLINDERS.

[Crushing strength is given in pounds per square inch. All 1:3 mortar (by weight) except 6c. to 18c., 6c. to 12c., 1:3:6 concrete; 13c. to 18c., 1:3:5 concrete (by volume).]

[NOTE.—Numbers in parentheses indicate number of specimens tested.]

Mark.	Per cent of oil.	Character of oil.	Stored in air.			Stored in water.		
			28 days.	6 months.	1 year.	28 days.	6 months.	1 year.
1	0	——	1,170(5)	1,350(2)	1,597(2)	2,135(6)	2,275(2)	2,308(2)
17	5	Fluid residual oil No. 4145	1,050(2)	830(2)	1,220(2)	1,715(2)	2,160(2)	2,210(2)
2	10	,, ,, ,,	790 1)	—	—	1,320(1)	—	—
22	15	,, ,, ,,	895(2)	780(2)	880(2)	1,290(2)	1,615(2)	1,700(2)
27	20	,, ,, ,,	775(2)	910(2)	1,126(2)	1,020(2)	1,420(2)	1,425(2)
18	5	Fluid residual oil No. 4146	916(2)	—	1,110(2)	1,770(2)	—	2,560(2)
3	10	,, ,, ,,	830(1)	—	—	2,400(2)	—	—
23	15	,, ,, ,,	1,215(2)	1,275(2)	1,670(2)	1,775(2)	2,410(2)	2,475(2)
28	20	,, ,, ,,	935(2)	1,295(2)	1,380(2)	1,345(2)	1,640(2)	1,780(2)
19	5	Fluid residual oil No. 4147	1,305(2)	1,155(2)	1,715(2)	1,995(2)	2,475(2)	2,700(2)
4	10	,, ,, ,,	1,070(1)	—	—	1,720(1)	—	—
24	15	,, ,, ,,	975(2)	1,085(2)	1,435(1)	1,670(2)	2,350(2)	2,250(1)
29	20	,, ,, ,,	795(2)	1,055(2)	1,310(2)	1,400(2)	2,010(2)	1,895(2)
21	5	Fluid residual oil No. 4149	1,305(2)	1,105(2)	1,395(2)	2,220(2)	2,665(2)	2,450(1)
6	10	,, ,, ,,	1,170(1)	—	—	1,750(1)	—	—
26	15	,, ,, ,,	1,440(2)	1,395(2)	1,330(2)	1,895(2)	2,215(2)	2,320(2)
31	20	,, ,, ,,	925(2)	1,085(2)	1,135(2)	1,230(2)	1,475(2)	1,530(2)
7	5	Cut-back oil asphalt No. 4170	1,010(2)	940(2)	1,315(2)	1,760(2)	2,065(2)	2,345(1)
8	10	,, ,, ,,	980(2)	1,005(2)	1,510(2)	1,680(2)	1,825(2)	2,200(1)
9	15	,, ,, ,,	1,055(2)	1,170(2)	1,555(2)	1,265(2)	1,365(2)	1,685(1)
10	20	,, ,, ,,	890(2)	1,220(2)	1,325(2)	1,175(2)	1,340(2)	1,375(1)
6c	0	——	1,020(3)	980(2)	1,090(3)	1,370(2)	1,965(2)	2,170(3)
7c	2½	Fluid residual oil No. 4923	750(2)	915(2)	1,105(2)	1,253(3)	1,715(2)	1,580(3)
8c	5	,, ,, ,,	711(2)	975(2)	1,016(2)	1,142(2)	1,690(2)	1,635(2)
9c	10	,, ,, ,,	656(2)	755(2)	850(1)	961(3)	1,400(2)	1,440(3)
10c	15	,, ,, ,,	542(2)	670(2)	675(2)	750(2)	995(2)	1,145(3)
12c	25	,, ,, ,,	605(3)	678(2)	—	620(3)	1,030(2)	1,120(2)
13c	0	——	920(2)	998(3)	1,010(1)	1,342(3)	1,705(3)	1,880(3)
14c	2½	Fluid residual oil No. 4923	727(2)	945(3)	995(3)	1,250(2)	1,830(2)	2,410(3)
15c	5	,, ,, ,,	720(2)	822(2)	912(3)	1,082(2)	1,626(2)	1,715(3)
16c	10	,, ,, ,,	694(2)	965(2)	975(3)	1,010(2)	1,406(2)	1,490(3)
17c	15	,, ,, ,,	693(2)	828(2)	888(3)	1,040(2)	1,360(2)	1,382(3)
18c	20	,, ,, ,,	572(2)	639(2)	772(2)	904(2)	1,116(2)	1,230(3)

made. The deformations under various loads were measured with a double micrometer screw compressometer of the type described by J. M. Porter in the "Proceedings" of the American Society for Testing Materials, vol. x., 1910. Loads were applied in 2,500-lb.

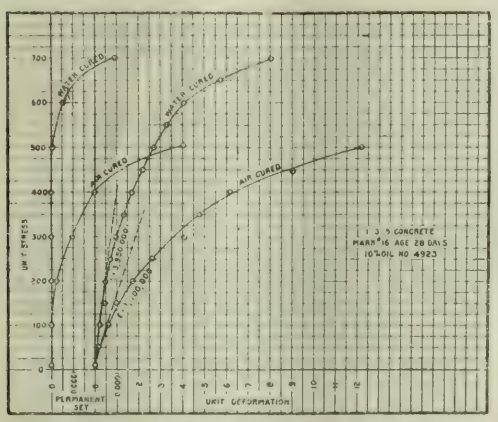
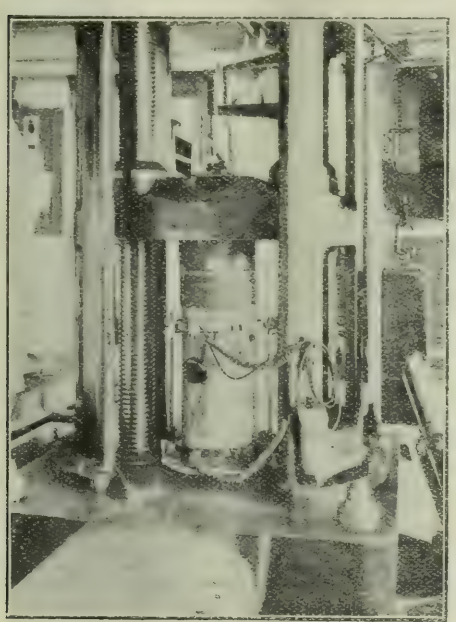


Fig. 5.—Modulus of Elasticity and Permanent Set.

and 5,000-lb. increments, and were released to 500 lb. after each increment of 5,000 lb., and deformation readings were taken for permanent set. Typical stress deformation and permanent set curves are shown in Fig. 5. In all cases the initial modulus of elasticity was obtained from the slope of the stress-strain curve at its origin. A view of a specimen mounted in the testing machine with compressometer attached is shown.



Testing the Strength and Elasticity of Oil-mixed Concrete.

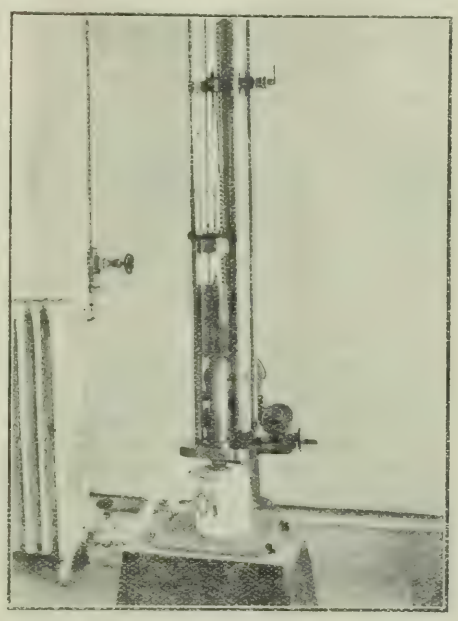
Table No. VII.
Initial Modulus of Elasticity (age 28 days).

Per cent of oil. No. 4923.	1:3:5 concrete		1:3:6 concrete.	
	Air-cured.	Water-cured.	Air-cured.	Water-cured.
0	1,300,000	2,550,000	1,300,000	2,200,000
2½	1,350,000	2,700,000	1,000,000	2,400,000
5	1,250,900	2,250,000	850,000	1,600,000
10	1,700,000	2,950,000	1,150,000	1,900,000
15	1,300,000	2,500,000	730,000	2,050,000

The above results show that oil has little effect on the stiffness of concrete. The increased value of the modulus of elasticity of the water-cured over the air-cured specimens is as marked in the oil-mixed as in the plain specimens. Tests at one year, although not here recorded, show that oil-mixed concrete gains as much in stiffness with age as the plain concrete does.

ABSORPTION.

The resistance of concrete to the penetration of moisture is measured by its absorptive qualities. To test the absorption of oil-mixed concrete compared



Impact Test on Oil-mixed Concrete.

with plain concrete, cylindrical specimens 6 in. in diameter and 6 in. high were dried to constant weight in an oven, after being cured for fifteen days in air. They were then immersed in water and weighed from time to time. The results of these tests are plotted on Fig. 6. It will be seen that the oil greatly decreases the percentage of absorption; the cylinder containing 10 per cent of oil absorbed 1·7 per cent of water, based on the dry weight, while the cylinder containing no oil absorbed 6·25 per cent.

PERMEABILITY.

To investigate permeability, specimens 3 in. in thickness and 6 in. in diameter were moulded with

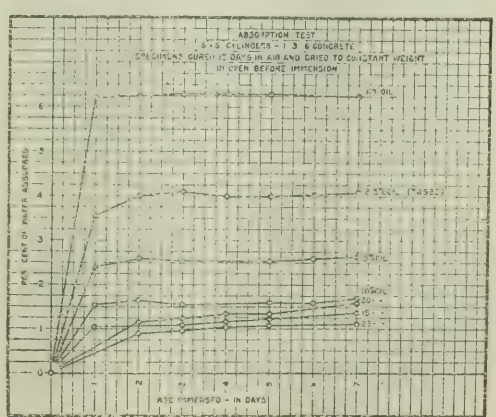

ABSORPTION TEST
6"x6" CYLINDERS - 1:3:6 CONCRETE
CYLINDERS CURED 15 DAYS IN AIR AND DRIED TO CONSTANT WEIGHT IN OVEN BEFORE IMMERSION
10% OIL
5% OIL
2½% OIL
15% OIL
20% OIL
PER CENT OF WATER ABSORBED
AGE IMMERSED - IN DAYS

Fig. 6.—Absorption Test.

a surrounding ring of 1:1 mortar. Before testing, the top and bottom surfaces were chipped off in order to eliminate the waterproofing effect of the rich surface layers. Plain 1:3 mortar at the age of twenty-eight days under 30-lb. pressure became damp after half an hour. Under 40-lb. pressure the leakage amounted to 146 cubic centimetres after twenty-four

hours' application. Specimens containing 5 per cent and 10 per cent of oil No. 4923 remained perfectly tight under 40-lb. pressure.

All permeability specimens made of gravel concrete and containing admixtures of oil have remained perfectly tight under 40-lb. pressure per square inch. Some of the plain gravel specimens made to compare with the oil-mixed specimens leaked, while others remained tight. Broken-stone concrete made with a very inferior grade of crushed gneiss is not perfectly watertight under pressure at early periods. After storing for one year, however, even this inferior grade of oil-mixed concrete gives indications of being much less permeable than plain concrete.

BOND TESTS.

To determine the adhesion of oil-mixed concrete to steel reinforcement, bond tests were made on specimens mixed in the proportions of 1:2:4 and containing various percentages of oil. Rods 12 in. long were embedded in the centre of cylinders 8 in. in diameter and 8 in. long. The test consisted in pushing the rods through the concrete, and the point of failure was taken at the drop of the scale beam.

Two kinds of bars were used—plain and deformed. All specimens were tested at twenty-eight days, and the results are plotted on Fig. 7. The bond strength is decreased, and the decrease depends directly on the quantity of oil in the mixture. It is evident that the bond between plain bars and concrete is so seriously affected by the mixture of oil that it would be inadvisable to use such a combination. The bond of deformed bars is not so seriously affected, but is somewhat decreased by the oil admixture.

SUMMARY OF CONCLUSIONS.

The following conclusions as to the effect of the oils used in cement and concrete may be drawn from the foregoing investigations:—

(1) The *tensile strength* of 1:3 oil-mixed mortar is very little different from that of plain mortar, and shows a substantial gain in strength at twenty-eight days and six months over that at seven days.

(2) The *times of initial and final set* are delayed by the addition of oil; 5 per cent of oil increases the time of initial set by 50 per cent, and the time of final set by 47 per cent.

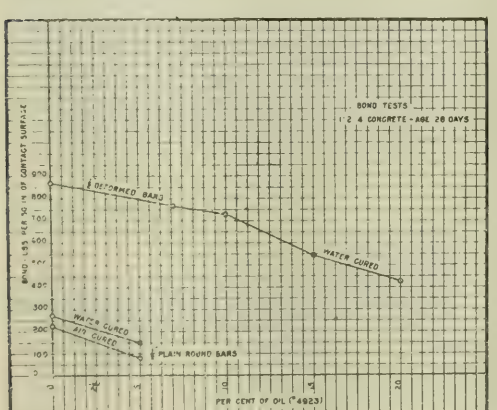


Fig. 7.—Bond Tests.

(3) The *crushing strength* of mortar and concrete is decreased by the addition of oil to the mix. Concrete with 10 per cent of oil has 75 per cent of the strength of plain concrete at twenty-eight days. At the age of one year the crushing strength of 1:3 mortar suffers but little with the addition of oil in amounts up to 10 per cent.

(4) The *toughness* or resistance to impact is but slightly affected by the addition of oil in amounts up to about 10 per cent.

(5) The *stiffness* of oil-mixed concrete appears to be but little different from that of plain concrete.

(6) *Elasticity.*—Results of tests for permanent deformation indicate that no definite law is followed by oil-mixed concrete.

(7) *Absorption.*—Oil-mixed mortar and concrete containing 10 per cent of oil have very little absorption, and under low pressures both are waterproof.

(8) *Permeability.*—Oil-mixed mortar containing 10 per cent of oil is absolutely water-tight under pressures as high as 40 lb. per sq. in. Tests indicate that oil-mixed mortar is effective as a waterproofing agent under low pressures when plastered on either side of porous concrete.

(9) The *bond tests* show the inadvisability of using plain bar reinforcement with oil-concrete mixtures. The bond of deformed bars is not seriously weakened by the addition of oil in amounts up to 10 per cent.

THE ALLENTOWN VIADUCT, PENNSYLVANIA.

A ferro-concrete highway viaduct now being built at Allentown, Pennsylvania, is described in a recent issue of *Engineering News*, in which it is called "one of the most notable of the many large reinforced-concrete viaducts which are now being erected" in the United States. Including the approaches, it is 2,600 ft. long, crossing a wide and shallow valley which is 125 ft. deep at the deepest part. Several roads run through the valley, two railways, and a stream, the Little Lehigh River.

The roadway is described as being "on a negative grade of 8 per cent, which eases off into a positive 2·6 per cent grade at the south approach." There are nine arches, each 120 ft. clear span; and eight 52½ ft. girder spans, "arched for architectural effect." The carriageway is 32 ft. wide, and there are two side-walks, each 6 ft. wide.

The main arch spans are a somewhat unusual form of a familiar type, a pair of arch ribs supporting spandrel columns on which the decking rests. There are separate piers for each arch rib, each pier being 15 ft. thick by 12 ft. 9 in. wide (transversely). The arch ribs are nearly semi-circular, 62 ft. rise for the span of 120 ft. They are about 11 ft. thick at the springings, 4 ft. thick at the crown, and 8 ft. wide. The spandrel columns are spaced 11 ft. 8 in. apart in the clear, and each is 2 ft. thick and 8 ft. wide, the full width of the arch rib on which it rests. These columns are carried right up to the deck, but for the last 16 ft. or so each is connected monolithically with its neighbour on the other arch rib, the pair forming a kind of jockey pier standing on the arch ribs, the connecting portion of the monolithic slab being of the same thickness as the limbs which form the spandrel columns proper. Except when it is acting as a wind brace, the stresses in the connecting slab cannot be very great, as the load over the central gap of 18 ft. between the main ribs is partly balanced by the longitudinal spandrel, the footway resting on them and corbelled out beyond them and the parapets. The underside of this central connecting slab is a semi-circular arch. The longitudinal spandrel seems, from the drawings, to be so designed that it will act as a girder, but between each pair of transverse spandrel arches it is arched on the under side, so as to seem to span the spaces between the jockey piers, this arching being segment with only a small rise.

Up to the springings of the arches the piers are solid, but above the springings they are built similarly to the spandrels as a hollow pilaster, so that to the eye the pier seems to be carried up solid. The piers and abutments of the 52½-ft. girder spans are cellular, with 3-ft. walls longitudinally, connected by 1½-ft. transverse curtain walls extending just below the ground line, "so that they may brace properly the slender piers and add to the massive appearance of the combination."

Ideas as to what constitutes "architectural effect" are apt to differ. Maybe there are some who would follow the principle that "*Magna ars est celare artem.*"

Creosoted Wood Block Paving.—The Improved Wood Pavement Company, Limited, 46 Queen Victoria-street, E.C., are engaged in repaving Elgin-crescent, Kensington, with creosoted wood blocks. The old creosoted blocks which are being removed were laid twenty years ago.

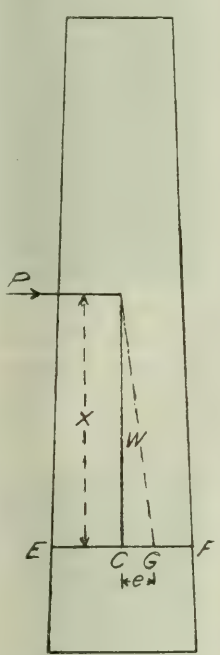
Wallasey's Town Hall.—It is reported, though not officially confirmed, that the Local Government Board have given their sanction to the building of the town hall in Wallasey, fixing the amount at £25,000 less than the estimated cost. It is stated that one reason for reducing the cost is in order that the proposed tower may be retained as part of the scheme.

The Stability of Brick Chimneys.*

By HAROLD CANE.

The author has recently had occasion to report upon the stability of several designs for brick chimneys, which have been submitted to him for that purpose, and the following paper embodies the result of certain investigations which he carried out in connection therewith, and which it appeared might be of some general interest in their bearing on the usual form of building regulations governing this subject. The paper is divided into four sections: the first deals with the methods of determining the moment of stability of brick chimney shafts; the second deals with the question of wind pressure; in the third is given some examples of existing chimneys; and the last contains a criticism of the regulations under which chimneys generally have to be built in this country, with suggested amendments.

The failure of a brick chimney is generally observed to commence by the opening of one of the bed joints on the windward side of the chimney. A crack thus begins which extends diagonally downwards along both sides of the chimney, tending to separate it into two parts. The final destruction of the chimney occurs either by the horizontal shifting of the upper portion until it loses its support from below, or by the crushing of a portion of the brickwork at the leeward edge, or by both causes combined.



Rankine states that the tenacity of mortar when fresh is too small to be relied on in practice as a means of resisting tension in the joints of a structure, so that a structure of masonry or brickwork, requiring as it does to possess stability while the mortar is fresh, ought to be designed on the supposition that the joints have no appreciable tenacity.

It is therefore necessary, in order that the stability of a brick chimney shaft may be assured, that the material composing the structure should only be subjected to compressive stress, for under these conditions there will be no tendency for the joints to open on the windward side of the shaft.

Let the accompanying figure represent a chimney of any section and let EF be any point at which it is required to determine the stability of the chimney shaft.

Let A_v = the area of a diametrical vertical section of the shaft above the joint EF.

X = the vertical distance of the centre of A_v from EF.

A = the area of the joint EF.

I = the moment of inertia of the horizontal cross section of the shaft at EF.

C = the centre of the cross section EF.

Y = distance of the neutral axis of the section EF from the extreme fibres.

p = intensity of wind pressure.

P = total wind pressure.'

W = weight of shaft above EF.

e = greatest permissible eccentricity of the centre of pressure or distance from the neutral axis of the section.

B = bending moment of wind pressure = pA_vX.

D = external diameter of shaft.

d = internal diameter of shaft.

* Extracts from paper read at the last meeting of the Concrete Institute.

The stresses in a chimney shaft arise from two causes:—

(a) The weight of the structure itself which causes compression over the whole of the cross section, the intensity of which is uniform, and = $\frac{W}{A}$.

(b) The pressure of the wind, which causes bending stresses, these being compressive on leeward side and tensile on the windward side, and the maximum intensity of these stresses is $\frac{By}{I}$.

When the shaft is not subjected to wind pressure, and assuming that the vertical axis is truly perpendicular, the centre of pressure of the static load coincides with C, the geometrical centre of the section, and the stress is equally distributed over the cross section. When the wind pressure is applied to the shaft the centre of pressure of the combined static and wind pressure loads shifts from the geometrical centre towards the leeward edge, and the intensity of compressive stress increases at the leeward and decreases at the windward edge, and as the wind pressure increases the eccentricity of the centre pressure increases until it reaches some point G, when a reversal of stress takes place on the windward edge. It follows, therefore, in order that the shaft may be of adequate stability, that the eccentricity of the centre of pressure should be so limited that no reversal of stress will occur, and, further, that the most economical design of chimney is one in which the eccentricity of the centre of pressure has its maximum value, consistent with safety, when the shaft is subjected to the maximum wind pressure.

The moment of W, the weight of the shaft multiplied by the eccentricity of the centre of pressure, is equal to the moment of the wind pressure. Therefore, if the maximum permissible eccentricity of the centre of pressure be designated e, then, in order to satisfy the conditions of stability, We, the moment of stability of the chimney shaft, must be equal to or greater than PX = B, the moment of the wind pressure.

The competent stresses on the extreme fibres of the section are $\frac{W}{A}$, the direct stress, and $\frac{By}{I}$ the bending stress; the resultant stresses being on the leeward edge, $\frac{W}{A} + \frac{By}{I}$, and on the windward edge $\frac{W}{A} - \frac{By}{I}$. The limit of safety is reached when $\frac{W}{A} - \frac{By}{I} = 0$, or when $We = B$, then $\frac{W}{A} = \frac{By}{I}$. From these two equations the value of e is obtained, which is $e = \frac{I}{Ay}$, this being the general equation for the maximum permissible eccentricity of the centre of pressure for a chimney of any form of cross section, the particular values of e for chimneys of the usual forms being as follows:—

$$\text{Circular, } e_c = \frac{0{\cdot}125\ (D^2 + d^2)}{D}$$

$$\text{Octagonal, } e_o = \frac{0{\cdot}1282\ (D^2 + d^2)}{D}$$

$$\text{Square, } e_s = \frac{0{\cdot}118\ (D^2 + d^2)}{D}$$

In the case of octagonal sections D and d are measured between the centres of opposite sides.

WIND PRESSURE.

The next point for consideration is the maximum wind pressure which a chimney shaft should be designed to withstand. Rankine recommends that a wind pressure equivalent to 55 lb. per ft.^{2} on a plane surface should be assumed in designing chimneys. Moleworth recommends 56 lb. per ft.^{2}, which is the same as that specified in the Board of Trade Regulations for the design of railway bridges. Christie, in "Chimney Design and Theory," states that the general practice in the United States is to assume a maximum wind pressure of 50 lb. per ft.^{2}. R. Kohfahl, dealing with German conditions, states that 41 lb. per ft.^{2} should be considered as the maximum pressure for buildings of ordinary size, and for high buildings greater pressures should be allowed for. Higher pressures than any of these have been observed, and as high pressures as 70 lb., 80 lb., and even 90 lb. per ft.^{2} have been recorded at Bidston Observatory. As a chimney shaft exposes a comparatively large surface

to the pressure of the wind, it would appear safe to assume an average intensity of pressure over the whole projected area of the shaft, considerably less than the highest pressures recorded. On the other hand, the pressure of the wind increases with the height above the ground, and it is recorded that on the top of the Eiffel Tower, 303 metres high, wind pressures have been observed five times as great as those observed at the Central Meteorological Bureau, the height of which is 21·5 metres. Two series of Stevenson's experiments show that within the limits of these experiments the wind pressure varies roughly as $h^{\frac{1}{7}}$; but both the pressures and the altitudes covered by these experiments are small, and further experiments with greater pressures and at higher altitudes might give somewhat different results.

Two other considerations in favour of assuming a fairly high value for the intensity of the wind pressure, both of which are practically indeterminate when designing a chimney, are the variation of the vertical axis from the true perpendicular, and the stresses caused by heat when the chimney is in service. The first causes bending stresses, which, when of the same sign as the stresses due to wind pressure, decrease the stability of the shaft; the intensity of these additional stresses cannot be determined until the shaft has been erected and plumbed, though they should not be of any considerable magnitude in a carefully built chimney. With regard to the heat stresses, Ostenfeld states that, during the storm of 1876, of a number of chimneys of identical dimensions only those were destroyed which were working at the time, which would appear to show that the heat stresses materially affect the stability of a chimney. After giving due consideration to the various points involved, it would appear to be adequate to assume a wind pressure equivalent to 50 lb. per ft.^{2} on a plane surface for chimneys of the usual dimensions in ordinary situations, but for a chimney of great height in an exposed position it would probably be advisable to increase this figure, while for chimneys of moderate height erected in protected situations a lower value might be assumed.

The corresponding pressures for the usual forms of chimneys are:—

Circular	$50 \times 0{\cdot}5 = 25$ lb. per ft.^{2}
Octagonal	$50 \times 0{\cdot}66 = 35$ „ „
Square (direction of wind normal to diagonal) ..	$50 \times 0{\cdot}6 = 30$ „ „

EXAMPLES OF EXISTING CHIMNEYS.

The author has calculated the stability of some existing chimneys according to the foregoing principles, two series of calculations being made for each chimney, one giving the maximum wind pressure which the shaft could withstand with zero stress on the windward edge, and the other giving the stress on the windward edge corresponding to a wind pressure equal to 50 lb. per ft.^{2} on a plane surface. The calculations relating to one of the most celebrated chimneys in the world, that of Messrs. Tennant & Co., at St. Rollox, show that in this chimney the joint of least resistance is 225 ft. from the top, at which point the maximum wind pressure sustainable with safety is 48·2 lb. per ft.^{2}, while the stress with 50-lb. pressure would be 3·4 lb. per in.^{2} tension. From this point the stability of the chimney increases towards the base, until at the latter point the corresponding figures are 61 lb. per ft.^{2} and 37·8 lb. per in.^{2} compression, and at the same point the intensity of direct stress is 150·3 lb. per in.^{2}.

The chimney of the Union Depot Railway Company of St. Louis was 162 ft. high, and the upper portion was blown down in May, 1896. In this chimney the joint of least resistance was 112 ft. from the top, and at this point the greatest safe wind pressure was 38·6 lb. per ft.^{2}, and with 50 lb. wind pressure the stress on the windward edge was 15·9 lb. per in.^{2} tension.

REGULATIONS.

The construction of brick chimney shafts in this country, so far as it is controlled by specific regulations, is regulated by the provisions of sec. 65 of the London Building Act, 1894, or by local by-laws similar thereto, for the author found, as the result of inquiries addressed to nearly twenty of the principal industrial towns in the country, that in every case but one in which the local authority had adopted by-laws regulating the thicknesses of chimney walls, minimum diameter, &c., these provisions were similar to those in force in London, but fortunately in 60 per cent of the towns concerning which inquiries were made, no regulations are in force regarding these points, each individual case being judged on its merits. It will be seen, therefore, that it is a matter of the first importance to determine how far the chimney shafts constructed according to these regulations conform to the conditions of stability and economy. With this object in view, the author designed a number of chimney shafts according to these regulations, and calculated the stability according to the foregoing principles. Stated briefly, sec. 65 of the London Building Act, 1894, requires that the walls of chimney shafts shall not be less than one brick thick for the top 20 ft. of height, and shall be increased one half-brick for each additional 20 ft. measured downwards; that the latter shall not be less than 2½ in. in 10 ft. of height, and that the external diameter at the base shall not be less than one-tenth of the height for square, or one-twelfth of the height for circular chimneys. In regard to circular chimney shafts 100 ft., 156 ft., and 200 ft. high, and of the respective minimum diameters and with walls of the thickness required by the Act, in none of them can the stability be considered satisfactory, and in the smaller chimneys it is most inadequate, while in no case is the material in the shaft disposed to the best advantage. Considering first the 100-ft. chimney, the maximum wind pressure which it would safely withstand is only 23 lb. per ft.^{2}, which is a pressure frequently exceeded, while with 50-lb. pressure the windward edge of the chimney would be under tensile stress to a height of about 85 ft., the maximum intensity of tensile stress being 48·4 lb. per in.^{2} at the base, the corresponding figures for the 156-ft. chimney being 34·5 lb. per ft.^{2} and 32·4 lb. per in.^{2} tension. The stability of the regulation chimney shaft increases as the height increases, and in the case of the 200-ft. shaft the maximum safe wind pressure is 42 lb. per ft.^{2}, the stress on the windward edge 13·9 lb. per in.^{2} tension, the joint of least resistance being 40 ft. from the ground, but the chimney is of practically equal stability from the base up to 60 ft. from the ground.

The author has designed a shaft 200 ft. high which could at all joints withstand a wind pressure equivalent to at least 50 lb. per ft.^{2} on a plane surface with zero stress on the windward edge; or, in other words, the stability of this shaft is practically 20 per cent greater than the regulation chimney of equal height and diameter, and at the same time the weight is 20 per cent less, so that a proper distribution of the material enables greatly increased stability to be obtained by the use of considerably less material than is permitted by the regulations.

It will be seen, therefore, that a chimney shaft constructed according to the London Building Act, or other similar regulations, is either of insufficient stability or excessive weight; while in many cases the weight is excessive at the same time that the stability is inadequate, and it would appear under these conditions that an amendment of the existing regulations governing the construction of brick chimney shafts would be very desirable, and in the author's opinion the regulations should not specify either minimum diameters, a minimum batter, or minimum thicknesses of walls, but that, in the interests both of safety and economy, it is necessary that the regulations should specify a wind pressure which chimneys should be designed to withstand, and that when subjected to the specified wind pressure no portion of any bed joint should be under tensile stress, or under compressive stress of greater than a specified maximum intensity.

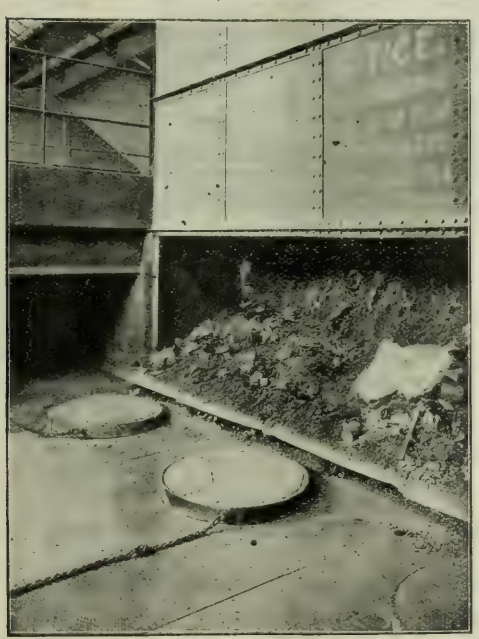
Public Baths for Arbroath.—At a meeting this week of a special committee appointed to carry out the arrangements in connection with the proposed public baths in Arbroath, a report was submitted by Mr. James Thomson, city engineer of Dundee, on the plans which were submitted to him for adjudication. The town council had offered premiums of £25, £15, and £10 for the best three plans suitable for the purpose, subject to the estimated cost being not more than the money at the disposal of the council, which, apart from professional fees, inspector's wages, and furniture, would be about £6,000. The first premium was awarded to Mr. Hugh Gavin, architect, Arbroath; second, Mr. David Wishart Galloway, architect, Brechin; third, Messrs. Wilson and Savage, architects, 98 Bedford-park, London. It is understood that Mr. Gavin's plan will be adopted by the council.

A Test of a Refuse Destructor at Smethwick.

By W. NAYLOR, F.C.S., ASSOC.M.INST.C.E.

In the articles which have appeared in the Special New Year's Annual Issues of THE SURVEYOR from time to time reference has been made to the thermal economic value of various adjuncts to destructor plant, boiler house economisers, hot-air feed regenerators, and so forth, and to the various claims of high or low chimneys, front or back feed, and hand firing or automatic stoking, while mechanical clinkering and similar other processes and operations have been put forward and discussed.

VIEW OF DESTRUCTOR FRONTS AT SMETHWICK, SHOWING FURNACE ARRANGEMENTS.



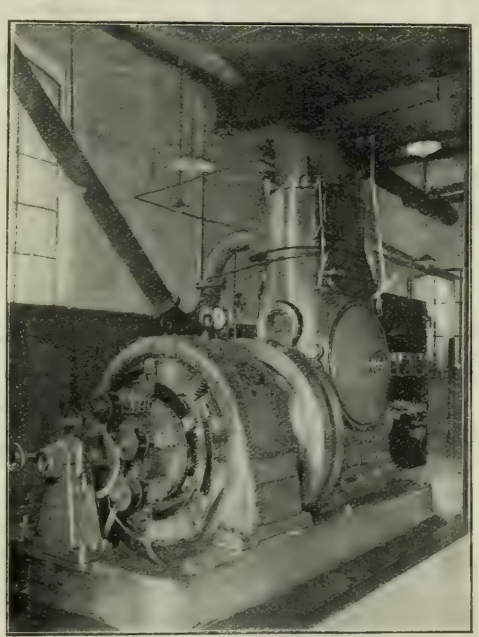
VIEW OF TIPPING PLATFORM, SMETHWICK DESTRUCTOR WORKS.

The bulk of the statements made, however, have been made on the *ipse dixit* of destructor makers, or have been based on figures appearing in the published tests of makers, and it would perhaps be considered interesting to present the result of a test made independently and in a purely professional capacity, and, moreover, made under rather unusual conditions, inasmuch as the plant was not considered as being likely to yield even average results.

The plant tested was that belonging to the Smethwick Corporation, and consisted of six cells, Messrs. Meldrum's patent top feed type, each cell having a grate area of 35 sq. ft. (150 sq. ft. in all), and one Lancashire boiler, 30 ft. by 8 ft., with two furnace tubes, 3 ft. diameter, fed from the combustion chambers.

A block plan of the arrangement is shown herewith, the cells being denoted by letters A, combustion chamber B, boiler C, feeding or tipping platform for the refuse D. The set of regenerators shown in dotted lines were not in operation at the time the test was made; in fact they have been taken out altogether on account of difficulties with ground water in the foundations.

Not only were the regenerators, therefore, out of action, but the arrangements for the consumption of the whole of the steam generated in the boiler in the course of its ordinary duty were wholly inadequate, for at present there is no outlet for the full supply of steam which the plant produces.



GENERATING SET DRIVEN BY STEAM FROM BOILER ATTACHED TO SMETHWICK DESTRUCTOR.

Such steam as could be utilised was absorbed by an electrical generating set, and the various small engines in connection with the destructor works; in addition there is a steam pipe connection with a private manufactory outside the destructor works altogether, this manufactory being supplied, at an agreed price, with steam for power purposes.

Notwithstanding this, the total consumption of steam during the test was below the capacity of the boiler and furnaces, the safety valve being at the blow-off during a very considerable portion of the six hours, and no conclusions, therefore, can be drawn either as to the efficiency of the boiler, or the actual evaporative efficiency of the combustion plant cells, combustion chamber and appurtenances.

But this condition of affairs was known before the test was decided upon, and its real object was to observe:—

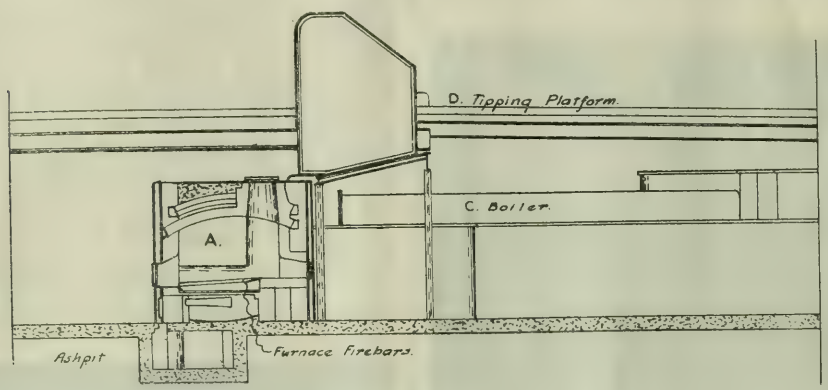
(1) The rate at which ordinary domestic refuse, such as is collected in an average industrial town like Smethwick, can be combusted by means of cold-air feed, with an otherwise modern plant.

(2) Whether in actual practice the benefit derivable from the use of regenerators and hot-air feed is strikingly noticeable—that is to say, whether the temperatures in the combustion chambers are sufficiently high and the withdrawn clinkers free or otherwise from combustible matter.

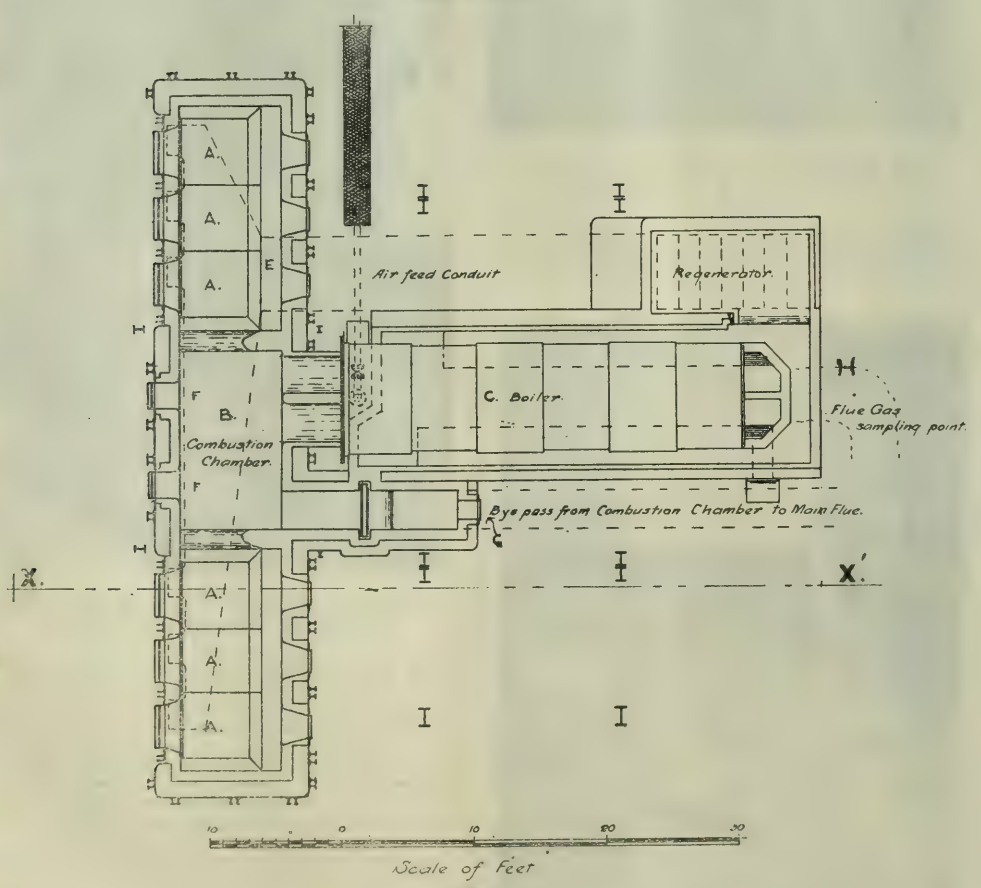
(3) Whether a uniform and steady rate of working can be maintained with freedom from unburnt gases in the main flue.

As the refuse was fed into the cells, the furnacemen threw about a dozen shovels full from each cartload between ashes, vegetable offal, paper, and distinctly inert or inorganic matter such as earthenware and metallic fragments differed not only in every load, but in every portion of a load. To obtain the calorific value by sampling was therefore impossible, and indeed wherever this is attempted in a destructor test it certainly should be checked and supplemented by a calculation of the calorific value based on the ratio of CO_2 and a moisture in the flue gases throughout the whole period.

This is easily done by arranging for calcium chloride



Section on Line XX.



Plan.

Smethwick Corporation Refuse Destructor Plant.

into receptacles provided, with the intention of obtaining a representative sample of the refuse over the six hours.

It was the writer's intention also to have this mass ground up finely for the purpose of estimating the calorific value. This, however, was discarded as being altogether useless, for the refuse was of such a conglomerate character that there could be no similarity between any two "dippings." The relation and caustic potash tubes to be fixed, independently of the flue-gas examination at the usual intervals, and fed with a branch pipe off the main flue. The ratio of moisture to CO_2 being ascertained, the calculation is practically reliable, inasmuch as the weight of moisture and combustible content of the refuse is the total weight of matter burnt, less the weight of clinker and flue ash. And since the combustible content may be entered up as carbon, having now the

total weight of carbon and moisture together and also the ratio of one to the other, the separate weights of each can be obtained. But as on this occasion no arrangements had been made for the separate estimation of steam consumed by the jets, the calorific value of the refuse cannot be presented, nor can any more be said than that it was certainly not specially selected "good," neither was it to be classed as bad.

The cold-air feed was induced by the steam jets along the conduit shown at E, and the temperatures of the combustion chambers ascertained by means of Watkin's Patent Heat Recorders from apertures specially provided at F.

Owing to the by-pass from the combustion chambers being in operation and cold air being also admitted for the purpose of flue cooling at the point G, the flue gases were sampled on their passage to the main flue at H, but as they had traversed neither economisers nor regenerators, their composition only was noted and temperature ignored. The composition was found to be very satisfactory—the maximum CO_2 being 14·9 per cent and the minimum 10·5 per cent. The mean between these two figures, however, must not be accepted as the average, for the bulk of the readings approached 14 per cent; nevertheless, as they were only "Orsat" intermittent estimations and not taken by a continuous recorder, the true average is not deducible.

It will be noticed from the table that the ashpit pressures, 1·49, were not unusually high for the rate at which the furnaces were being worked, and the pull at the chimney base was good—1 in. of water.

The main items to be observed, however, are: (1) The refuse burnt; (2) combustion chamber temperatures. Here, in spite of cold-air feed and cold-water feed, the results compare favourably with the best destructor practice.

Care was taken that no clinker should be withdrawn partially burnt, and that the ashpit pressures should be such as would not drive over into the combustion chambers and flues the lighter particles of refuse. The test was therefore not open to charges either of "shifting" instead of burning, or "withdrawing" instead of burning.

The temperature of the combustion chambers was easily 2,174 degs. Fahr., causing to "run" the low carbon steel rods by means of which the recorders were inserted, and this temperature was well maintained. The amount of refuse burnt, too, it will be seen, was at the rate of 71 lb. per sq. ft. of grate area per hour; indeed, to burn at a much greater rate would necessitate either additional stokers or a resort to mechanical methods of stoking.

It becomes fairly plain, therefore, that the cost of regenerators is a point worthy of consideration, and that the question of whether the preheating of air-feed by means of "built-in" conduits is also worthy of special consideration.

In the table of figures presented from a test made soon after the works were installed, and when the regenerators were in operation and supplying air-feed at an average temperature of 765 degs. Fahr., the average temperature of the combustion chambers was 2,093 degs. Fahr., and the refuse burnt 64·4 lb. per sq. ft. of grate area.

For the heavy working of the furnaces as detailed above only the usual number of workmen were employed—two furnacemen and one charger. The wages paid are: First furnaceman, 7¾d. per hour; second furnaceman, 7¼d. per hour; charger, 6¾d. per hour. A cleaner-down or general labourer is also employed about the works all the year round at a wage of 26s. per week, and if his wages were added to the above, the cost per ton for charging and clinkering is 5s. 8d., or if the manager's wages be included, between 8d. and 9d. In the latter case, however, some allowance ought to be made for the time devoted by the manager to the electrical plant, and plant which returns revenue.

The amount which the borough engineer—to whom my thanks are due for assistance and facilities courteously afforded in connection with this test—informs me is paid annually for interest and sinking fund, including building, machinery, boiler, &c., is £840, a sum which amounts to about 8½d. per ton on the foregoing figures.

Test of Smethwick Refuse Destructor Plant.

February 25, 1913.

Type of Plant	Meldrum's Patent Simplex Top Feed Refuse Destructor—	
	No. of cells (area 150 sq. ft.)	Six
	Type of boiler 30′ × 8′ Lancashire	Lancashire
	Heating surface	1,046 sq. ft.
	Duration of test	6 hours
	Time of test from	11 a.m. to 5 p.m.
Class of Refuse	Household Refuse—	
	Weight of refuse destroyed (28 tons, 11 cwt., 1 qr.)	63,980 lb.
	,, ,, per hour	10,663·33 lb.
	,, ,, consumed per sq. ft. of grate area per hour	71·085 lb.
	Residual clinker (9 tons, 14 cwt., 1 qr.)	21,756 lb.
	Proportion of clinker by weight	34·00%
	Ashpit pressure (average)	1·49 in.
Water	Total water evaporated during test	49,561 lb.
	,, ,, per hour	8,260·33 lb.
	,, ,, ,, sq. ft. of heating surface per hour	7·89 lb.
	,, ,, ,, lb. of refuse actual	·7746 lb.
	,, ,, from and at 212° F.	·92 lb.
	Chimney pull at base (average)	1 in.
Gas Analysis	CO_2	Max. 14·9% Min. 10·5%
	O_2	,, 9·3% ,, 6·3%
	CO	,, 0·0% ,, 0·0%
	Combustion chamber temperature	2174° F.
	Feed water temperature, in tank	68°·48 F.
Steam Pressure	Steam pressure (average)	122·12 lb. absolute

Note.—By-pass damper from combustion chamber was open during the whole of the test, the boiler safety valve also blowing off during the greater portion of the time.

W. Naylor, A.M.I.C.E., F.C.S.
J. Haslam Walker, M.Sc. (Vict.).

Town-Planning Schemes.—Four town-planning schemes, relating to Stockport (Lancashire), Prestwich (Lancashire), Bidston (Cheshire), and Prenton (Cheshire), and covering an area of 10,000 acres, have been authorised by the Local Government Board.

Clydebank Water Filtration.—The Clydebank and District Water Trust have decided to filter the whole of the water supply and to accept the offer of the Paterson Engineering Company for the installation of mechanical filters at a cost of £9,750, which includes the cost of chemicals during the first year of the operation of the filters.

Gloucestershire Roads.—During the year ended March 31st last, the expenditure on the main roads in the County of Gloucestershire, Mr. E. S. Sinnott, M.Inst.C.E., the county surveyor, states in his annual report, amounted to £108,802. The total outlay in connection with the rural roads during the same period was £96,420 — an average of £92 19s. 7d. per mile, inclusive of salaries, improvements, bridges and footways. The county council now possess nineteen steam rollers and one motor roller, the oldest machine having been purchased in 1890, and the newest this year. During the present year it is proposed to purchase four new scarifiers. Stone required for 1913-14 is as follows: Granite or basalt, 54,931 tons; tarred granite or basalt, 7,187 tons; carboniferous limestone, 36,539 tons; tarred limestone, 2,902 tons; oolitic limestone, 3,800 tons; slag, 3,714 tons; Tarmac, 7,700 tons; Naishcombe quartzite, 3,800 tons; tarred Naishcombe quartzite, 850 tons; land stone, 80 tons; total, 121,503 tons.

Staines Joint Isolation Hospital.

NEW BUILDINGS TO SERVE FOUR DISTRICTS.

Yesterday afternoon witnessed the opening of a hospital which has been erected to serve the Staines registration area, comprising the rural district of Staines and the urban districts of Staines, Sunbury and Feltham for the isolation of infectious diseases other than smallpox. The need for isolation accommodation has repeatedly been referred to by the medical officers of health for the various constituent districts, the complaint being that, owing to the absence of any means of isolation in many small houses, secondary cases easily traceable to the first outbreak were continually recurring. This absence of means of isolation was also specially commented upon by Dr. Blaxall, a medical inspector of the Local Government Board, in 1891, and again by Mr. C. J. Huddart, an assistant inspector of the Local Government Board, in his report to that authority after an extended visit to the district in 1903 and 1905.

The site of the new hospital is situate at West Bedfont, in the parish of Stanwell, and is as nearly as possible in the centre of the Staines registration district. It is practically 4 acres in extent, the remaining 3 acres being reserved for possible extensions in the future. The soil is a somewhat heavy loam upon a bed of fine sand and gravel. It is one of the driest positions in the neighbourhood, the subsoil water level in summer time being some 16 ft. down, while in winter it is still some 7 ft. to 8 ft. below the surface.

The hospital consists of six buildings, comprising administration block, lodge and discharging wards, laundry and disinfecting block, scarlet fever pavilion, diphtheria pavilion and observation block.

ADMINISTRATION BLOCK.

This block is built in crimson facing bricks up to the stringing courses under the first floor, and backed with selected stocks. The whole of the rest of the walls are in selected stocks, except partitions upon the upper floors, which are in "Mack." The whole of the exterior above the stringing course is cement rendered and shingle cast.

The roofs are close boarded, felted with ½-ply congo roof felting, and covered with sand-faced crimson tiles. The ridges throughout are in 7-lb. lead.

Accommodation is provided for two large bedrooms, partly contained in the roof, and a large boxroom or spare bedroom upon the second floor. The large spare spaces in the roof have been utilised as tank rooms, boxrooms, and storage places. On the first floor there are ten bedrooms, the greater portion of which are arranged as single rooms to permit of separate accommodation for each nurse. Two bathrooms and one water-closet are also provided on this floor.

On the ground floor the tradesmen's entrance is provided at the kitchen lobby, as near as possible to the main entrance, while an enclosed yard screens the scullery, coals, &c. Accommodation is provided on this floor for a servants' sitting-room, which can be used as a kitchen when the hospital is not fully occupied, a nurses' dining-room, the matron's sitting-room and reception-room adjoining. At the western end of the corridor is a service door and hatch for convenience in approaching the matron's room or the doctor's dispensary.

On the north wall is the doctor's dispensary and consulting room, nurses' workroom, pantries, stores, lavatories and water-closets. A special service door is provided in the kitchen for serving meals, &c., for the wards.

LODGE AND DISCHARGING WARDS.

The lodge, &c., is built in crimson facings to plinth height, and above in selected stocks. The whole of the walls above plinth are cement rendered and shingle cast. The roof is similar in construction to the administration block. The accommodation provided in the lodge is a living-room, bedroom, scullery, pantry and general conveniences.

At the rear of the lodge are the discharging wards, consisting of undressing room, bath and dressing room.

LAUNDRY AND DISINFECTING BLOCK.

This block consists of a washhouse and ironing room, a disinfecting station, with infected and disinfected entrances, a mortuary, ambulance shed and large coal store.

The disinfecting chamber is fitted with one of Messrs. Manlove, Alliott & Co.'s L. O. steam disinfectors connected to a 6-h.p. boiler. The fittings in the mortuary were supplied by Messrs. Doulton & Co.

SCARLET FEVER AND DIPHTHERIA PAVILIONS.

These two pavilions are alike in design and finish. The accommodation consists of a female ward on the left of the entrance with eight beds, and a male ward on the right with six beds. A single private male and female ward is provided in each pavilion, which makes a provision of thirty-two beds in all.

Each bed stands in a cube of 12 ft. by 13 ft. and 13 ft. high, being the Local Government Board's regulation space of 2,000 cub. ft. per bed.

To each ward are annexes providing lavatory accommodation, &c., while the centre is occupied by the nurses' duty room, entrance hall, bathroom and linen store. Over the hall and nurses' duty room is a large room which can be made to serve all sorts of purposes.

The hospital fittings, baths, &c., are supplied by Messrs. Doulton & Co. The hot-water service in the annexes is supplied and fitted by Messrs. Ewart & Sons. The heating and ventilating is by Messrs. E. H. Shorland & Brother.

OBSERVATION BLOCK.

The external design of this building follows that of the last two, and provides for four beds on the cubicle system, with a central nurses' duty room. A deep verandah is provided to this building facing to the south-east, and the necessary offices are provided. The general detail or finish follows that of the other pavilions, and need not be repeated here.

GENERALLY.

The whole of the buildings are provided with an intercommunicating telephone service, all passing through the matron's room. The matron's room is also connected up to the main trunk telephone service.

It may be noticed that the accommodation provided does not equal the requirement of the Local Government Board—viz., one bed per thousand of population—but the board here made a small concession to the committee, or the wards would have had to provide for six more beds, with additional accommodation in the administration block.

DRAINAGE.

The sewage from the hospital will be treated at the outfall works of the urban council. There is a main sewer on each side of the sunk garden in the hospital grounds, picking up the lateral drains from each block of buildings. These sewers join at a manhole close to the laundry, and thence gravitate to two 100-gallon ejectors fixed at the rear of the rural council's depot. These ejectors lift the sewage, as well as that from the union workhouse, on to the outfall works. At the head of each main drain is a 6-in. ventilating shaft and a 200-gallon flushing tank, fitted with an Adams automatic discharge syphon, which can be timed to flush the sewers sufficiently as often as required. The whole of the sewers are laid with easily self-cleansing gradients. Each block of buildings is separately trapped from the main sewer, and is provided with its own system of ventilation. The down spouts from the eaves of the buildings for the most part discharge into 100-gallon dry brick soakaways, except those to the laundry and administration block roofs. These discharge into a system of drains which communicate with large underground storage tanks.

COST OF THE WORKS.

The total cost of the works, including buildings, fittings, sewers, roads, fences, laying out of grounds and furnishing, has been practically £16,400. A loan has been obtained for this amount, and is repayable in twenty-eight years.

Mr. G. W. Manning, LIC.R.I.B.A., surveyor to the Staines Rural District Council, is the architect of the buildings.

CORRESPONDENCE.

For every ill beneath the sun
There is some remedy or none;
If there be one, resolve to find it;
If not, submit, and never mind it.
—ANON., *circa* 1843.

LIGHTNING CONDUCTORS.

To the Editor of THE SURVEYOR.

SIR,—It is quite true that lightning conductors are very frequently left after installation for long periods without inspection and test, and get so far out of order as to be practically useless. So-called failures of lightning conductors—of which there are, on the average, less than a dozen cases out of 300 to 400 buildings damaged by lightning every year in this country—are as often due to neglect to keep the conductors in order as to want of expert knowledge in their application. But periodical inspection is not such a rarity as your note in last week's issue appears to imply. Besides annual testing of those on St. Paul's Cathedral and many other important buildings, I have to test conductors on the London County Council schools (about 600) every five years, and the churches in the Gloucester diocese (about 400) every three years. I have also a large number of other installations to inspect at intervals ranging from two to seven years, and I think public opinion is at last realising the necessity of this precaution.

The suggestions in Mr. Ernest J. Berg's paper before the Illinois Electric Association may possibly be appropriate to conditions existing in that State, though I doubt it, but they are certainly not applicable here. Far from the network of overhead wires affording ample protection, it is a fact that more cases of damage by lightning occur in towns than in rural districts, area for area. In a chart I am compiling, by marking the positions of lightning accidents, every town in England of any importance is clearly indicated by the numerous cases of damage by lightning that have occurred in it.

Mr. Berg's suggestion that a building 100 ft. by 50 ft. would require six rods is merely an arbitrary assertion of no value, for a structure of this size might have one or thirty points liable to be struck, and each would require to be protected; it depends on the configuration of the building.

Galvanised iron conductors may possibly prove effective in Mr. Berg's district, though Prof. McAdie, one of the highest authorities in the United States, advocates copper, and has attributed failures to the use of iron; but experience has shown that in our climate iron conductors, even if galvanised, are not sufficiently durable, and, far from being cheaper, they are much more costly than copper ones. The advantages claimed for iron are merely theoretical ones that will not stand the test of experience or even of experiment.

The suggestions as regards grounding of rods (or "earthing" them, as we call it) are more remarkable than reliable. All experts are agreed that the earth connection of a lightning conductor should have a low resistance. This can be obtained only by a considerable area of metal surface in contact with moist earth. Gas and water mains, having a very large extent of surface contact, afford the lowest possible resistance, and the pipes that lead from them into the buildings are therefore dangerous rivals to the lightning conductor, which must have a very much lower resistance when the building is so served than would be necessary if it were not. It is therefore not possible to fix a maximum resistance applicable to all cases, but one can say definitely that in no case would "driving a galvanised-iron gaspipe a few feet into the ground" give a sufficiently low resistance, and I do not think a man with practical experience would have made such a suggestion.

In this country we generally make earth connections with copper plates 3 ft. square, but sometimes have to use much larger ones; or we connect to water mains, though this should only be done under expert advice, as it is possible that difficult complications might be introduced.—Yours, &c.,

ALFRED HANDS.

91 Leadenhall-street,
London, E.C.
May 19, 1913.

ROADS IN THE MALAY STATES.

To the Editor of THE SURVEYOR.

SIR,—I should be obliged if, either by direct communication or through the medium of your paper, any of your readers could give me some reliable information regarding the type of road surface one should adopt to deal with—(1) Motor traffic; (2) case of erosion of surface by excessive rainfall; if tarred surfaces are commended, give some types used and data regarding them.—Yours, &c.,

FARQUHAR TAIT, ASSOC.M.INST.C.E., M.I.M.E.

Public Works Department,
Taiping, Perak,
Federated Malay States.
April 20, 1913.

[We responded, by direct communication, to Mr. Tait's request, and should be glad if readers could favour us with additional suggestions to meet his query.—Ed. THE SURVEYOR.]

Public Health Law.—This concise little work* has been prepared mainly for the use of all concerned in local government work who may find the larger books too elaborate. In twenty chapters it covers the ground sufficiently for its purpose, including such matters as highways, but omitting rating, elections, &c. For students it should be of assistance in preparing for examinations in Public Health Law, while the practitioner will find its arrangements well suited for easy reference.—*The Law Times.*

* A Manual for Municipal and County Engineers and Surveyors, Town Clerks, Clerks to District Councils, and other officers and members of local authorities. By S. G. Turner, of the Middle Temple, Barrister-at-Law, A.M.I.C.E., &c. London: St. Bride's Press, Ltd. Price 10s. 6d.

Assistants' and Students' Section.

CONDUCTED BY SYDNEY G. TURNER, ASSOC.M.INST.C.E.

All communications in regard to this page must be addressed to The Editor, St. Bride's House, 21 Bride-lane, Fleet-street, E.C. *Envelopes must be marked "Assistants' Section" in the top left-hand corner. Correspondents are invited to submit questions for consideration and answers to the questions which appear. For the contributions considered to be the most meritorious, one or more premiums in books will be awarded monthly. Diagrams must be drawn to scale on separate sheets, ready for reproduction.*

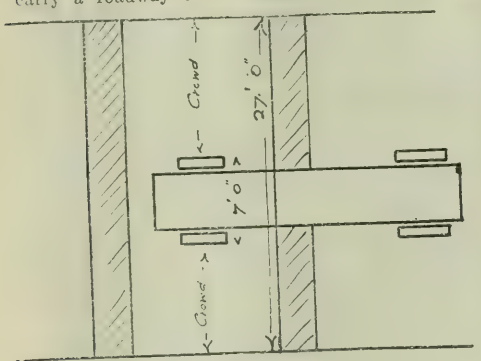
QUESTIONS.

This week answers are invited to the following questions:—

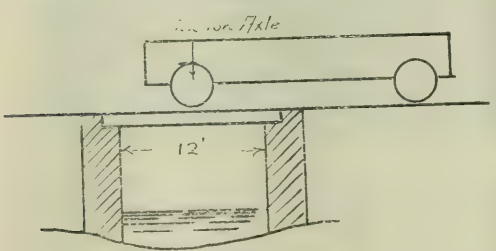
324. Oil Engines.—Assuming two engines of equal horse-power (4-h.p.), one an oil engine and the other a petrol, what would be the approximate cost for running each engine for fuel and repairs? How would the costs compare with each other, including first outlay and oil, repairs, &c.? In regard to efficiency, which engine would be the more efficient from an economic standpoint? ("Griffo.")

325. Air Compressors.—How is the size of an air receiver calculated in connection with an air compressor? Of what thickness of metal would it be made if (1) of cast iron, (2) wrought iron, assuming it had to withstand a pressure of from 15 lb. to 40 lb.? Give any further particulars regarding same. ("Griffo.")

326. Reinforced-Concrete Bridge Design.—Show a suitable design in reinforced concrete, either in a single slab or slab and beams, for a decking to carry a roadway over a bridge; span 12 ft., width



Plan.



Section.

27 ft., cover 9 in. macadam; brickwork abutments. Show the calculations by which the section, steelwork, &c., is arrived at. The maximum live load that can come on the bridge is a 22-ton axle, and the remainder of the bridge covered with a crowd. (G. B. S., *Hove.*)

327. Flow of Sewers.—State the advantages of egg-shaped and circular sewers, and give conditions under which such advantages would occur. Give proofs of velocities and discharge. (D. G. B., *Darlington.*)

328. Concrete Paving.—Give details of the construction of wooden moulds for concrete pavement slabs, and explain the method of using them. ("Beginner.")

329. Sewerage.—Using the generally accepted most accurate formula, at what gradients must 9-in., 12-in. and 15-in. pipe sewers be laid to give a uniform velocity of 4 ft. per second when flowing two-thirds full? ("M. C. E.")

[The Editor is at all times glad to hear from readers who desire to submit questions regarding matters of general interest, points of daily practice, &c., for insertion in the "Assistants' and Students' Section." Questions which are published are taken into consideration, as well as other matter, in awarding the Monthly Premium.]

REPLIES TO QUESTIONS.

321. Paving.—What is the correct method of setting out a paved road? Show how to work out the heights and cross-fall for a road 54 ft. wide, to be paved with a camber of 1 in 48 (channels each side are level). (P. G., *Chichester.*)

The following additional reply to this question has been received since our last issue:—

The best form of cross-section for a paved carriageway is one approximating to a hyperbola. This form of cross-section has a decided advantage over the segment of a circle often adopted, in which the breasting is unnecessarily inclined. The method of obtaining the cross fall is as follows:—

Let a = horizontal distance from vertex to channel in feet.

h = height of vertex above channel in feet.

w = width between channels in feet.

Camber = 1 in 48

$$\therefore h = \frac{a}{48}$$

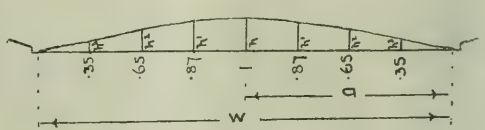


Diagram I.

The height h^1 at the distance $\frac{a}{4}$ from the vertex should be 0·87 h.

The height h^2 at the distance $\frac{a}{2}$ from the vertex should be 0·65 h.

The height h^3 at the distance $\frac{3a}{4}$ from the vertex should be 0·35 h.

Width of Road = 54 ft.

$$a = \frac{54}{2} = 27 \text{ ft.}$$

camber 1 in 48

$$\therefore h = \frac{a}{48}$$

$$= \frac{27}{48}$$

$$= \cdot 56 \text{ ft.}$$

$$h^1 = \cdot 56 \times \cdot 87$$

$$= \cdot 49 \text{ ft.}$$

$$h^2 = \cdot 56 \times \cdot 65$$

$$= \cdot 36 \text{ ft.}$$

$$h^3 = \cdot 56 \times \cdot 35$$

$$= \cdot 20 \text{ ft.}$$

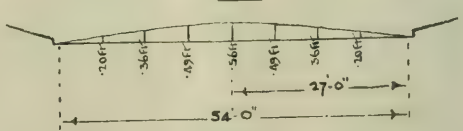


Diagram II.

(H. P. S., *Widnes.*)

Junior Institution of Engineers.—A week-end excursion to Brussels, from 4th to 7th July, has been arranged by this institution for the purpose of visiting the Ghent Exhibition.

Coast Erosion Observatory.—A new tidal observatory, the first of its kind in Great Britain, erected within a compact building in the vicinity of the Castle, Dunbar, was opened on Tuesday. The Ordnance Survey Department have selected this district as the most suitable on the East Coast of Great Britain, and one of the main objects of the observatory will be to afford a means of directly examining local movements of the coast-line if any occur.

The Surveyor
And Municipal and County Engineer.

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ROAD MAINTENANCE IN THE ISLE OF WIGHT RURAL DISTRICT.

In his first annual report on the maintenance of the highways in the Isle of Wight rural district, Mr. Leslie A. Cozens, the surveyor, draws the council's serious attention to the growth of mechanically propelled vehicles using the roads at the present time, both for pleasure and commerce. Mr. Cozens observes that the worst feature of mechanically driven vehicles is the manner in which they, with few exceptions, keep one track in the centre of the highways, rarely breaking track except to allow other vehicles to pass. He has on several occasions noted that even after a new section of material has been laid down, where there is a soft or inefficient subsoil, in a very short time it presents practically the same appearance as before the road was repaired, being rutted and pot-holey, the soft crusts of new material being beaten into pot-holes, and then further damaged, mainly by the hydraulic action of the wheels of motors descending quickly into the holes, which are partly filled with water. The surveyor suggests that drivers of these vehicles could help the repairs bill very considerably if they would show more consideration in this matter.

FOUNDATIONS.

The island being essentially a pleasure resort, Mr. Cozens says, it behoves them to maintain the highways in good order, adding that to do this in many places the roads require to be very considerably strengthened and brought into shape. Many of the highways lie between high banks over subsoils of clay and chalk, and are subject very considerably to seepage water. With the method and material at present employed, and with the destructive action of ever-increasing traffic on the main routes, it would take many years to strengthen the roads by the application of top coatings of gravel, as these topcoats were in nearly every instance called upon not only to take the wear and tear of the traffic, but to act as foundations also, and it is urged that for these roads and the more heavily used main routes a harder and better class of material should be obtained. By that the surveyor means that, if possible, selected weathered gravels of more uniform gaugings from the best and hardest pits should be obtained; also picked flints, where procurable, and where there is a suitable foundation of local materials, granites.

Pointing out the need for larger grants of local material in many districts, the surveyor shows that at present, if one section of a district is properly repaired, the remaining length of road has practically to be starved. He proceeds to remark that many of the roads on chalk subsoils require thicker top coats to enable them to withstand the action of frost, which seriously disturbs roads overlying these subsoils.

ROAD WIDENING BETWEEN HEDGES.

Many of the roads have been widened out between existing hedges by filling up low-water tables so as to give more available width with a better crossfall. In carrying out these works, which necessitate strengthening the foundations of the sides and covering with a top coat of material, the general practice in the past has been to take these amounts from the materials allowed for ordinary maintenance, thus materially decreasing the covering capacity of the quantities allowed, and Mr. Cozens suggests that this practice should be discontinued in the future, and special amounts allowed for these works.

He adds: "The widening out of the roads (where it can be properly done without doing away with useful and necessary watercourses) is a forward step, inasmuch as the traffic can safely use the sides as well as the centres of the roads. The more one studies the results of traffic on the roads the more one is convinced that traffic should be induced to spread and use the whole width of the road, and to do this the crossfall should be kept as flat as possible, always allowing fall enough from the centre to the sides to allow the surface water to drain away."

MILEAGES AND PERCENTAGES.

There are 232½ miles of main roads and 85¾ miles of district roads (exclusive of bridle roads) to be maintained, a total of 318¼ miles. The estimated quantity of materials of all kinds for the repair of the highways for the year 1912-13 was 31,700 yds., and the actual quantity of gravel used was 33,925 yds. (inclusive of the extra amount of gravel allowed under the Road Board scheme, 1,737 yds.), or an average of 106·6 yds. of gravel per mile of highway. No ballast, granite, or flint is included in these figures.

The amount of the "estimated" quantity of material ten years ago—viz., 1902-3—was 24,650 yds., and this has gradually increased up to the present date, showing a nett increase in ten years of 28 per cent.; but whereas in 1902-3 the amount of 24,650 yds. was, as far as can be ascertained, used wholly for resurfacing, in the estimate of 1912-13, 1,500 yds. of ballasting material and 600 yds. of binding material are included, reducing the percentage of increase of surfacing material to 20 per cent.

The amount expended on highway work for the past year is, as far as is at present known (inclusive of tar-spraying, Road Board work, repairs to sea walls and groynes, and special work at Blackgang, but exclusive of establishment and legal charges and salaries), £18,657, equalling £57 1s. 1d. per mile of road (318¼). Of this amount £17,424 was expended on main roads and £1,233 on district roads, or equalling £74 18s. 10d. and £14 7s. 9d. per mile respectively.

Taking the figures for actual ordinary maintenance of road surfaces, including tar-spraying, but excluding establishment and legal charges, salaries, special Road Board work, repairs to sea walls and groynes, improvements, and special work at Blackgang, the cost is £15,585, equalling £48 18s. 8d. per mile. Of this amount £14,686 was expended on main roads, and £898 on district roads, equalling £63 3s. and £10 9s. 8d. per mile respectively.

In comparison with this Mr. Cozens points out that the average cost per mile of the main roads for 1910-11 (two years ago) was in—

	Mileage.	Cost per mile. £
Bedfordshire (where there is a large percentage of secondary roads)	783½	72
Berkshire	381	146
Buckinghamshire	502	102
Hampshire	606	110
Kent	748	195
Surrey	223	331
Sussex (W.)	160	148
Sussex (E.)	411	182

SYSTEM OF LENGTHMEN.

Mr. Cozens suggests the consideration at some future date of the question of inaugurating for the

highways a system of lengthmen for the roads in place of the present foremen for districts, who should each be responsible for, say, 5 to 7 miles of road, according to the character of the roads and districts, and who would trim, quarter, and repair and maintain the length under his control.

He also suggests consideration being given to the appointment of an efficient man to work with each roller as a foreman spreader, to take charge of and be responsible for the working of the roller gang. This man would in each district be assisted by the road foreman, and a better result would be obtained by a system of this nature instead of as at present, when either an odd hand is picked up to help with this work or the foreman of the adjoining district is drafted to help, which means that his district is not properly supervised during that time. Mr. Cozens observes: "No matter how good a material may be, if it is inefficiently or badly spread the result must be otherwise than good—the road quickly becoming wavy, full of holes, and wearing badly."

SUGGESTION AS TO TRACKING.

In order to minimise somewhat the damage caused to the roads by tracking, the surveyor also asks the council to consider the advisability of procuring for those roads needing it a small quantity of granite, in order that when new sections of material are being laid a strip of this material, say 1 yard in width, might be spread in the wheel tracks to lessen the wear and tear on the present materials.

TAR-SPRAYING.

The year under review was most unfavourable for tar-spraying, and the usefulness of this work as a dust preventative could not be fully appreciated, as most of the summer months had a great deal more than the average amount of rainfall.

Satisfactory work has been made on gravel surfaces only where good subsoils, having good uniform top coatings, with fairly quick-drying surfaces, exist, but the work on clay subsoils has not been so satisfactory, the tar quickly churning up in wet weather and making the condition of affairs worse than before the roads were treated. "The usefulness of tarred roads," says Mr. Cozens, "will be enhanced by leaving untarred those lengths subject to the action of seepage water, in damp situations, and on clayey and defective subsoils. Surface tarring for its success depends on the nature of the subsoils, being of far greater value on gravelly, rocky, or sandy subsoils, whereas on clayey or damp soils the tar works up into slime in wet weather."

During the year a total length of nearly 24 miles of roads were tarred, together with 2⅔ miles of footways, these together containing an area of 232,656 sq. yds.

The cost of this work, as far as can be ascertained, was £1,506, equalling 1·55d. per sq. yd. (exclusive of instalment cost of spraying machine and allowing for tar in stock).

TAR GROUT.

A departure from the usual method of road making in the island was made at Yarmouth, when occasion was taken of the delivery of one of the cargoes of quartzite to lay this down in Yarmouth-square, thoroughly rolling in the stone dry, and then tar-grouting between the stones and filling with ¼-in. granite chips. This was allowed to settle for about fourteen days, when the loose chips were swept off and the whole given a top dressing of tar and chips. The approximate cost for granite, rolling, and grouting with tar and chips equals 24·3d. per square yard, plus 3·8d. per square yard for top sealing with tar and chips, or a total of 28·1d. per square yard, as against the 21.5d. for a granite and water-bound coat. While the work is stated to look very well, Mr. Cozens thinks a better result could have been obtained if the weather had been finer.

The Road Congress.—A special issue of The Surveyor will be published on June 20th.

Victorian Roads Board Staff.—At the first meeting of the Country Roads Board of the State of Victoria, Australia, it was decided to invite applications for a secretary, at £360 per annum, and two draughtsmen at £200 each. The Minister for Public Works announced that he had arranged for temporary offices for the board until accommodation could be found closer to his own department. He would keep in touch with the board and facilitate their labours as far as possible.

LOWER THAMES VALLEY DISTRICT SURVEYORS' ASSOCIATION.

ANNUAL MEETING AND DINNER.

The annual meeting and dinner of the above-named association was held on Saturday, the 3rd instant, at Sunbury-on-Thames, the district of which the president, Mr. Harold F. Coales, Assoc.M. Inst.C.E., is the engineer and surveyor.

SUNBURY SEWAGE WORKS.

The proceedings commenced with a visit to the Sunbury sewage works, where a most simple, yet effective, method of dealing with the sewage has been in operation for some fifteen years, during which time no complaints of nuisance or pollution have ever been received. Mr. Coales conducted the party over the works and explained that the sewage is conveyed to the works through two rising mains, of 12 in. and 10 in. diameter respectively, by means of ejectors situated in various parts of the district. Upon arrival the sewage is passed through screening chambers, each containing two screens, one of ¾-in. mesh and the other of ½-in., and the treatment thereafter is entirely by broad irrigation, there being no detritus tanks, septic tanks or filters of any kind. After screening the sewage is conveyed by carriers over the land and discharged at the various points desired. The farm, which is let to a market gardener at a rental of 30s. per acre, consists of about 14 acres, and is divided into six sections, each section being sloped so that the liquid passes equally over the whole of the land. The council are in no way responsible for damage to crops, but there has as yet been no complaint from the farmer.

STAINES JOINT HOSPITAL.

A visit was next paid to the Staines joint hospital at Ashford, an illustrated description of which is given elsewhere in this issue. The members and their friends were welcomed by the chairman of the board of management (Mr. Harry Fear, J.P.), and then, under the guidance of the architect, made an inspection of the whole of the buildings.

FERRO-CONCRETE SCHOOL BUILDINGS.

Later an inspection was made of a recently erected Poor-law school in ferro-concrete, designed by Mr. Manning for the Staines Board of Guardians. The external walls of this buildings are of 5-in. hollow clinker breeze blocks on a concrete plinth, supported at intervals by 14-in. by 9-in. rebated reinforced concrete piers, which also support the roof. The plans when submitted to the Local Government Board were approved almost entirely without reservation, and, although the building represents an entirely new type of construction, practically no defect has become apparent. The cost of the building, fitted ready for occupation, and including all fees, was £2,260, this being at the rate of 6½d. per cubic foot, or £45 per head.

Before leaving Ashford the party were shown the gauging chamber and recorder installed for the purpose of measuring the quantity of sewage discharged from the Staines joint workhouse into the Staines Urban District Council's system.

DINNER.

In the evening, at the "Flower Pot Hotel," Sunbury, the following members and friends sat down to dinner, Mr. Coales occupying the chair: Messrs. H. F. Coales (Sunbury), president, R. Wilds (Walton), vice-president, J. W. Croxford (Brentford), hon. secretary and treasurer, J. J. Crawshaw (Weybridge), H. C. Fread (Esher), E. Willis (Chiswick), J. Stevenson (Molesey), S. H. Chambers (Hampton), J. Roebuck (Eton), R. H. Jeffes (New Malden), M. Hainsworth (Teddington), William Fairley (Richmond), F. W. Pearce (Twickenham), A. Gladwell (Eton), Councillor H. Fear, J.P., chairman Staines Joint Hospital Committee, R. R. Robbins, J.P., chairman Staines Rural District Council, G. W. Manning (Staines), Councillor J. Clements (Brentford), Councillor G. Stevens (Feltham), Thomas Cole (secretary Institution of Municipal and County Engineers), F. Sadler (Acton), Councillor W. H. Lucas, J.P., chairman Sunbury Urban District Council, Councillor H. H. Allen (Sunbury), Councillor D. M. Southerland (Sunbury), Councillor W. W. Bolton (Sunbury), and H. T. Wakelam (Middlesex).

Mr. E. Willis (Chiswick), in proposing the toast of "The President of the Lower Thames Valley District Surveyors' Association," referred to the un-

tiring efforts of Mr. Coales, to which was due in such a large measure the success which had attended the work of the association during the past year.

Mr. Coales, replying, thanked the members for the unfailing support accorded him, and paid a well-deserved compliment to the excellent work of Mr. Croxford, the secretary of the association.

"The Lower Thames Valley District Surveyors' Association" was proposed by Mr. F. W. Pearce (Twickenham), who remarked that since the formation of the association fifteen years ago by Mr. Hainsworth, of Teddington, it had been an entire success because the members worked together without jealousy, and helped by their meetings to advise each other when in difficulties, all of which was for the benefit of the local authorities, whose servants they were.

Mr. Coales responded, and endorsed what had been said by Mr. Pearce. Since the inauguration of the society he had learned much from his connection with it, of which his council had the benefit.

The toast of "The Institution of Municipal and County Engineers" having been proposed by Mr. G. W. Manning (Staines), Mr. H. T. Wakelam responded, and said that, although at the first meeting of the institution he attended, held at Cheltenham, there was a smaller attendance than at the first meeting of the Lower Thames Valley District Surveyors' Association, they now had 1,511 members.

Mr. R. H. Jeffes (New Malden) proposed "The Visitors," and Mr. W. H. Lucas, J.P. (chairman Sunbury-on-Thames Urban District Council), responded, and referred to the high esteem in which Mr. Coales was held by the Sunbury Urban District Council.

WORK OF THE ASSOCIATION.

"The Vice-president and Honorary Secretary and Treasurer" was proposed by the President, and responded to by Mr. Wilds (Walton-on-Thames), the vice-president, and Mr. J. W. Croxford (Brentford), the honorary secretary and treasurer. The latter thanked the president for the kind remarks he had expressed regarding him, and said it gave him great satisfaction to know that his efforts met with such appreciation. During the present session a short code of rules had been formed, and he had already been approached by the secretary of a newly-formed association of a similar nature in the South-west of England, to whom he had forwarded a copy of this code of rules. Although a comparatively small association, they were very much alive, and the following brief summary of the work of the association during the past session might be found interesting: Seven meetings had been held, in addition to the visits which they had enjoyed that day. Summer visits would be held, the first being arranged for June 14th, when members would inspect the making of blocks for building purposes from clinker and cement, and would also make an inspection of roads carried out under various methods of construction. The meeting would be held at Brentford and Acton, and arrangements were being made that the association might examine the foundations of the new Kingston Bridge. Papers had been read upon the following subjects: (1) "Notes upon the Effect of Intercepting Traps in House Drainage," by Mr. Willis, Assoc.M.Inst.C.E.; (2) "The Control and Inspection of New Buildings," by Mr. Sadler. The following matters had been discussed with considerable advantage to members who were present at the meetings: The Daylight Saving Bill; the employment of permanent workmen on work carried out by loan; means of escape from factories in case of fire; the question of drains and roadways in garden cities which are contained in one curtilage, and the application of the by-laws and Acts of Parliament; as to what constitutes a new building; the construction of public mortuaries; the provision of hydrants in case of fire; the ownership of subsoil under roadways under various conditions; fireproof roofing materials; vacuum road cleaners; reinforced concrete; the making up of private streets where the work has to be carried out in two or more districts; the removal of clinkers from laundries; the effect of motor omnibuses on road surfaces; the testing of gas; road surfacing materials of various kinds; temporary floors for swimming baths, &c.; the building line of old roads; the erection of temporary buildings. The association had also discussed various Bills before Parliament affecting the area represented by the membership. He expressed his appreciation of the excellent arrangements which the president had made for that day's gathering, and thought he should be congratulated, not only upon this, but upon the large amount of work covered during the session, as well as upon the excellent attendance at the meetings.

NEW SEWAGE DISPOSAL WORKS AT HORBURY.

VISIT OF ENGINEERS.

A visit of inspection of municipal engineers and others was made to the Horbury (Yorks) Sewage Disposal Works on Friday last. The works have recently been reconstructed and enlarged at a cost of some £10,000, from the plans and under the supervision of Mr. J. H. Drew, engineer and surveyor to the Wath-on-Dearne Urban District Council, and until recently engineer and surveyor to the Horbury Council. A number of interesting and novel features characterise the works, among which are the construction of the tanks and filters in ferro-concrete on piers which have been rendered necessary owing to the liability of the site to flooding from the adjacent river Calder. Among those present were Dr. Calvert (chief chemist and deputy inspector to the West Riding Rivers Board); Messrs. J. H. Drew (Wath-on-Dearne Urban District Council); Frank Massie (Wakefield Rural); E. B. Martin (Rotherham); C. Lund (Cleckheaton); T. Henry (Retford Rural District Council); A. Rothera (Liversedge); F. Hutchinson (District Rivers Board inspector); R. Payne (Wath); Tetley, J.P. (chairman Horbury Urban District Council); C. Chambers Smith (Westminster); G. H. Shipley (Leeds); E. Schofield (clerk of works to the Horbury Urban District Council); D. Jones (Yorkshire Hennebique Construction Company); R. Ames (Ames Crosta Engineering Company); F. Naylor (Messrs. Naylor Brothers); C. H. Lester; J. Mills; and W. Flinders.

At the close of the inspection Mr. Frank Massie tendered the thanks of the visitors to Mr. Drew, the engineer for the scheme, and the chairman and members of the Horbury Council for giving them the opportunity to inspect the works. He wished to compliment Mr. Drew upon the very capable engineering skill he had shown in designing the works, and for the successful manner in which the work had been carried out. He had had two difficult problems to face: One was the liability of the land to flooding, and the other was to purify a sewage which was exceptionally strong, owing to the large amount of manufacturers' waste in it. He had surmounted the two problems admirably, and it must be a source of great gratification to the Horbury Council to know that they had obtained a scheme so economically and well carried out. Mr. E. B. Martin (Rotherham) endorsed the remarks of Mr. Massie, and pointed out that there was only one other sewage works in England where the special form of construction such as that which had been adopted at Horbury was to be found, and it was therefore all the more creditable that Mr. Drew's work had been so successful.

In the evening the visitors were entertained to dinner at the Hotel Metropole, Leeds, Mr. Councillor Payne (West Riding County Council and Wath-on-Dearne Urban District Council) in the chair, when further complimentary references were made to Mr. Drew, to the contractors, and to the chairman of the evening in speeches by Mr. C. Lund (Cleckheaton), Mr. T. Henry (Retford), Mr. Chambers Smith (Westminster), and others.

Scottish Meeting.—The programme of the meeting of the Institution of Municipal and County Engineers to be held at Dundee on Friday and Saturday, June 6th and 7th, was issued yesterday. The arrangements provide for a reception of members at the Victoria Art Galleries on the first day, at 12.15 p.m., by the Lord Provost, magistrates and town council, and their subsequent entertainment to luncheon by the corporation. The business proceedings will commence at 2 o'clock, when papers on "Reconstructed Dundee," by Dr. A. H. Miller, the chief librarian and curator, and "Maintenance of County Roads in Dundee District," by Mr. J. B. Robertson, road surveyor, Forfar County Council (Dundee District), will be discussed. Various municipal works will come in for inspection later in the afternoon, and in the evening the annual dinner of the Scottish District will take place. The following day (Saturday) will be devoted to visits to Dundee waterworks, Loch of Lintrathen, and Glamis Castle.

LOCAL GOVERNMENT BOARD INQUIRIES.

The Editor invites the co-operation of SURVEYOR *readers with a view to making the information given under this head as complete and accurate as possible.*

INQUIRIES HELD.

Abergavenny T.C. (May 14th. Mr. Edgar Dudley).—£1,260 for road improvement purposes.—One loan asked for was of £1,210 for the purchase of 26 High-street, and the other of £150 for widening Monk-street. It was stated that the corporation had bought the High-street freehold property for £1,160. The proposed width of the roadway was 40 ft. It was shown that on market days especially traffic was very congested at that spot.

Bath R.D.C. (May 1st. Mr. A. G. Drury).—17,000 for sewerage works.—The proposed works comprise a main outfall sewer taken along the valley of the Avon from Swainswick to Monkton Combe, and discharging into the sewers of the Bath Corporation, terms having been arranged with the corporation for dealing with the sewage. Mr. J. E. Willcox, of Willcox & Raikes, Westminster and Birmingham, explained the details of the scheme, which is a comprehensive one providing for the sewerage of Swainswick, Batheaston, Bathampton, Bathford, Claverton, Monkton Combe, and Combe Down, together with a portion of the city of Bath situated near Combe Down. In addition to the gravitation sewers, arrangements are made for pumping the low-level sewage at Batheaston by means of pumps run by electric motors. There was some objection to the apportionment of cost by Bathford, which was, however, withdrawn on an explanation being given as to the manner in which the apportionment had been arrived at.

Bristol T.C. (May 15th. Mr. Edgar Dudley).—£6,412 for street widenings and improvements.—The thoroughfares concerned are Chalk-road, St. George, Windmill Hill-terrace, Bedminster (where it is proposed to pay £1,000 for the purchase of property), West-street, St. Phillip's, Fox-road, Baptist Mills, Canon-street, Bedminster, Kingsland-road, Cheltenham-road, and Stapleton-road. With respect to Windmill Hill-terrace the inspector said he would like some further information as to the value of the property. The city engineer, Mr. L. S. McKenzie, said they would have liked to get the property a little cheaper, but that was the lowest price they could possibly obtain it for. He must admit they ought to have got it a little cheaper. He pointed out that £1,500 was wanted at first. The inspector asked on what basis they suggested the land was worth £1 15s. 10½d. per sq. yd. Mr. McKenzie replied, that if they could have got it for £850 they would have considered it a fair bargain. The real point was the danger at that narrow spot. Mr. Dudley: That is not the point in my mind. How is this £1,000 arrived at? The city engineer: Rather on the basis of what we are paying in the neighbourhood.

Coventry T.C. (May 20th. Mr. M. K. North).—£3,000 for the purchase of the Craven Arms and two shops adjoining, for the widening of High-street.—The inspector asked about the price, and the city engineer (Mr. J. E. Swindlehurst) replied that the price of £28 per square foot was fair, considering what had been paid for buildings in the same street before. There was no opposition to the scheme.

Croydon T.C. (May 14th. Mr. A. A. G. Malet).—This was an inquiry for sanction to a scheme for the construction of a motor relief road between Thornton Heath and Purley, to take all through traffic, and to that extent reduce the chronic congestion in the narrow main street of the town, where 10-mile speed limits for motorists are in force. The road, nearly 4 miles in length, will take an almost straight course across what is at present open country. It will be a slightly shorter route than through the town, and, being of an average width of 60 ft., no special speed limit will be imposed. The total cost of the scheme is estimated at £55,493, towards which the Road Board has promised £30,000 and the Ecclesiastical Commissioners £5,500, the road passing through an undeveloped estate of theirs. After allowing for these contributions, and a small sum to come from the London and Brighton Railway Company, the estimated cost to the ratepayers of Croydon is put at £19,743. The plans include two new railway bridges, one of which will abolish the present level crossing over the Croydon and Wimbledon line at Waddon Marsh. Mr. E. F. Morgan, borough road surveyor, in detailing the negotiations with the Road Board, said their opinion was that this was a "wonderful opportunity," because of the quantity of ground available without purchase and demolition of property.—The evidence was continued at adjourned sittings of the inquiry, extending over many days. Mr. Jesse Ellis, vice-chairman of the National Traction Engine Owners' and Users' Association, said that that body passed a resolution unanimously in favour of the new road. It would be a great boon to all drivers of heavy motor vehicles. Mr. George Noble, secretary to the National Cyclists' Union, said he was sure the majority of cyclists would much prefer the new road instead of the crowded main road, and Mr. W. Burke, secretary to the Cyclists' Touring Club, gave similar evidence. Mr. A. E. Brassington, traffic manager, Eastern Motor Wagon Company, said the road was needed, and similar testimony was given by Mr. W. A. Codd, chief engineer at Selfridge's, who is in charge of the firm's motor vans. Both said their drivers would be instructed to use the new road. The inspector stated he had reason to believe that the Road Board would increase their contribution by £16,000 if necessary. Mr. Robert Chart, the district council's highway surveyor, said the Russell-road exit at Purley was most dangerous on account of the narrowness of the carriageway, but more particularly owing to the cross traffic from Godstone-road. He produced a suggested plan showing a deflection of the road in a more south-westerly direction from Coldharbour-lane, saying he thought it offered considerable advantages over the corporation's scheme; but Mr. S. Jacobs, assistant town clerk, said this scheme had been considered and abandoned on account of the gradients. Mr. Chart mentioned that the daily average of vehicles for the week between 8 a.m. and 8 p.m. at the corner of Godstone-road was 4,364. In answer to supplementary questions put by the inspector, Mr. Morgan, borough road surveyor, admitted that the bridge at Waddon Marsh-lane was designed for a double line, although there was only a single line now. The cost was estimated at £5,225, and of Epsom-road Bridge at £4,335, and the railway company offered no contribution beyond £250. Both bridges would vest in the railway company and be out of the corporation's control, but the corporation would have to maintain the roads over them.

Darlington T.C. (May 15th. Mr. R. H. Bicknell).—£1,919 for the extension of the Borough-road stone-yard.—It was explained that it is proposed to acquire about 4,620 sq. yds. of freehold land with a cottage, stables, and other buildings erected thereon, adjoining the existing yard.

Evesham and Pebworth Joint Water Committee (May 14th. Mr. W. O. E. Meade-King).—£13,499 for purposes of water supply.—This scheme provides for augmenting the present Evesham Villages scheme which was carried out in 1905. Mr. Willcox, of Willcox & Raikes, Westminster and Birmingham (engineers), explained that the scheme embraced the supply to the villages of Aldington, Aston Somerville, Bretforton, Church Honeybourn, Cleve Prior, Cow Honeybourn, Great and Little Hampton, Hinton, North and Middle Littleton, Offenham, Pebworth, Sedgebarrow, and South Littleton, and comprised the provision of 17¾ miles of mains for the purpose of bringing water from springs at Stanway on the Cotswolds, recently acquired by the Joint Committee from Lord Elcho, and for the supply of the additional parishes now proposed to be included in the scheme—viz., Hampton, Badsey, Aldington, Offenham, and Wickhamford. Mr. E. H. Wadams, the clerk to the Joint Committee, explained the terms on which the springs (which yield over 500,000 gallons of water per day, of exceptional purity) have been acquired and the apportionment of cost between the parishes. There was some opposition by the parish of Hampton, on the grounds that they may shortly be incorporated with Evesham. The total area served by the scheme is about 15 square miles.

Hinckley U.D.C. (May 19th. Mr. Courtenay Clifton).—£2,000 for the erection of twelve workmen's dwellings.—The clerk to the council, Mr. A. S. Atkins, gave the necessary particulars as to the necessity of the houses, and the surveyor, Mr. E. H. Crump, ASSOC.M.INST.C.E., explained the details of the accommodation and cost of the proposed dwellings, and presented a balance-sheet of the estimated receipts and expenditure. From this it appeared that the suggested houses, which are of the five-roomed type, with three bedrooms, will be let at 5s. per week. The houses will be just self-supporting after

all expenses have been paid in connection with repayment of principal and interest, rates, insurance, and empties. It was stated that there was at present not one single empty house in the town. There was no opposition to the scheme.

Marston Sicca R.D.C. (May 13th. Mr. W. O. E. Meade-King).—£850 for the purpose of water supply. —The scheme provides for laying mains for the supply of the village of Marston Sicca, and provision will also be made for extending the mains in future to the village of Dorsington. The water supply is to be obtained from the Evesham and Pebworth Joint Water Committee's scheme, for which Messrs. Willcox & Raikes, of Westminster and Birmingham, are the engineers.

Middlesbrough T.C. (May 15th. Mr. R. H. Bicknell).—£3,920 for paving Commercial-street with whinstone setts.—The town clerk (Mr. Preston Kitchen) said the very dilapidated condition of the street made it a matter of urgent necessity for some reconstruction work at once to be carried out. It was proposed to entirely reconstruct the carriageway with whinstone setts on a foundation of 6-in. concrete. Mr. S. E. Burgess, borough engineer, gave the necessary particulars of the proposed work.

Oundle U.D.C. and R.D.C. (April 30th. Mr. W. W. E. Fletcher).—£1,500 to provide additional accommodation at the infectious diseases hospital at Wood-lane, Oundle. The urban council applied for sanction to borrow £1,200, and the rural district council £300.—It was explained that the proposal was to erect a permanent hospital for eight beds, the rural council to provide a sum of £300 and the urban district council £1,200. On the completion of the scheme the rural council was to pay three-fourths of the cost of the upkeep and the urban the remaining quarter.

Scarborough T.C. (May 13th. Mr. R. H. Bicknell). —£1,000 for the draining of Peasholme undercliff in the North Bay.—The inspector pointed out that with respect to £742 of the total amount of the loan they had not—and could not have—any precise drawings. The corporation should ask the board to sanction the loan of £258, and later the borough engineer could give a plan showing where the drains had been laid, the retaining walls erected, and the terracing done. The town clerk (Mr. Sydney Jones) said that would suit the council's purpose admirably. They would be content at present if the board would sanction the loan for £258.

Swaffham R.D.C. (May 19th. Mr. W. H. Collin).—£1,097 for the purpose of erecting six working-class dwellings at Holme Hale. It was stated that the rents would be 3s. a week, and that there would be a deficiency of £20 a year to be provided out of the rates.

APPLICATIONS FOR LOANS.

Bourne U.D.C.—£950 for the erection of six working-class dwellings.

Eye T.C.—£650 for the erection of four cottages, and for sinking a well.

Flint C.C.—£2,600 for a new school.

Folkestone T.C. — £600 for paving with lithofalt blocks.

Hampshire C.C.—£2,509 for a new school.

Hastings T.C.—£743 for paving works.

Linthwaite U.D.C.—£24,500 for a housing scheme.

Maldens and Coombe U.D.C.—£710 for private street works in part of Coombe-gardens.

Maldon R.D.C.—£5,500 for a water supply scheme.

Norwich T.C. — £25,000 for the extension of the electricity works.

Ogmore and Garw U.D.C.—£5,000 for a housing scheme.

Paignton U.D.C.—£5,600 for laying out the foreshore at Preston.

Panteg U.D.C.—£850 for the erection of a swimming bath.

Pershore R.D.C.—£2,800 for the erection of sixteen cottages.

Petworth R.D.C.—£2,400 for workmen's cottages.

Radcliffe U.D.C. — £6,400 for street improvement works.

Sheffield T.C.—£400 for making footpaths.

Stratford-on-Avon T.C.—£600 for sewerage works, £1,500 for a reservoir, and £1,000 for two Bell's mechanical filters.

Tenby T.C.—£9,699 for the culvert scheme.

Thurnscoe U.D.C. — £1,325 for widening a bridge, and £1,450 for laying out the recreation ground.

Twickenham U.D.C.—£5,250 for wood paving works.

West Sussex C.C. — £1,927 for extensions to the Midhurst Grammar School.

Widnes T.C.—£20,000 for waterworks extensions.

Winsford U.D.C.—£1,000 for sewerage extensions.

Yarmouth T.C.—£3,800 for electricity extensions.

LOANS SANCTIONED.

Bridlington T.C.—£4,400 for seventeen years, and £600 for thirty years, for extensions to the electricity works.

Chadderton U.D.C.—£4,723 for works of sewerage.

Croydon T.C.—£3,500 for the purchase of property for road improvement purposes.

Dartford U.D.C.—£350 for the extension of the fire station.

Fareham R.D.C.—£12,831 for sewerage works.

Lowestoft T.C.—£3,000 for electricity mains, and £2,000 for house services.

Mansfield T.C.—£450 for a school site.

Normanton U.D.C.—£1,621 for repairing private streets.

Rochdale T.C.—£13,000 for street works.

Sunderland T.C.—£4,500 for the construction of a new street.

Sutton-in-Ashfield U.D.C.—£1,417 for works of sewerage.

Taunton T.C. — £1,722 for the erection of twelve workmen's dwellings.

West Sussex C.C.—£1,533 for a new school.

FORTHCOMING INQUIRIES.

MAY.	£
26.—**York.** For electricity works extensions (Mr. T. C. Ekin)	30,000
27.—**Great Crosby.** For the purpose of road widening (Mr. Edgar Dudley)	1,200
27.—**Hebden Bridge.** For the extension of the electricity works (Mr. T. C. Ekin) ...	3,250
27.—**Hythe.** For works of sea defence (Mr. R. M. Crosthwaite)	12,500
27.—**Narberth.** For works of water supply (Mr. R. G. Hetherington)	161
27.—**Sheffield.** For street and sewerage works (Major C. E. Norton)	41,790
27.—**Tiverton.** For the purpose of the gas undertaking (Mr. R. H. Bicknell) ...	2,900
28.—**Atherton.** For electric lighting purposes (Mr. T. C. Ekin)	5,500
28.—**Blackburn.** For street widening purposes (Mr. Edgar Dudley)	2,330
28.—**Brixham.** For works of street improvement (Mr. R. H. Bicknell)	2,750
28.—**Knutsford.** For works of road improvement (Mr. M. K. North)	5,000
28.—**Marsden.** For street and sewerage purposes (Major C. E. Norton)	8,251
28.—**Paignton.** For the provision of a depot (Mr. R. H. Bicknell)	1,600
28.—**Pembroke.** For the provision of machinery at the pumping station (Mr. R. G. Hetherington)	1,600
29.—**Blaenavon.** For the provision of a cemetery (Mr. R. G. Hetherington) ...	2,200
29.—**Colne.** For road improvement purposes (Mr. M. K. North)	1,349
29.—**Congleton.** For works of water supply (Mr. A. A. G. Malet)	360
29.—**Leyland.** For works of street improvement (Mr. Edgar Dudley)	279
29.—**Manchester.** For electricity and street purposes (Mr. T. C. Ekin)	76,133
29.—**Plymouth.** For street improvement works (Mr. R. H. Bicknell)	18,989
29.—**Wetherby.** For sewage disposal purposes (Major C. E. Norton)	400
30.—**Bradford.** For sewerage and housing purposes (Major C. E. Norton)... ...	11,840
30.—**Eccles.** For street works and the extension of pumping plant (Mr. A. A. G. Malet)	15,979

Municipal Work in Progress and Projected.

The Editor invites the co-operation of Surveyor readers with a view to making information given under this head as complete and accurate as possible.

The following are among the more important projected works of which particulars appear below: Buildings—Dunfermline £11,000, East Sussex £9,113, North Riding £6,000, Sheffield; housing and town planning—Houghton, St. Austell; roads and materials—Stafford £2,000, Swansea £55,000; sewerage and sewage disposal—Balbriggan, Cannock £12,270, Trowbridge £16,500; water, gas and electricity—Birmingham.—Particulars of other works projected will be found in our "Local Government Board Inquiries" pages.

BUILDINGS.

Anstruther T.C.—A scheme of alterations at the town hall, involving a probable expenditure of £320, is under consideration.

Bridgnorth T.C.—The question of restoring and improving the council chamber at a cost of something like £300 has been referred to a committee for further consideration.

Dumbartonshire C.C.—It has been decided to construct new sea walls, embankments, and relative works where necessary between Strone and Arrochar, Helensburgh and Garelochhead, and Finnart and Strone, at a cost of about £7,000.

Dumfriesshire C.C.—The council have approved of a draft order of the Local Government Board for the purpose of establishing a sanatorium for the treatment of seventy phthisical patients from the counties of Dumfries, Kirkcudbright, and Wigtown, and the burghs of Dumfries and Maxwelltown, under the National Insurance Act.

Dunfermline T.C.—Improvements are to be carried out at the central library at a cost of £11,000.

East Sussex C.C.—For the purpose of extending the wharfage and the storage accommodation at Newhaven, it has been agreed to purchase the necessary land, and erect buildings at an estimated cost of £9,113.

Harwich T.C.—Swimming baths, which have been erected near Commercial-road, were presented to the corporation on Saturday by Messrs. C. J. Wilson, G. M. Wilson, and Jas. Glenny, manufacturers, the ground on which the baths stand being also a gift from Messrs. Wilsons & Glenny (Limited). The erection of the baths cost £2,000.

Hastings T.C.—It has been agreed to erect two new shelter seats on the parade, one at St. Leonards and one at Hastings, at an estimated cost of £400.

Kilmarnock T.C.—It has been decided to provide accommodation for five additional nurses at the Kaimshill sanatorium.

Lambeth B.C.—The tender of Mr. W. Dallenger, at £265, has been accepted for the erection of a pavilion in Vauxhall Park.

Lichfield T.C.—The council have approved proposals submitted by the city surveyor, Mr. W. B. Chancellor, for improvements to the Guildhall, and for the conversion of the house adjoining into a new council chamber and municipal offices. The house was purchased a few years ago for £1,210, and the proposals of the surveyor involve a further expenditure of £2,790.

North Riding C.C.—The county hall at Northallerton is to be enlarged at an estimated cost of £6,000.

Panteg U.D.C.—The surveyor, Mr. H. R. Davies, has prepared plans for a public swimming bath, the cost of which he estimates at £850. The council have resolved to proceed with the scheme.

Richmond (Surrey) T.C.—The council are, when estimates of cost and possible receipts have been prepared, to consider the advisability of providing a floor for the new first-class swimming bath, so that the building may be let during the winter for badminton, public meetings, concerts and similar purposes.

Salford T.C.—In connection with the proposed purchase of a plot of land of about 65 acres for a sum of £2,650 for sanatorium purposes at Rose Hill, Marple, it was stated at the meeting on Wednesday last that it is intended to remodel the scheme, and that in the meantime the resolutions which had been recommended for adoption would be withdrawn.

Scarborough T.C.—The borough engineer, Mr. H. W. Smith, has received instructions to submit plans and estimates for an open-air swimming bath in South Bay.

Sheffield T.C.—The proposed new abattoir scheme has been adopted.

Southmolton T.C.—The plans of the borough surveyor, Mr. H. C. E. Rayner, for a new cattle market, have been approved.

Sunderland R.D.C.—The new infectious diseases hospital is being supplied with Shorland's warm air ventilating patent Manchester grates, patent exhaust roof ventilators and inlet ventilating panels, by Messrs. E. H. Shorland & Brother, Limited, of Failsworth, Manchester.

Yarmouth T.C.—The borough surveyor, Mr. J. W. Cockrill, has received instructions to report on a suitable site for and the cost of providing a crematorium.

HOUSING AND TOWN PLANNING.

Dalkey (Co. Dublin) U.D.C.—A scheme is to be submitted to the next meeting for the erection of twenty-five working-class houses.

Houghton U.D.C.—The scheme for building fifty houses under the Housing of the Working Classes Act has been carried a step further, the surveyor, Mr. J. W. Holbrook, having submitted an amended block plan showing the houses built in two long rows with a main front street instead of cross streets. By adopting this he estimates a saving of £110 in road-making, and it will give each house a uniform depth of 55 ft. instead of 50 ft. for the smaller houses.

Norwich T.C.—Certain premises in Barrack-street are to be converted into eight cottages at an estimated cost of £696, in accordance with the plans and specifications of the city engineer, Mr. A. E. Collins.

Prestatyn U.D.C.—Tenders are being invited for the erection of fifteen dwellings for workmen.

St. Austell R.D.C.—A housing scheme involving the erection of thirty-six houses has been adopted.

Spalding R.D.C.—Tenders are to be obtained for both brick and concrete houses.

Staffs C.C.—The medical officer of health, Dr. G. Reid, has prepared reports respecting the serious sanitary condition of the houses at Brownhills, Coseley, and Sedgley, and these have been forwarded to the urban district councils of those places with a request that they should inform the county council what steps they proposed to take to remedy the state of things described.

PARKS AND OPEN SPACES.

Hawick T.C.—The Moat Park is to be converted into a public park at a cost of about £335.

Paignton U.D.C.—The council have adopted the following estimate of the surveyor, Mr. C. O. Baines, for laying out the land and foreshore at Preston, which has been purchased for £4,467—viz.: Filling and consolidating, £1,200; tar-macadam promenade, £920 5s.; retaining wall at the back of the promenade, £450; model yacht pond, £222; digging, &c., £27 15s.; conveniences, £800; four shelters, £480; drainage, £800; contingencies and electric pump, £700.

ROADS AND MATERIALS.

Aberdeen C.C.—It has been agreed to comply with the Deeside District Committee's request to pave ¼ mile of the Ballater-Braemar road with random granite setts, by way of an experiment.

Barnard Castle R.D.C.—The council have approved a plan prepared by the surveyor, Mr. L. Simpson, for a road diversion to remove dangerous corners on the Cockerton main road near Spinford Bridge, the estimated cost being £653.

Bridlington T.C.—It has been agreed, subject to ratification by the Bridlington Rural District Council and the sanction of the Local Government Board, to widen Cardigan-road to 50 ft.

Durham R.D.C.—The council have accepted the offer of the Master and Governors of Sherburn Hos-

pital to give the land required to take off an awkward corner at Cassop Moor, and Mr. Oliver's tender, at £657, for taking off the hill, filling in the hollow, and re-making part of the road between Lowes Barn and Neville's Cross has been accepted.

Essex C.C.—It is announced by the county surveyor, Mr. F. J. Wood, that 1,913,598 super. yds. of main road will be surface-treated with tar, at a cost of £11,959, being an average of 1½d. per super. yard.

Hexham R.D.C.—It has been agreed that the maximum wage of the roadmen in the council's employ be increased to 24s. per week, but it has been left to the discretion of the three road surveyors as to which of the men should be brought up to the standard.

Kensington B.C.—The Improved Wood Pavement Company, Limited, are carrying out the work of repairing Elgin-crescent with creosoted wood blocks. The old creosoted blocks were laid twenty years ago.

Maldens and Coombe U.D.C.—Back Coombe-parade is to be made up at an estimated cost of £249.

Melton Mowbray U.D.C. — The surveyor, Mr. Edmund Jeaves, has been instructed to experiment with tar paving on the footpaths of a section of the town.

Newton Abbot U.D.C.—The surveyor, Mr. C. D. White, has been authorised to obtain tenders for the widening of the Torquay-road at Penn Iron Bridge. It is proposed to increase the width of the road from 16 ft. to 30 ft.

Salford T.C.—A sum of £487 is to be expended on road and footpath repairs at Pendleton.

Scalby U.D.C.—A grant of £185 has been made by the county council for works of road widening.

Southwark B.C.—It has been decided to accept the offer of the Road Board to make a free grant of £4,500 and a loan of a similar sum, free of interest, for two years for the purpose of carrying out a scheme of repaving in the borough.

Stafford T.C.—New streets are to be constructed on the Coton Field estate, at an estimated cost of £2,000.

Swansea T.C. — The Highways Committee have decided that the expenditure of £55,000 on the main roads of the borough shall be extended over three years.

Warwick R.D.C.—A report by the surveyor, Mr. G. F. Taylor, suggesting that application should be made to the Road Board for a grant for the maintenance of the highways, has been approved.

SEWERAGE AND SEWAGE DISPOSAL.

Balbriggan R.D.C.—The Local Government Board have written to the council calling upon them to proceed with a sewerage scheme without delay. The matter has been referred to committee.

Belfast T.C.—Instructions have been given for the preparation of an estimate of the cost of sewering a portion of the land acquired for the extension of the cemetery.

Birmingham T.C.—The General Purposes Committee have been authorised, after conference with the other authorities interested, to report to the council whether the continued existence of the Birmingham, Tame and Rea Drainage Board as a separate authority was now necessary, and in what manner the dissolution of the board and the joint sewerage district could be secured on equitable terms.

Cannock U.D.C.—The Local Government Board have approved of the proposed new works at the sewage farm, and suggested certain additions, which, with the increase in the cost of materials, will bring the total cost of the scheme to £12,270.

Chippenham U.D.C.—A public convenience is to be erected at the Town Bridge, near the site of the old Monkton spring, at a cost of £120.

Dalkey (Co. Dublin) U.D.C.—A sewerage scheme is to be submitted at the next meeting of the council.

East Grinstead R.D.C.—Main sewerage extensions are to be carried out at a cost of £894.

Edmonton (Alberta) T.C.—It has been decided to expend £400,000 on the work of extending the sewerage system.

Fareham R.D.C.—The Local Government Board have suggested certain amendments in the sewerage scheme, and conditionally upon these being carried out the scheme will go forward.

Gosport and Alverstoke U.D.C.—A chalet for women is to be constructed at a cost of £291.

Lanchester R.D.C.—The council have approved of a joint scheme with the Brandon Urban District Council for new sewerage works at Esh Winning, the proportion of the cost to be paid by Lanchester being £175, and by Brandon £134.

Linthwaite U.D.C.—The tender of Mr. A. Graham, of Huddersfield, at £885, has been accepted for the construction of the valley sewer.

Llandaff and Dinas Powis R.D.C. — Negotiations are proceeding with the Cardiff Corporation with respect to the terms for receiving the sewage of the council's district into the city sewers.

Rotherham R.D.C. — It is proposed to carry out sewerage extensions at Maltby at a cost of £2,064.

Runcorn R.D.C.—The proposed sewerage scheme, which has been sanctioned by the Local Government Board, has been reviewed by the council, who have decided to send the matter back to the Sewerage Committee.

Trowbridge U.D.C. — The Sewage Committee have accepted the tender of Messrs. H. Isley & Co. for the reconstruction of the sewage disposal works. The amount of the loan sanctioned for the scheme is £16,500.

WATER, GAS, AND ELECTRICITY.

Barrow-in-Furness T.C.—An additional gasholder is to be built, and main extensions carried out at an estimated cost of £12,654.

Birmingham T.C.—The Fire Brigade Committee recommend that the tender of Messrs. J. Dallas & Sons, at £11,285, be accepted for the new fire station at Aston.—The Tramways Committee recommend the purchase of seventy-five new cars, at a cost of £83,000, and ten motor-omnibuses and spare equipment, at a cost of £10,000.

Clogher R.D.C.—It is proposed to provide a new water supply for Aughnacloy at an estimated cost of £3,120.

Kirkintilloch T.C. — Progress is being made with the scheme for the erection of a new gasholder, at an estimated cost of £4,000.

Weston-super-Mare U.D.C.—A committee has been appointed to go into the question of the water supply with a view to a subsequent application for powers to the Local Government Board.

Wolverhampton T.C. — Converters, switchboards, and an extra high-tension switchgear are to be installed at the electricity works at a cost of £5,567.

MISCELLANEOUS.

Reading T.C.—During the past year the tramway undertaking earned a nett profit of £2,801.

Rhayader (Radnor) R.D.C. — The council have adopted a recommendation from the surveyor, Mr. J. Powell, that the best roadmen should have their wages increased from 16s. to 18s. per week.

PERSONAL.

Mr. A. A. Turriff, burgh surveyor of Elgin, has had his salary increased by £20 a year.

Mr. James H. O'Connor, of Mountwelter, has been appointed assistant county surveyor of Wexford.

Mr. W. L. B. Smale, of Exeter, has been appointed highway surveyor for the northern district of Liskeard.

Mr. W. B. Wormleighton, surveyor to the Loftus Urban District Council, has had his salary increased by £20 a year.

Mr. Peter Sinclair, of Carnoustie, has been appointed surveyor and sanitary inspector to the Buckhaven Town Council.

Mr. E. H. Crump, ASSOC.M.INST.C.E., surveyor and waterworks engineer, Hinckley, has been elected a Fellow of the Surveyors' Institution.

Mr. J. W. Plews, surveyor to the Ripon Rural District Council, will attend the International Road Congress as the council's representative.

Mr. E. J. Marsh, surveyor to the Church Stretton Urban District Council, has been appointed manager of the newly-acquired waterworks undertaking.

Mr. R. J. Moores, assistant to Mr. S. H. Chambers, surveyor to the Hampton Urban District Council, was on Tuesday voted an increase of salary.

Mr. T. H. B. Heslop, county surveyor of Norfolk, has been deputed by the Eastern Highways Committee of the county council to attend the International Road Congress.

Mr. Wilfred H. Veal, assistant borough surveyor, Falmouth, has received an appointment in the office of the borough surveyor of Poole. There were sixty-two applications for the position.

Mr. W. Noble Twelvetrees, who is well known as an authority on reinforced-concrete construction, will become editor of *Ferro-Concrete* as from the July issue of that publication—which commences a new volume.

Mr. James Hembrow, architectural assistant to the borough engineer of Chelmsford, has been appointed town planning assistant to the Edmonton Urban District Council, at a commencing salary of £140 per annum.

Mr. Walker, for seventeen years building inspector to the Wimbledon Town Council, has had a well-deserved increase of salary to £3 15s. per week. In the course of the discussion it transpired that Mr. Walker's hours of work were from 7 a.m. until 5 p.m., and that he received an allowance of 2s. 6d. per week for a bicycle.

Mr. Wilfred V. Davies, clerk in the office of Mr. R. H. Clucas, the borough engineer of Kingston, Surrey, has been appointed to a similar position under Mr. H. C. Fread, surveyor to the Esher and the Dittons Urban District Council, in succession to Mr. W. F. Mason.—Mr. T. L. Johnson has also been appointed clerk of works in connection with the sewage contract of the Esher authority.

Mr. John H. Blizard, ASSOC.M.INST.C.E., of 11 Victoria-street, Westminster, S.W., has been appointed by the Windsor Rural District Council to act as joint engineer with Mr. A. M. Fowler, M.INST.C.E., in the execution of the works of main sewerage for the Sunninghill and Sunningdale (Berks) district, which are now about to commence. The appointment has also been approved by the Local Government Board. Mr. Fowler is the engineer of the scheme.

With reference to our statement last week in this column that Mr. E. P. Richards, M.INST.C.E., was about to sever his connection with the Calcutta Improvement Trust, which we gave on the authority of a correspondent, we are asked to say that that gentleman is coming home on sick leave, and that he has not severed his connection with the trust. He is at present engaged on the preparation of a report to that authority.

FOR OTHER ADVERTISEMENTS

See End of Paper.

PUPIL.—The City Engineer and Surveyor of Lichfield has a vacancy in his office for a pupil. Particulars of work being executed and salary paid can be had upon application. (478)

ARTICLED PUPIL.—The Borough Engineer of Woolwich has a vacancy for an articled pupil. Extensive Metropolitan area. Important works in hand.—Apply J. Rush Dixon, M.INST.C.E., Town Hall, Woolwich. (481)

THE URBAN DISTRICT COUNCIL OF BARNES.

SURVEYOR'S CLERK.

Applications are invited for the appointment of a Second-Class Clerk in the Engineer and Surveyor's Office.

Candidates must be good shorthand writers and typists, and preference will be given to those with previous experience in a Municipal Surveyor's Office.

The salary will be at the rate of £70 per annum, rising by annual increments of £8 to a maximum of £126.

Applications, in candidate's own handwriting, stating age and experience, accompanied by copies of not more than three testimonials of recent date, and endorsed "Surveyor's Clerk," to be sent to the undersigned not later than Saturday, 31st May, 1913.

Canvassing will disqualify.

G. BRUCE TOMES, ASSOC.M.INST.C.E.,
Engineer and Surveyor.

The Council House,
High-street, Mortlake, S.W. (476)

SURVEYOR'S ASSISTANT wanted at once; must be well up in outdoor Land Surveying; capable of using the Theodolite; neat draughtsman. Salary, 30s. to 40s. per week.—Apply Box 1,254, office of THE SURVEYOR, 24 Bride-lane, Fleet-street, E.C. (482)

WELLINGBOROUGH.

REINFORCED-CONCRETE BANDSTAND.

The Urban District Council of Wellingborough are prepared to receive Tenders for the Construction of a Reinforced-Concrete Bandstand in the Castle Fields Recreation Ground.

Plans and Specifications can be obtained upon application to the undersigned upon payment of a deposit of 2 guineas, which will be returned on receipt of a *bonâ-fide* Tender and the return of the documents.

Tenders, sealed and endorsed "Tender for Bandstand," must be delivered to me not later than 10 a.m. on Monday, June 9, 1913.

The lowest or any Tender will not necessarily be accepted.

E. YOUNG HARRISON, ASSOC.M.INST.C.E.,
Engineer and Surveyor.

Council Offices,
Market-square,
Wellingborough. (480)

ESSEX COUNTY COUNCIL.

HIGHWAYS COMMITTEE.

The above Council are desirous of receiving Tenders for:—

(1) Resurfacing the undermentioned roads with tarry, bituminous or asphalt Macadam, laid to an approved thickness;
(2) The maintenance of this Macadam for a period of 3 years after the completion of the Contract.

The roads referred to are:—

(1) London to Colchester—from Hare Street to Brentwood; length, 6 miles; area to be resurfaced, 60,000 sq. yds.;
(2) London to Southend—from Barking to Grays; length, 9·62 miles; area to be resurfaced, 102,000 sq. yds.

Tenders are to be delivered not later than 12 noon on Saturday, May 31, 1913, addressed to the County Surveyor, Chelmsford.

Forms of Tender can be obtained upon application.

The County Council reserve the right to divide the proposed work between several contractors, and to accept the part of a Tender.

The Contractors whose Tenders are accepted will be required to supply guarantees in accordance with the terms of the Contract for the execution of the work.

PERCY J. SHELDON, M.INST.C.E.,
County Surveyor.

Chelmsford.
May 21, 1913. (479)

TEDDINGTON URBAN DISTRICT COUNCIL

SEWAGE PUMPING MACHINERY.

The Council are prepared to receive Tenders for the Supply and Erection of Pumping Machinery, Auxiliary Plant, Pipework, &c., at their Sewage Disposal Works, Broom-road, Teddington.

The Specification and Drawings in two Sections—viz.,

Section A—Worthington Pumping Engine, or Alternative;
Section B—Centrifugal Pumps, Auxiliary Plant, Pipework, &c.—

may be seen, and Forms of Tender and Specification obtained, on application to Mr. William Fairley, Consulting Engineer, Parliament Mansions, Victoria-street, Westminster, on deposit of a crossed cheque for £5, made payable to the Council, which deposit will be returned on receipt by the Council of a *bonâ-fide* Tender and the return of all documents issued.

Copies of the Drawings and Specifications may also be inspected at the office of Mr. Marshall Hainsworth, Surveyor to the Council, Public Offices, Teddington.

Sealed Tenders, on the forms provided by the Council, to be received by the undersigned not later than noon on Monday, the 16th day of June, 1913.

The Council do not bind themselves to accept the lowest or any Tender.

(By order)
G. H. SALMONS,
Clerk to the Council.

Public Offices,
Teddington.
May 22, 1913. (477)

CLEFT CHESTNUT FENCING.

A wire-bound cleft chestnut fence specially intended to meet the requirements of surveyors, and one that does not spoil the rural aspect of the country—an important point—has been placed on the market under the above name by Akonia, Limited, the well-known inventors and makers of Akonia, of Lancashire, and Birkbeck Bank Chambers, London.

Among the distinguishing features and advantages of this fencing which must appeal to borough and rural authorities, the following may be particularly mentioned: It is easily fixed, as shown herewith, by means of pulley blocks. It is unclimbable, quickly erected, adaptable for use on irregular ground, and easily removable without injury.

It is made at the firm's fencing works in Kent, and nothing but the best grown chestnut undergrowth is used. It is supplied in various patterns and heights and the second view shows one that is very much appreciated and very popular.

The prices run from 8d. to 1s. 10d. per yard, according to the height, the latter varying from 2 ft. 6 in. with pales 4 in. apart, to 6 ft. with pales 4 in. apart and three strands of wire.

The wire used is of the best galvanised description and the pales are stapled top and bottom, the intermediate posts being driven into the ground 2 ft. and creosoted. Hand and field gates to match are also supplied and the material is guaranteed to last about twenty years. When desired the fencing can be treated with wood preservative, and the Company also undertake the fixing, although the erection is so simple that any handy man can carry it out.

Among the various purposes for which the surveyors' fencing is suitable are: main-road fencing, side roads, footpaths, recreation grounds, school enclosures, sewage farms, allotments, hospital grounds, asylums, cottages, and parks. The fencing has been adopted by many urban and rural authorities. For tree-guards in parks and elsewhere it should be particularly suitable. A complete illustrated catalogue and further particulars will be sent on application.

An Example of the New Fencing.

Cleft Chestnut Tree Guards.

Sheffield's Municipal Wage Bill.—Sheffield City Council recently approved the proposal to grant increases of wages to 1,572 labourers in the corporation departments. This will cost £7,252 per annum, necessitating a penny rate.

Drainage Works and Sanitary Fittings.—A third edition, revised and brought up to date, particularly as regards the questions of concrete sewers, sewer ventilation and flushing, and the Public Health Acts Amendment Act of 1907, still further evidences the success of this little manual,* which manifestly deserves the attention and confidence of all concerned in the important subject with which it deals.—*The Bookseller.*

* "Drainage Work and Sanitary Fittings." By Wm. H. Maxwell, Price 2s. nett. London: St. Bride's Press, Ltd., 24 Bride-lane, E.C.

SOME RECENT PUBLICATIONS.*

The Civil Engineers' Pocket-book. By Albert J. Frye. Price 21s. nett. London: Constable & Co., Limited.

This work is described in its sub-title as a reference book for engineers, contractors, and students, containing data, methods, formulæ, and tables, and even this comprehensive description scarcely indicates the wide scope of the contents. The book is divided into seventy-one sections, each of which is devoted to a separate subject-matter, so that it is in effect a treatise in summary form comprising the whole range of civil engineering theory and practice. Thus, in addition to the large number of tables which one naturally looks for in a "pocket-book," there is a considerable amount of explanatory text. This is exceedingly well and clearly written, especially when allowance is made for the self-imposed limitations of the author as regards space. It is, of course, impossible to enumerate anything like the whole of the subjects dealt with, but they may broadly be classified as Practical Mathematics (including a good explanation of the differential and integral calculus), Mechanics, Theory of Structure, Strength Properties and Production of Materials, Properties and Tables of Beams, Girders and Columns, Civil Engineering Structures—*e.g.*, Bridges, Dams, &c.—Surveying, Paving, Water Supply, Sanitation, Steam and Gas Power, Electric Power and Lighting. Taking section 60, which deals with Highways, as typical of the work and as most likely to be of interest to our readers, we see that it is divided into five parts, dealing respectively with Traction, Roads and Streets, Pavement Specifications, Care of Road Surfaces, and miscellaneous matters, and consists of about 50 closely printed pages of useful notes. Mr. Frye's pocket-book has been excellently produced on thin paper by Messrs. Constable. The typography is excellent, so that even closely printed tables may be consulted without in any way trying the eyes; and the text is illustrated with many clearly drawn diagrams. In a book of this kind, which contains a mass of information upon a great variety of subjects, it is essential that the matter should be arranged and indexed so as to render any desired subject capable of easy reference. This is fully secured in the book before us by an analytical table of contents, supplemented by an excellent general index.

Electric Furnaces in the Iron and Steel Industry. By W. Rodenhauser and I. Schoenawa; authorised translation and additions by C. H. Vom Baur. Price 15s. nett. London: Chapman & Hall, Limited.

This work, which deals comprehensively with electric furnaces designed specially for the steel and iron industry, is divided into two parts. The first treats of all questions relative to the construction of these electric furnaces, and the apparatus used, while the other part takes up the practical use of electric furnaces in the steel mill and all its metallurgical reactions. The authors have carefully avoided advocacy of any special type of furnace, and the value of the book is enhanced by the fact that most of the results given are based on actual experience. The introduction of the electric furnace into the realm of steel and iron manufacture has rendered it necessary that those who are engaged in that important industry should be thoroughly acquainted with its construction and possibilities. The authors of this book have succeeded in producing a comprehensive manual of practical information for the practical man, and at the same time in giving a sufficiently full and lucid explanation of the electric laws and phenomena involved, and the scientific principles upon which the work rests. The translation into English of so excellent and practical a treatise should meet with a cordial welcome from British engineers and others concerned with iron and steel manufacture.

Forest Physiography. By Isaiah Bowman. Price 21s. nett. New York: John Wiley & Sons.

This is a book of great importance to waterworks engineers, for it treats exhaustively the subject of forest physiography with reference to soil and climate, and the effect which forests have on the rainfall. A large part of the work is devoted to detailed descriptions of the physiographical features of different parts of the United States. Hence it is of greater usefulness to American than to English engineers, but the principles described in the first eight chapters of the book are of universal application. These chapters deal with: (1) The Importance, Origin, and Diversity of Soils; (2) Physical Features of Soils; (3) Water Supply of Soils; (4) Soil Temperature; (5) Chemical Features of Soils; (6) Humus and the Nitrogen Supply of Soils; (7) Soils of Arid Regions; (8) Soil Classification. The book—which contains over 750 pages—is very fully illustrated with sketches, maps, and figures, and there are three coloured plates.

Method of Fixing Cleft Chestnut Fencing.

CHEMISTRY IN GASWORKS.

The Institute of Chemistry of Great Britain and Ireland have issued in pamphlet form accounts of two valuable lectures on "Chemistry in Gasworks," which Mr. W. J. A. Butterfield, M.A., F.I.C., delivered before that society recently. In these lectures Mr. Butterfield has endeavoured to indicate that the gasworks chemist should not be merely a machine for carrying out routine analyses, but should be the source of the ideas and methods by which the processes of manufacture should be determined and controlled. The gas industry is essentially a chemical industry, but he insists that the gasworks chemist, in addition to a sound grounding in chemistry, and a special knowledge of (17) chemistry of fuels and materials used in and

* Any of the publications reviewed, or referred to as received, will be forwarded by the St. Bride's Press, Limited, on receipt of published price

a gasworks, should have a better knowledge of mechanics than is necessary to the chemist in many other industries. Even of greater importance, he also points out, is a thorough training in physics, the chemical problems of gas manufacture, and of the supply and use of gas being always intimately associated with questions for the elucidation of which a special knowledge of physics is of the greatest possible service. The lectures are published free to members of the Institute of Chemistry, but copies will be supplied to other persons at the price of 2s. 6d.

The annual number of our Toronto contemporary, *Contract Record and Engineering Review*, issued on April 30th, is a remarkably fine production of over 260 pages. Articles by men of international prominence in the constructional field are a special feature of the number, among the subjects dealt with being the inoffensive collection and disposal of sewage, early Canadian bridge building, the highways of Europe, the construction of broken-stone roads, and the evolution of road-building machinery. That the value of publicity is not overlooked on the American Continent is evident from the fact that no fewer than 300 advertisers have taken space in the issue.

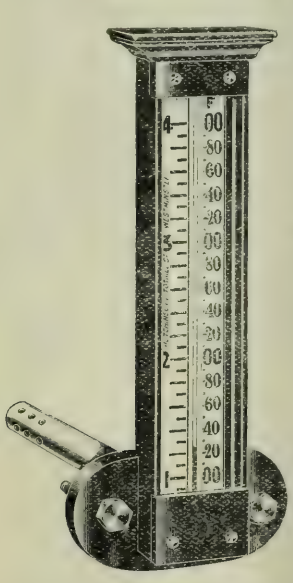
London Debt, 1911-12.—Issued by the London County Council, this return shows, in respect of the various London local authorities, the gross and nett debt outstanding at March 31, 1912, and the charge on the rates in the year 1911-12, together with an analysis of the total nett debt of London according to the method of borrowing and the nature of the services for which loans have been raised, comparative tables showing the debt and debt charge in recent years. The publication is obtainable through any bookseller, price 4d.

"To the Continent" is the title of a new booklet, with facsimile water-colour illustrations, which the Great Eastern Railway Company have issued as a handy guide to the popular Harwich-Hook of Holland route. It can be obtained free by sending postcard to the Continental Manager, G.E.R., Liverpool-street Station, London, E.C.

Under the title of "Motor-car Troubles: Their Symptoms and their Cure," Messrs. Harper & Brothers are shortly issuing a pocket-book for motorists by H. W. Slauson. The work is arranged so that the proper remedy may instantly be found for any of the ills to which the motor-car is liable.

THERMOMETER FOR PORTABLE TAR BOILERS.

Herewith is an illustration of one of the patterns of Hutchinson's thermometers, designed for users of coal - tar asphalt, &c. A smaller type of this instrument was exhibited last month in The Surveyor Section of the Building Trades Exhibition, and attracted considerable attention from surveyors and engineers, who made some useful and practical suggestions as to graduations on the scale, length of stem, and method of fixing the thermometer to tar and asphalt heaters, or boilers, as they are generally called.



The maker, whose name appears on the scale, was quick to take advantage of the suggestions he received, and the present thermometer is the result. It is to be fixed so that the stem passes direct into the tar tank without passing through any hot-air jacket or "flue," and should be about 6 in. above the bottom of the tank. We understand that a hinged metal door is provided for supporting the glass.

INSTITUTION OF MUNICIPAL ENGINEERS.

VISIT TO THE METROPOLITAN WATER BOARD'S WORKS.

By the kind permission of Mr. William B. Bryan, M.Inst.C.E., chief engineer to the board, a visit was paid on Wednesday, May 14th, to the new works of the Metropolitan Water Board at Enfield Lock and Chingford. The members assembled at Liverpool-street Station at 12.30, and journeyed direct to Enfield Lock Station, whence a walk of about half a mile took them to the pumping station, where they were met by Mr. T. C. Deverell, the resident engineer of the works. Only one of the Humphrey pumps was working at the time, but as this was delivering at the rate of 40,000,000 gallons a day, a fair estimate was obtained of what could be done when all the pumps were working at full pressure. A two-mile walk along one side of the reservoir followed, the party proceeding in Indian file along the concrete coping of the embankment wall. The reservoir showed no disposition to fill up for many a long month, despite the enormous quantity of water which is daily being pumped into it, and it has not yet attained a high enough level for any water to be drained from it.

The visit was of the most interesting nature, and the weather was all that could be desired. A vote of thanks to Mr. Deverell was given before the party broke up. It was unfortunate that a number of members, unable to face the two-mile concrete stretch along the reservoir, remained behind and were not present when the roll was called. The following are the names of those who answered to the call: Messrs. C. M. Teulon (Eastbourne), D. C. Fidler (Hayes), C. L. Gray (London), A. N. Hudswell (Woolwich), P. E. Weeks (Woolwich), J. W. Riggs (Hertford), G. V. Sparrow (Poole), H. M. Jordan (London), J. N. Gangulee (London), H. J. Higgins (Lewisham), R. B. Higgins (Lewisham), R. L. Khastiger (London), J. N. Jackson (Hambledon), G. T. Suter (Petworth), W. J. Cragg (Petworth), W. J. Coleman (Cookham), J. J. Paterson, M.D., B.Sc., medical officer of health (East Berks), N. Hoskins (London), A. Venkataraman (London), N. W. Hoskins (London), A. Deboy (London), D. R. Varma (London), S. S. Bhagat (London), A. S. Shah (London), E. Holden (London), C. J. Hoskins (London), J. R. Vigil (London), and B. Wyand, secretary of the institution. Mr. Horace Boot, vice-president, wrote apologising for not being able to attend as promised, owing to a special call to Manchester.

Akonia for Ascot.—The Stewards of the Ascot Royal Enclosure have decided to use Akonia for dust prevention on the occasion of the Ascot Races. The London Electric Railway Company are using Akonia to allay the dust on the platforms of the tube stations.

Junior Institution of Engineers.—On the twenty-ninth anniversary of the foundation of the Junior Institution of Engineers on Monday, June 30th, at the Institution of Electrical Engineers, Victoria Embankment, the second Gustave Canet lecture will be delivered by Dr. Dugald Clerk, F.R.S., who has chosen as his subject "The Working Fluid of Internal Combustion Engines."

Aberdeen Water Supply.—The much debated water supply for the city of Aberdeen has been advanced a stage by Mr. C. P. Hogg, Glasgow, and Mr. C. H. Roberts, Aberdeen, who have prepared a joint report on the river Avon as a source of water supply for Aberdeen. Their estimate of cost is as follows—8½ million gallons daily average supply, £942,900; 10 million gallons daily average supply, £953,500; 14 million gallons daily average supply, £1,273,000. The engineers have already reported on the rivers Dee and Dye and are of opinion that the waters of Avon are distinctly superior to those of the other two rivers named. The report adds: "In comparing the three sources, however, it should be remembered that the supplies from the Dee and the Dye would be filtered, while it is not proposed to filter the Avon water. As the benefit to be obtained from filtration is very great, it is doubtful whether an Avon supply unfiltered would show superiority, chemically or bacteriologically, over properly filtered supplies from either of the two sources. In any event it would be difficult to find many towns enjoying supplies superior to that which could be obtained from any one of the three sources referred to."

INSTITUTION OF MUNICIPAL AND COUNTY ENGINEERS.

President—Mr. R. J. Thomas, M.Inst.C.E., County Surveyor, Buckinghamshire.

SCOTTISH MEETING.

A meeting of the institution will be held in the Scottish District at Dundee on June 6th and 7th.

ROCHDALE MEETING.

A meeting of the institution in the North-Western District will be held at Rochdale on June 14th (Saturday).

LEEK MEETING.

A meeting of the institution in the West-Midland District will be held at Leek on June 28th (Saturday).

ANNUAL MEETING.

The annual meeting of the institution will be held from July 16th-19th.

Thomas Cole,
Secretary.

92 Victoria-street, S.W.

INSTITUTION OF MUNICIPAL ENGINEERS.

President—Mr. Frank Latham, M.Inst.C.E.I., F.S.E., Borough Engineer and Surveyor, Penzance.

NORTH-WESTERN DISTRICT.

A North-Western District meeting will be held at the Town Hall, Salford, on Saturday, May 31st.

Programme.

1.30 p.m.—District business meeting.
2 p.m.—Paper, "The Sewage Sludge Problem and its Solution," by Dr. Grossman, M.A., F.I.C., to be presented for discussion.

COUNCIL MEETINGS.

A council meeting will be held at the Town Hall, Salford, on Saturday, May 31st, at 4 o'clock.

The following other council meetings have been arranged: June 28th, London; July 30th, London.

B. Wyand,
Secretary.

39 Victoria-street, S.W.
May 1, 1913.

ROYAL SANITARY INSTITUTE.

PROVINCIAL SESSIONAL MEETING, CHESTER.

A sessional meeting will be held on Friday, May 30th, in the council chamber, Town Hall, Chester, at 7.30 p.m., when a discussion will take place on "Modern Methods for the Purification and Softening of Water Supplies," to be opened by Mr. Joseph Parry, M.Inst.C.E., chief engineer, Liverpool Corporation waterworks.

It is hoped that the following, among others, will take part in the discussion: Prof. J. Radcliffe, M.Sc.Tech., Municipal School of Technology, Manchester; Messrs. W. Matthews Jones, M.Inst.C.M.E., city surveyor and engineer, Chester; Coard S. Pain, Assoc.Inst.C.E., F.S.I., Liverpool; F. Storr, M.Inst.W.E., water engineer, Wrexham, and James Wilding, F.S.I., surveyor and water engineer, Runcorn.

The chair will be taken by Mr. H. Percy Boulnois, M.Inst.C.E., chairman of council of the institute.

On the following morning an inspection will be made of the Permutit softening plant at the West Cheshire Water Company's pumping station (Hooton). The visit to these works, it is expected, will take about two hours and a-half. Chester waterworks will be visited in the afternoon.

ANNUAL REPORT.

The annual report of the Royal Sanitary Institute which has just been issued shows a satisfactory progress and development in the institute's work, both in England and other parts of the Empire. A new branch has been established in New Zealand, and the total number of members and associates on the roll of the institute is 4,257.

An epitome of the three years' work since the institute was established in its new premises in Buckingham Palace-road is appended in the report, and shows that the change of premises was in every way satisfactory. Not only has the institute increased more rapidly, but the attendance at its lectures of members, students, and the general public indicates that the present situation of the institute is a convenient one.

The financial aspect is equally satisfactory; the institute has paid for the new buildings out of the accumulated fund, and the growth in the income has more than overtaken the increased expenses involved by the larger buildings.

ANNUAL CONGRESS AND EXHIBITION, EXETER.

Up to the present, we learn, three foreign and Colonial Governments, three Government Departments, fifteen county councils, thirty-two county boroughs, seven metropolitan boroughs, fifty-five boroughs and urban district councils, ten rural district councils, five port sanitary authorities, six education authorities, and thirty-four societies, universities, and colleges have appointed delegates to the congress of the Royal Sanitary Institute which is to be held at Exeter from July 7th—12th next, under the presidency of Earl Fortescue, K.C.B., Lord-Lieutenant of Devonshire.

Order of Proceedings.

Monday, July 7th.

1 p.m.—Reception of members and delegates in the Guildhall, by the Right Worshipful the Mayor.
1.30 p.m.—Public luncheon, in the Rougemont Hotel.
3 to 5.30 p.m.—Conducted parties to places of interest in the city. Tea at the Guildhall.
8 p.m.—Inaugural address to the congress, in the Barnfield Hall, by the Right Hon. Earl Fortescue, K.C.B.

Tuesday, July 8th.

10 a.m.—Meetings of—
Section A.—Sanitary Science and Preventive Medicine, in the University College.
Conferences of Municipal Representatives in the Guildhall, and of Engineers and Surveyors in the University College.
4 p.m.—Garden party at Rougemont, at the invitation of the Sheriff of Exeter and Mrs. Every.
8 p.m.—Lecture to the Congress, in the Barnfield Hall, by Sir William J. Collins.

Wednesday, July 9th.

10 a.m.—Meetings of Sections—
A.—Sanitary Science and Preventive Medicine.
C.—Domestic Hygiene.
Conference of veterinary inspectors in the University College.
1.30 p.m. and later.—Excursions—By brake over Woodbury Common; by train to Hennock waterworks; by train to the landslip at Lyme Regis and Rousdon; by brake to Rosamondford creamery and dairy farm, at the invitation of A. T. Loram, Esq., J.P.; by brake to city waterworks at Pynes; excursion by boat to Turf. Parties will also be formed to visit other city works.
8 p.m.—Conversazione and reception in the Royal Albert Memorial, at the invitation of the Mayor and Mayoress of Exeter.

Thursday, July 10th.

10 a.m.—Meetings of Sections—
B.—Engineering and Architecture.
Conferences of medical officers of health and sanitary inspectors in the University College.
4 p.m.—Garden party at "Maryfield," Exeter, by invitation of Mr. H. E. Duke, K.C., M.P.
Garden party at Shobrooke Park, Crediton, by invitation of Sir John and Lady Shelley.
Garden party at Mamhead, on the invitation of Sir Robert L. Newman, Bart.
8 p.m.—Congress dinner.

Friday, July 11th.

10 a.m.—Meetings of Sections—
B.—Engineering and Architecture.
D.—Hygiene of Infancy and Child-study, in the University College.
1 p.m.—Closing meeting, in the Guildhall.
3.30 p.m.—Garden party in the Palace Grounds.

5.30 p.m.—During the afternoon parties will be formed to be shown round the cathedral, and at 5.30 there will be an organ recital.

7.30 p.m.—Popular lecture in the Barnfield Hall, by Sir John M'Call, M.D., LL.D.

Saturday, July 12th.

Excursion to Totnes by train, by steamer down the Dart River to Dartmouth, returning by Torquay.

Excursion to Dartmoor and through the Lydford Gorge.

ENGINEERING AND ARCHITECTURE SECTION.

Mr. H. Percy Boulnois, M.INST.C.E., late deputy chief engineering inspector to the Local Government Board, will preside over the Engineering and Architecture Section, the other officers of the section being as follow: Vice-Presidents—Messrs. R. M. Challice; S. C. Chapman, M.INST.C.E., water engineer, Torquay; Chas. Cole, M.S.A.; O. A. G. Edwards, ASSOC.M.INST.C.E., district engineer, L.S.W.Rly., Exeter; E. H. Harbottle, F.R.I.B.A.; Frank Howarth, M.INST.C.E., water engineer, Plymouth; James Jerman, F.R.I.B.A.; J. A. Lucas, F.S.I., A.R.I.B.A.; E. Y. Saunders, M.R.SAN.I., borough surveyor, Barnstaple; and B. Priestley Shires, F.R.I.B.A. Local Secretaries—Messrs. Samuel Hutton, surveyor and water engineer, Exmouth Urban District Council; and Harbottle Reed, F.R.I.B.A., Castle-street, Exeter. Recording Secretary—Mr. A. Saxon Snell, F.R.I.B.A., 9 Bentinck-street, Manchester-square, London, W.

CONFERENCE OF ENGINEERS AND SURVEYORS.

This conference, which is open to all municipal and county engineers, will have as its president Mr. Thos. Moulding, M.INST.C.E., city engineer and surveyor of Exeter, assisted by the following: Vice-Presidents—Messrs. Albert E. Brookes, county surveyor, Cornwall County Council; H. T. Chapman, C.E., county surveyor, Wells, Somerset; David Edwards, ASSOC.M.INST.C.E., borough engineer, Taunton; H. A. Garrett, ASSOC.M.INST.C.E., borough surveyor, Torquay; Francis Parr, ASSOC.M.INST.C.E., borough surveyor, Bridgwater; James Paton, C.E., borough surveyor, Plymouth; John Siddalls, C.E., borough surveyor and sanitary inspector, Tiverton. Local Secretaries—Messrs. W. P. Robinson, ASSOC.M.INST.C.E, county surveyor (N. Division), 22 Queen-street, Exeter; and Robt. H. Dymond, assistant city surveyor, Exeter. Recording Secretary—Mr. J. S. Brodie, M.INST.C.E., borough engineer, Blackpool.

CONFERENCE OF SANITARY INSPECTORS.

Mr. James Robinson will act as president of the Conference of Sanitary Inspectors.

A Health Exhibition which has been arranged in connection with the congress will be opened on Saturday, July 5th.

E. White Wallis,
Secretary.

INSTITUTION OF WATER ENGINEERS.

EIGHTEENTH SUMMER GENERAL MEETING.

The eighteenth summer general meeting of the Institution of Water Engineers will be held at Wakefield on Thursday, Friday and Saturday, June 5th, 6th and 7th, under the presidency of Mr. C. Clemesha Smith, M.INST.C.E., corporation waterworks engineer.

By kind permission of the mayor and corporation the meetings will be held in the town hall, and at the opening of the proceedings on Thursday the institution will be welcomed to Wakefield by his worship the mayor (Councillor Edwin Lodge Hirst, J.P.).

Ladies will be cordially welcomed at the meetings and visits.

The programme will include the presentation of premiums awarded by the council for papers presented during the year 1912.

PAPERS AND COMMUNICATIONS.

The following papers have been promised for reading and discussion at this meeting, and advance copies will be sent out as soon as printed to members who signify their intention of attending the meeting.

(1) "The Valuation of Water Undertakings on Transfer to Local Authorities," by E. J. Silcock, M.INST.C.E. (held over from winter meeting).

(2) "The Water Supply of Jersey," by Alfred J. Jenkins, ASSOC.M.INST.C.E.

(3) "Animal Growths in Water Pipes," by Samuel C. Chapman, M.INST.C.E.

(4) "Reservoir Storage in Relation to Stream Flow," by W. J. E. Binnie, M.INST.C.E., F.G.S., B.A.(CANTAB.), and Herbert Lapworth, D.SC., M.INST.C.E., F.G.S.

The president-elect (Mr. C. Clemesha Smith) will deliver his presidential address on Thursday, June 5th, and will also supply an illustrated description of the Wakefield waterworks, which will be circulated among those present at the meeting.

A lecture on "The Underground Waters of the Lower Calder" will be delivered by Prof. Percy Kendall, F.G.S.

VISITS TO WORKS.

On Thursday afternoon, June 5th, visits will be made to the Kirkhamgate filtration works and the Ardsley reservoir of the Wakefield Corporation waterworks.

On Friday, June 6th, visits will be made to the Green Withens and Ringstone reservoirs (Rishworth Moors) of the Wakefield Corporation waterworks, and to the works of Messrs. J. Blakeborough & Sons, at Brighouse.

SOCIAL FUNCTIONS.

The annual dinner will be held in the banquet chamber of the town hall on Friday evening, June 6th, when the Mayor of Wakefield and other distinguished guests will be entertained by the institution.

On Thursday evening, June 5th, there will be a reception at the town hall on behalf of the Corporation of Wakefield.

On Friday, June 6th, luncheon will be provided by the Water Committee of the corporation, and on Thursday and Friday afternoons tea will be provided (by invitation) for those taking part in the visits arranged for those days.

Percy Griffith,
20 Victoria-street, S.W. *Secretary.*

THE SURVEYORS' INSTITUTION.

The annual general meeting of the Surveyors' Institution, to receive the report of the council and the announcement of the result of the election of officers for the ensuing year, will be held in the lecture hall on Monday next, at 5 o'clock.

If the results of the examinations are received in time, the prizes awarded to successful candidates in connection with the recent preliminary and professional examinations will be presented by the president at the meeting.

St. Petersburg Water Supply.—Sir William Lindley's scheme for supplying water to St. Petersburg from Lake Ladoga has been rejected by the town council. The cost of the work would have been about £10,000,000

APPOINTMENTS VACANT.

Official and similar advertisements received up to 4.30 p.m. on Thursdays will be inserted in the following day's issue, *but those responsible for their despatch are recommended to arrange that they shall reach* THE SURVEYOR *office by noon on* **Wednesdays** *to ensure their inclusion in the weekly list of summaries. Such advertisements may, in cases of emergency only, be telephoned (No. 1359 Holborn), subject to later confirmation by letter.*

CLERK OF WORKS.—May 24th.—Downpatrick Rural District Council. £2 2s. per week.—Mr. R. L. Marrow, clerk.

ASSISTANT SURVEYOR.—May 24th.—Corporation of Chesterfield. £120—£150.—Mr. J. Middleton, town clerk.

SURVEYOR AND INSPECTOR OF NUISANCES.—May 26th.—Sowerby Urban District Council. £91 per annum.—Mr. Edgar Booth, clerk, 7 Harrison-road, Halifax.

ENGINEERING ASSISTANT. — May 26th.—Corporation of Wimbledon. £130—£150.—Mr. A. Steele Sheldon, town clerk.

SURVEYOR'S ASSISTANT.—May 27th.—Corporation of Bootle. £80—£100. Mr. J. H. Farmer, town clerk.

CLERK OF WORKS.—May 28th.—Repton Rural District Council.—Mr. C. F. Chamberlin, clerk, Union Offices, Burton-on-Trent.

INSPECTOR OF NUISANCES.—May 28th.—Llandaff and Dinas Powis Rural District Council. £107 per annum.—Mr. M. Warren, clerk, Park House, 20 Park-place, Cardiff.

SURVEYOR'S GENERAL ASSISTANT.—May 30th.—Cannock Urban District Council. 25s. per week.—Mr. C. A. Loxton, clerk.

ASSISTANT DRAINAGE ENGINEER.—May 30th.—For Para sewerage, Northern Brazil. £50 a month and house allowance.—Sir Douglas Fox & Partners, 56 Moorgate-street, London, E.C.

WORKING ROAD FOREMAN.—May 31st.—Chertsey Urban District Council. 35s. a week.—Mr. T. E. H. Chaldecott, clerk.

JUNIOR ENGINEERING ASSISTANT.—May 31st.—Corporation of Newport (Mon.). £75—£104 per annum.—Mr. H. Tremelling, borough engineer and surveyor.

TEMPORARY DRAUGHTSMAN. — May 31st.—Corporation of Chelmsford. £2 2s. per week.—Mr. Percival T. Harrison, borough engineer.

SECOND ASSISTANT SURVEYOR.—June 2nd.—Burnley Rural District Council. £70 per annum.—Mr. J. S. Horn, clerk.

JUNIOR PRIVATE STREET WORKS ASSISTANT.—June 2nd.—Corporation of Stoke-on-Trent. £65 per annum.—Mr. A. Burton, borough surveyor.

SEWAGE WORKS FOREMAN.—June 2nd.—The Maldens and Coombe Urban District Council. £2 12s. 6d.—£3 per week.—Mr. James W. Johnson, clerk, New Malden, Surrey.

SURVEYOR'S GENERAL ASSISTANT.—June 2nd.—Hayes Urban District Council. £70—£100 per annum.—Mr. Douglas C. Fidler, engineer and surveyor.

SURVEYOR AND INSPECTOR OF NUISANCES.—June 3rd.—Leiston (Suffolk) Urban District Council. £150 per annum.—Mr. H. A. Mullens, clerk.

ROAD FOREMAN.—June 4th.—Cornwall County Council. 50s. a week.—Mr. Albert E. Brookes, county surveyor, Truro.

ENGINEER AND SURVEYOR.—June 5th.—Conway and Glan Conway Rural District Council. £110—£150.—Mr. James Porter, clerk.

COUNTY ARCHITECT.—June 7th.—West Riding County Council. £500 per annum.—Mr. Francis Alvey Darwin, clerk, County Hall, Wakefield.

BUILDING ENGINEER.—June 6th—25th.—Municipality of Rangoon. 600—800 rupees per mensem.—The Secretary, Rangoon Municipality, Burmah. The latest date of despatch of letters to reach Rangoon by June 25th is by the Indian mail leaving London on June 6th.

GENERAL SURVEYING AND ENGINEERING ASSISTANT.—June 9th.—Corporation of Lancaster. £120 per annum.—Mr. Arthur G. Bradshaw, borough surveyor and water engineer.

BUILDING INSPECTOR.—June 14th.—Corporation of Stafford. 45s. a week.—Mr. W. Plant, borough engineer.

ASSISTANT VALUER AND SURVEYOR.—June 30th.—Calcutta Improvement Trust. 600—800 rupees per month.—Mr. C. H. Bompas, chairman, 5 Clive-street, Calcutta.

ASSISTANT ENGINEER. Public Works Department of Northern Nigeria. £300—£400 a year.—Crown Agents for the Colonies, Whitehall-gardens, London, S.W.

MUNICIPAL COMPETITIONS OPEN.

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BLACKBURN.—June 2nd. Designs for a street improvement scheme, for the corporation.—The Town Clerk.

EXETER.—June 7th. Designs for a hostel, for the city council. Assessor, Mr. Edwin Cooper, F.R.I.B.A.—The Town Clerk.

NEWCASTLE-UPON-TYNE.—June 14th.—Designs for new public baths at Benwell, Walker, and Heaton.—The town clerk.

DEVONPORT.—June 14th.—Designs for municipal buildings, for the corporation. Premiums, £350, £150 and £100.—The Town Clerk.

NEWCASTLE-UPON-TYNE.—June 19th.—Designs for laying out a portion of the Walker estate, for the corporation. Premiums, £50, £30 and £20.—The Town Clerk.

LIVERPOOL.—June 24th.—Designs for a sanatorium of 250 beds. Premiums, 150, 100 and 50 guineas.—Mr. Edward R. Pickmere, town clerk.

CHEPPING WYCOMBE.—September 1st.—Designs for town-planning the borough and an area immediately adjoining. Premiums, £25, £10 and £5.—Mr. T. J. Rushbrooke, borough surveyor, High Wycombe.

BRACKLEY.—Plans and specifications of twelve cottages, for the corporation of Brackley.—Mr. C. E. Barnes, town clerk.

BRACKLEY.—No date.—Plans and specifications for twelve cottages, for the corporation.—Mr. C. E. Barnes, town clerk.

MUNICIPAL CONTRACTS OPEN.

Official and similar advertisements received up to 4.30 p.m. on Thursdays will be inserted in the following day's issue, *but those responsible for their despatch are recommended to arrange that they shall reach* **The Surveyor** *office by noon on* **Wednesdays** *to ensure their inclusion in the weekly list of summaries. Such advertisements may, in cases of emergency only, be telephoned (No. 1359 Holborn), subject to later confirmation by letter.*

Buildings.

KENT.—May 23rd.—For the erection of tool sheds, for the Education Committee.—Mr. W. H. Robinson, architect, Caxton House, Westminster.

LLANDILO-FAWR.—May 23rd.—For the construction of works of water supply, for the rural district council.—Mr. Henry Herbert, engineer, Brynmarlais, Ammanford.

CHESTERFIELD.—May 24th.—For the erection of a filter-house and valve-house, for the rural district council.—Mr. G. Frith, waterworks engineer.

SOUTHMOLTON.—May 24th.—For the erection of ten cottages, for the corporation.—Mr. H. C. E. Rayner, borough surveyor.

BUCKS.—May 26th.—For alterations to police court and erection of police cottage, for the Standing Joint Committee.—Mr. R. J. Thomas, county surveyor, County Hall, Aylesbury.

SHIPLEY.—May 26th.—For the enlargement of a school, for the Education Committee.—Mr. S. Bradley, Exchange Building, Bank-street, Bradford.

GRIMSBY.—May 26th.—For constructing foundations for a turbine plant, and erecting a corrugated-iron building, for the corporation. — Mr. W. A. Vignolas, borough electrical engineer.

LITTLEHAMPTON.—May 26th.—For the erection of a shelter and toll-houses, for the urban district council.—Mr. H. Howard, surveyor.

WORTHING. — May 27th. — For alterations and other works at the town hall, for the corporation. Borough surveyor.

MAESTEG.—May 27th.—For the construction of river retaining walls, for the urban district council.—Mr. E. E. Davies, clerk.

WEST HAM.—May 27th.—For the extension of the technical institute, construction of underground conveniences, and private street works, for the corporation.—Mr. Fred. E. Hilleary, town clerk.

NELSON.—May 27th.—For the erection of offices and workshops, for the corporation.—Mr. W. Shackleton, borough engineer and surveyor.

HEMEL HEMPSTEAD.—May 28th.—For alterations to highway depot, for the corporation. Mr. W. R. Locke, borough surveyor.

BENTLEY-WITH-ARKSEY.—May 28th.—For the erection of offices and caretaker's house, for the urban district council. Mr. R. G. Whitley, 261 Bentley-road, Doncaster.

MANCHESTER.—May 28th.—For the construction of foundations for turbo-generator and filter house, for the Electricity Committee.—Mr. F. E. Hughes, secretary to the committee, Town Hall.

LARNE.—May 28th.—For building three labourers' cottages, for the rural district council.—Mr. S. M. Wallace, clerk.

DUNDEE. — May 28th. — For the extension of Morgan Academy, for the School Board.—Mr. J. H. Langlands, 31 Murraygate, Dundee.

HAMMERSMITH.—May 28th.—For rebuilding work and repairs, for the borough council.—Mr. H. Mair, borough surveyor.

CROYDON.—May 29th.—For the erection of a fire station and library, for the corporation.—Mr. S. Jacobs, deputy town clerk.

BRIGHTON.—May 30th.—For the erection of a nurses' home at Haywards Heath Asylum, for the Visiting Committee.—Mr. J. G. Gibbins, 43 Brunswick-road, Hove.

HYTHE.—May 31st.—For the construction of timber groynes, for the corporation.—Mr. Bernard C. Drake, town clerk.

MARLBOROUGH.—June 2nd.—For the erection of sixteen cottages, for the corporation.—Town Clerk.

BURNLEY.—June 2nd.—For the construction of a R. S. girder and concrete bridge, for the rural district council.—Mr. J. S. Horn, clerk.

SUNBURY-ON-THAMES.—June 2nd.—For alterations to an engine house, for the urban district council.—Mr. Charles E. Goddard, clerk.

TREDEGAR.—June 3rd. — For the erection of an office, stores, and showroom, for the urban district council.—Mr. W. Lloyd Roach, surveyor.

TURTON.—June 4th.—For the erection of a cottage, for the urban district council.—Mr. V. W. Laithwaite, surveyor.

HUNSTANTON.—June 4th.—For additions to the isolation hospital, for the urban district council.—The Surveyor.

PORTSMOUTH.—June 4th.—For the erection of a dispensary, for the corporation.—Borough engineer.

LANCASHIRE. — June 4th. — For alterations and additions to a school, for the Education Committee. Messrs. Biram & Fletcher, George-street, St. Helens.

MIDDLESEX.—June 6th.—For extensions to the Napsbury Asylum, including additional accommodation for female staff, residence for an assistant medical officer, and alterations and additions to the upholsterer's shop, for the Sub-committee of Visitors. —Mr. Henry G. Armour, clerk, Napsbury Asylum, St. Albans.

CUMBERLAND. — June 7th. — For alterations to master's house, for the Education Committee.—Mr. J. Forster, 13 Earl-street, Carlisle.

MILFORD (Co. Donegal).—June 14th.—For the erection of forty-nine labourers' cottages, for the rural district council.—Mr. S. Watters, clerk.

LANCASHIRE.—June 20th.—For the erection of a school, for the Education Committee.—Mr. H. Littler, architect, 16 Ribblesdale-place, Preston.

HERTS.—June 27th.—For the construction of a bridge, for the county council.—Mr. Urban A. Smith, Hatfield.

HERTFORDSHIRE.—June 27th.—For the construction of a new bridge over the Stort Navigation at Bishops Stortford, for the county council. — Mr. Urban A. Smith, county surveyor, Hatfield.

HERTFORDSHIRE.—June 27th.—For the construction of a new bridge over the Stort Navigation at Sawbridgeworth, for the county council.—Mr. Urban A. Smith, county surveyor, Hatfield.

Iron and Steel.

PLYMOUTH.—May 25th.—For the supply of cast-iron pipes, for the corporation. -Mr. F. Howarth, water engineer.

ALFRETON.—May 26th. -For the supply of cast-iron pipes, and specials, and pig lead, for the urban district council.—Mr. R. F. Ward, water engineer.

MERTHYR.—May 30th.—For the supply of cast-iron pipes and special castings, for the corporation.—Borough waterworks engineer.

STOKE-ON-TRENT.—May 31st.—For the supply of cast-iron work for storm-water drainage scheme, for the corporation.—Mr. A. Burton, borough surveyor.

KANTURK. — June 4th. — For sinking wells and erecting pumps, for the rural district council.—Mr. T. Guiney, clerk.

DEWSBURY.—June 4th.—For the erection of ornamental wrought-iron railing, for the corporation.—Borough surveyor.

CHEADLE.—June 6th.—For providing and laying cast-iron water mains and sluice valves, for the rural district council.—Mr. F. S. Cox, clerk.

Roads.

NORTH WALSHAM.—May 24th.—For the supply of granite, tar, and road rolling, for the urban district council.—Mr. J. W. Stevens, surveyor.

AXBRIDGE.—May 24th.—For the supply of 8,000 tons of granite or basalt macadam and chippings, for the rural district council.—Mr. J. Knight Dunster, district surveyor, Winscombe, Somerset.

WIGAN.—May 24th.—For the supply of paving materials, pitch, and creosote oil, for the corporation.—Mr. William Henry Tyrer, town clerk.

DORKING.—May 24th.—For the supply of broken granite and hire of steam roller, for the urban district council.—Mr. W. A. Clegg, surveyor.

MANSFIELD.—May 24th.— For the supply of road materials, for the urban district council.—Mr. F. Cook, surveyor.

GRANTOWN-ON-SPEY.—May 24th.—For constructing kerbs and footpaths, for the corporation.—Mr. J. Willett, surveyor, Elgin.

RUNCORN.—May 26th.—For laying tar-macadam in certain streets, for the rural district council.—Mr. R. Garnett, Sankey-street, Warrington.

LONDON.—May 26th.—For road construction at Norbury, for the county council.—The Clerk, Spring-gardens.

WALTON-UPON-THAMES. — May 26th. — For making up a private street, for the urban district council.—Mr. P. H. Webb, clerk.

ROCHFORD.—May 26th.—For making up certain private streets, for the rural district council. — Mr. Frederick Gregson, clerk, 26 Alexandra-street, Southend-on-Sea.

HARROGATE.—May 26th.—For private street improvement work, for the corporation.—Mr. C. E. Rivers, borough engineer and surveyor.

FAREHAM.—May 26th.—For steam road rolling and scarifying, for the rural district council.—Mr. A. Laker, clerk.

HENDON.—May 26th.—For making up certain roads, for the urban district council.—Mr. S. S. Grimley, engineer and surveyor.

THE MALDENS AND COOMBE.—May 26th.—For making-up Coombe-gardens and paving with artificial stone slabs, for the urban district council.—Mr. James W. Johnson, clerk, New Malden.

BINGLEY.—May 26th.—For road alterations at Cottingley Bridge, for the urban district council.—Mr. H. Bottomley, surveyor.

WANDSWORTH.—May 26th.—For making up and paving part of Tooting Bec-gardens, Streatham, for the borough council.—Mr. Edward J. Ellis, deputy town clerk.

OYSTERMOUTH. May 27th. For carrying out private street works, for the urban district council.—The surveyor.

PONTEFRACT.—May 27th.— For the supply of broken granite and unbroken whinstone, for the corporation.—Mr. J. E. Pickard, borough engineer and surveyor.

MONMOUTH.—May 27th.—For the supply of stone, and hauling, for the county council.—Mr. W. Tanner, county surveyor, Newport, Mon.

WOODFORD.—May 27th.—For asphalt macadam construction.—Mr. William Farrington, surveyor.

LEYTON. — May 27th. — For work of making up certain roads, for the urban district council.—Mr. E. H. Essex, surveyor.

BARNOLDSWICK.—May 27th.—For making good certain streets, for the urban district council.—Mr. W. Ellis, engineer and surveyor.

TOTTENHAM.—May 27th.—For the making up of one road, and sections of two other roads, for the urban district council.—Mr. E. Crowne, clerk.

TOTTENHAM.—May 27th.—For making-up work, for the urban district council.—Mr. W. H. Prescott, engineer.

WANDSWORTH.—May 27th.—For the execution of wood paving and other works, for the borough council. —Mr. P. Dodd, borough engineer.

SOUTHAMPTON.—May 27th.—For executing road paving works in East-street, for the corporation.—Mr. R. R. Linthorne, town clerk.

HADLEIGH.—May 27th.—For the supply of granite (Guernsey preferred), for the urban district council.—Mr. W. F. Grimwade, clerk.

ROCHDALE.—May 28th.—For work of making up and sewering, for the corporation. — Borough surveyor.

LEWISHAM.—May 28th.—For laying wood paving, for the borough council.—Borough Surveyor.

WAKEFIELD. — May 29th. — For the supply of granite and whinstone setts, for the corporation.—City surveyor.

ASHFORD.—May 29th.—For the supply of unbroken Kentish ragstone, and coarse gravel or pit flints, for the urban district council.—Mr. William Terrill, surveyor.

FRIERN BARNET.—May 29th.—For the supply of hoggin, gravel, Leicester granite, and cartage, for the urban district council.—Mr. E. J. Reynolds, engineer and surveyor.

BRIGHTON.—May 30th.—For the supply of 500 cub. yds. of hand-picked land flints, for the corporation.—Mr. Hugh Talbot, town clerk.

KENDAL.—May 31st.—For road reconstruction, for the corporation.—Mr. F. W. Oxberry, borough surveyor.

WINTERTON.—May 31st.—For the supply of 300 tons of granite, for the urban district council.—Mr. Norman Gibson, clerk.

ELY.—May 31st.—For the supply of granite, for the urban district council.—City surveyor.

BURNLEY.—June 2nd.—For work of road reconstruction, for the rural district council.—Mr. H. Pritchard, engineer.

GODSTONE.—June 2nd.—For the supply of granite, Kentish ragstone, tar-macadam, kerbing and channelling, and laying tar-macadam, and the supply of tools, oils, and iron goods, for the rural district council.—Mr. George E. Crowter, engineer and surveyor.

DOVER.—June 2nd.—For the supply of broken Guernsey granite and Guernsey granite siftings, for the corporation.—Mr. R. E. Knocker, town clerk.

SURBITON.—June 2nd.—For the execution of private street improvement work at Malvern-road, for the urban district council.—Mr. Frederick W. Wood, clerk.

TYNEMOUTH.—June 2nd.—For laying random sett and chip paving, for the corporation.—Mr. J. F. Smillie, borough surveyor.

EALING.—June 3rd.—For making up several roads, for the corporation.—Mr. C. Jones, borough engineer.

LEITH.—June 3rd.—For supplying and rolling 3,000 tons of hard whinstone, for the corporation.—Burgh surveyor.

SKELMANTHORPE.—June 3rd.—For making-up work (labour only), for the urban district council.—Mr. J. Rower, surveyor.

FULHAM.—June 4th.—For making up a carriageway, for the borough council.—Mr. F. Wood, borough surveyor.

HASTINGS.—June 14th.—For work of road rolling, for the rural district council.—Mr. A. R. Inskipp, clerk.

LEWES.—June 20th.—For scarifying and steam rolling, for the corporation.—Mr. Montague S. Blaker, town clerk.

Sanitary.

WIGAN.—May 24th.—For the supply of stoneware pipes, bends and junctions, for the corporation.—Borough engineer.

GRANTHAM.—May 24th.—For the removal of house refuse, for the corporation.—Mr. A. H. Malim, town clerk.

ROTHERHAM.—May 26th.—For laying and jointing 9-in. stoneware pipes, with manholes, for the rural district council. — Messrs. Oxley & Coward, clerks.

FINCHLEY.—May 26th.—For the construction of 456 yds. of 15-in. and 9-in. surface-water sewer, part under highways and part under open land, for the urban district council.—Mr. E. H. Lister, clerk.

WIGTON.—May 26th—June 7th.—For laying pipe-sewers, manholes, lampholes, flushing-chambers, and the construction of sewage purification works, for the rural district council.—Messrs. Taylor & Wallin, Cathedral Buildings, Newcastle-on-Tyne.

HANTS.—May 26th.—For construction of surface-water drains and gullies, for the county council.—Mr. W. J. Taylor, county surveyor, the Castle, Winchester.

SOUTHAMPTON.—May 27th.—For laying storm-water drain and other works, for the corporation.—Borough engineer.

NUNEATON.—May 27th.—For the construction of earthenware pipe sewers, for the corporation.—Mr. F. C. Cook, borough engineer and surveyor.

WHITSTABLE.—May 27th.—For the construction of a brick and concrete tank sewer, concrete tube sewers, stoneware pipe sewers, cast-iron rising main, cast-iron outfall sewer, manholes, pumping station, tanks, cottage, and percolating filters, for the urban district council.—Messrs. Strachan & Weekes, civil engineers, 9 Victoria-street, Westminster.

LANCASTER.—May 28th.—For laying sewerage pipes and manholes, for the rural district council.—The Surveyor.

ST. DOGMELLS.—May 28th.—For the supply of pail closets, for the rural district council.—Mr. I. E. E. George, Troedyrhiw, Cardigan.

KNARESBOROUGH.—May 28th.—For the removal of house refuse, for the rural district council.—Inspector of Nuisances, 14 Bower-road, Harrogate.

WINDLESHAM.—May 28th.—For laying a 24-in. concrete tube culvert, inspection chamber, and branch drains, for the urban district council.—Mr. Edwin T. Close, clerk, Bagshot.

WOKINGHAM.—May 28th.—For the construction of stoneware sewers, manholes and ejector chamber, and supply of cast-iron pipes, for the corporation.—Mr. C. W. Marks, borough engineer and surveyor.

YEOVIL.—May 29th.—For the construction of sewerage and sewage disposal works, consisting of about 4,000 yds. of 9 in. and 6 in. sewers, with manholes, ventilators, septic tanks, trickling filters, and appurtenances, for the rural district council.—Mr. J. E. Rodber, clerk.

SHORT HEATH.—May 30th.—For the construction of sewage disposal works, for the urban council.—Mr. Litchfield Meek, clerk, 33 Market-place, Willenhall.

OAKENGATES.—May 31st.—For sewerage and sewage disposal works extension, for the urban district council.—Messrs. Berrington, Son & Watney, Prudential Chambers, Lichfield-street, Wolverhampton.

EPSOM.—June 2nd.—For the removal of house refuse, for the rural district council.—Mr. F. A. Pratley, surveyor

BIRMINGHAM.—June 4th.—For the construction of about 4¼ miles of stoneware pipe sewer, about 1 mile of 3 ft. 6 in. by 2 ft. 6 in. brick and concrete egg-shaped sewer, 180 yds. of cast-iron pipes, in railway and river crossings, river outlets, and other works, for the corporation.—Mr. Henry E. Stilgoe, city engineer and surveyor.

SKELTON AND BROTTON.—June 4th.—For laying pipe sewer, with manholes, for the urban district council.—Mr. R. S. Moon, surveyor.

WINDSOR.—June 9th.—For works of drainage, for the rural district council.—Mr. J. B. Gale, clerk.

SEDGHILL.—June 9th.—For the removal of ashes, for the urban district council.—Mr. T. Spencer, clerk.

RIPLEY. — June 10th. — For the construction of sewage disposal works, for the urban district council.—Mr. G. W. Bird, surveyor.

LANCHESTER.—For alterations to sewage works, for the rural district council.—Mr. J. R. Lupton, surveyor.

Stores.

CLECKHEATON.—May 24th.—For the supply of granite, dross, lime, cement, stoneware pipes, kerbs, setts, tar, pitch, and oil, for the urban district council.—Mr. John H. Linfield, clerk.

GREENOCK.—May 26th.—For the supply of coal, cement, lime, fireclay pipes, pavement, whinstone setts, road metal, pitch and oil, and cartage, for the corporation.—Master of Works.

Miscellaneous.

HULL.—May 28th.—For builder's work, setting two Lancashire boilers, paving, and flagging, for the corporation.—Mr. A. E. White, city engineer.

TORONTO.—May 28th.—For the removal of 35,000,000 cub. yds. of material by hydraulic dredging, for the Toronto Harbour Commissioners.—Mr. E. L. Cousins, chief engineer.

MADRAS.—July 2nd.—For the supply of one first-class lathe, and two first-class lathes, for the corporation.—Mr. James R. Coats, engineer.

TENDERS FOR MUNICIPAL WORKS OR SUPPLIES.

The Editor invites the co-operation of SURVEYOR *readers with a view to making the information given under this head as complete and accurate as possible.*

* Accepted. † Recommended for acceptance.

FARNBOROUGH.—For the erection of a refuse destructor, with buildings and chimney stack, for the urban district council.—Mr. J. E. Hargreaves, surveyor :—

Manlove, Alliott & Co., Nottingham	£2,347
Goddard, Massey & Warner, Nottingham	2,315
Meldrums, Limited, Timperley	2,220
Horfall Destructor Company, Pershore	2,205
Hughes & Stirling, Limited, London ‡	2,005

‡ Accepted conditionally.

HERTS.—For the erection of Chorleywood new county council school, for the county council.—Mr. Urban A. Smith, county surveyor :

W. Dudley, High-road, New Southgate	£3,132
H. J. & A. Wright, High-street, Great Missenden	3,090
W. Payne, Leavesden, Watford	3,062
Lovell & Co., Gerrard's Cross, Bucks	2,987
Brand, Pettit & Co., West Green-road, Tottenham	2,963
Redhouse & Son, Stotfold, Baldock	2,949
C. F. Kearley, High-street, Uxbridge	2,874
Fassnidge & Son, Uxbridge	2,812
Darvell & Son, Chorleywood †	2,634
O. P. Drever, Kettering	2,551
Webster & Cannon, Aylesbury	2,540
Acock & Co., Tenter-street, Moorfields	2,480

HINCKLEY.—For laying outfall sewer and manholes, for the urban district council.—Mr. E. H. Crump, engineer and surveyor :—

A. E. Palmer, Glenfield, Leicester	£4,113
H. Farrow, Bonnington-road, Brixton, London	4,090
J. J. Shardlow, Jarvis-street, Leicester	3,947
H. Lidgard & Co., Cleethorpes	3,464
W. H. Crawley, Spring-gardens, Doncaster *	2,479

HORNCASTLE.—For the supply of X granite, XX granite, X slag, and slag chips, for the urban district council.—Mr. F. Weeber, surveyor :—

	Per ton. s. d.
A. Dunham (Ellis & Everard), Horncastle (X granite)	12 9
H. Walter (Groby Granite Company), Horncastle (X granite)	12 3
H. Walter (Groby Granite Company), Horncastle (XX granite)	12 1
H. Walter (Groby Granite Company), Horncastle (X slag)	6 1
Hensman & Son, Horncastle (chips)	6 4
Ord & Maddison, Darlington (X stone)	13 3
Tilbury Contracting Company, London (X stone)	13 0
M. Jackson & Son, Louth (X stone)	12 6
Mountsorrel Granite Company, Leicester (X stone)	12 0
Enderby and Stoney Stanton Granite Company, Narborough (X stone)	12 5

IRLAM.—For sewerage works, and the construction of ejector chamber, manholes and lampholes, for the urban district council :—

R. Allen, Halton View, Widnes.

LEICESTERSHIRE.—For work of road improvement, for the county council.—Mr. S. Perkins Pick, county engineer, Leicester :—

Johnson & Langley, Leicester	£1,298
A. E. Palmer, Glenfield	1,285
J. J. Shardlow, Jarvis-street, Leicester	1,274
T. Smart, Trent Bridge, Notts	1,090
W. Moss & Son, Coalville	1,040
Stimpson & Rollston, Leicester	1,016
T. Barker & Sons, Loughborough	996
W. Moss & Sons, Limited, Loughborough *	956

MACCLESFIELD.—For making up Riseley-street, for the corporation.—Mr. S. C. Baggott, borough engineer :—

Ashton & Holmes, Black-road, Macclesfield	£567
Gorton & Wilson, Elizabeth-street, Macclesfield	555
J. Clayton, Sunderland-street, Macclesfield *	527

NORTH BROMSGROVE.—For the Barnt Green sewerage, contract No 2, for the urban district council.—Mr. R. Green, engineer :—

Tilt Brothers, Bromsgrove	£3,296
Currall, Lewis & Martin, Birmingham	3,154
G. P. Trentham, Birmingham	3,120
Edwards & Co., Doncaster	3,115
W. Thorpe, Hollywood	2,884
G. Law, Kidderminster	2,747
Jukes & Co., Tipton	2,677
Johnson & Langley, Leicester	2,618
Martin & Element, Smethwick *	2,585

OUNDLE.—For fixing oil engine and air receiver, with pipes and fittings, in connection with the sewage ejector at sewage disposal works, for the urban district council.—Mr. G. Belson Chilvers, engineer and surveyor :—

J. C. Hannah, Northampton	£149
Hughes & Sons, Newport Pagnell	136
Goddard, Massey & Warner, Limited, Nottingham	135
Teasdale Brothers, Limited, Darlington	127
Campbell Gas Engine Company, Limited, Halifax	110
Campbell Gas Engine Company, Limited, Halifax (alternate scheme)	130
Hodson & Sons, Oundle *	72

ROCHDALE.—For the construction of earthenware pipe sewers and manholes, for the corporation :—

R. & T. Howarth, Royds-street, Rochdale.

STOCKPORT.—For alterations to the ejector chamber at the sewage outfall works, for the corporation.—Mr. J. Atkinson, borough surveyor :—

H. Bardsley, Booth-street, Stockport, £203.

MEETINGS.

Secretaries and others will oblige by sending early notice of dates of forthcoming meetings.

MAY.

23-24.—Surveyors' Institution: Meeting at Oxford.
24.—Association of Managers of Sewage Disposal Works: Meeting at Kettering.
24.—Junior Institution of Engineers: Visit to King George Reservoir, Chingford. 3 p.m.
26.—Royal Institute of British Architects: Mr. Thomas Hastings, New York, on "Modern Architecture." 8 p.m.
26.—Surveyors' Institution: Annual General Meeting. 5 p.m.
30-31.—Royal Sanitary Institute: Sessional Meeting at Chester. Discussion on "Modern Methods for the Purification and Softening of Water Supplies." Visit to Waterworks.
31.—Institution of Municipal Engineers: Dr. Grossmann, M.A., F.I.C., on "The Sewage Sludge Problem and its Solution." Salford Town Hall. 1.30 p.m.

JUNE.

4.—Royal Institute of British Architects: Annual Dinner, Whitehall Rooms
5-7.—Institution of Water Engineers: Summer General Meeting at Wakefield.
6-7.—Institution of Municipal and County Engineers: Meeting at Dundee.
14.—Institution of Municipal and County Engineers: Meeting at Rochdale.
23-28.—International Road Congress in London.
28.—Institution of Municipal and County Engineers: Meeting at Leek.

JULY.

7-12.—Royal Sanitary Institute: Annual Congress and Exhibition at Exeter.
16-19.—Institution of Municipal and County Engineers: Annual Meeting at Great Yarmouth.

APPOINTMENTS OPEN.

THE MALDENS AND COOMBE URBAN DISTRICT COUNCIL.

SEWAGE WORKS FOREMAN.

The Council invite applications from competent persons for the post of Foreman at the Sewage Works. Applicants must have a thorough knowledge of gas and oil engines and pumping machinery, be able to execute minor repairs, and have had practical experience in the treatment of sewage, preferably the bacterial treatment.

Salary, £2 12s. 6d., rising (subject to satisfactory service) to £3 per week.

The successful candidate will be required to pass a medical examination.

Applications (on prescribed form, which may be obtained from the undersigned upon receipt of a stamped and addressed foolscap envelope), accompanied by copies of three recent testimonials, endorsed "Foreman," and addressed to the undersigned, must be delivered at the Municipal Offices, New Malden, not later than Monday, 2nd June, 1913.

Canvassing, directly or indirectly, will be a disqualification.

JAMES WM. JOHNSON,
Clerk to the Council.

Municipal Offices,
New Malden, Surrey.
May 16, 1913. (461)

IMPROVER ASSISTANT wanted in County Road Surveyor's Office, South of Scotland; ample opportunity to gain experience in all latest methods of road maintenance and bridges. State experience and lowest salary required.—Apply Box 1,252, office of THE SURVEYOR, 24 Bride-lane, Fleet-street, London, E.C. (463)

CANNOCK URBAN DISTRICT COUNCIL.

APPOINTMENT OF GENERAL ASSISTANT.

The Council invite applications for the above appointment. Applicants must have had experience in a Municipal Surveyor's Office, including the keeping of all the various books, and be an efficient shorthand-typist. Preference will be given to one who has had experience as a draughtsman.

The salary will be 25s. per week.

Applications, in candidate's own handwriting, stating age and qualifications, to be addressed and delivered to the undersigned, accompanied by copies of three testimonials, not later than 10 a.m. on Friday, the 30th inst., endorsed "Surveyor's General Assistant." Canvassing will be deemed a disqualification.

C. A. LOXTON,
Clerk to the Council.

Council Offices,
Cannock.
May 14, 1913. (453)

COUNTY BOROUGH OF STOKE-ON-TRENT.
BOROUGH SURVEYOR'S DEPARTMENT.

The Corporation invite applications for the Appointment of a Junior Private Street Works Assistant in the Borough Surveyor's Office, at a salary of £65 per annum.

Applicants must be neat and expeditious Draughtsmen, and accurate Surveyors and Levellers.

Applications, stating age and experience, accompanied by not more than three recent testimonials, and endorsed "Junior Assistant," must be sent to me on or before Monday, June 2nd, 1913.

Preference will be given to candidates who have had experience in a Borough Surveyor's Office.

Canvassing, directly or indirectly, will be a disqualification.

A. BURTON, A.M.I.C.E., F.S.I.,
Borough Surveyor.

Town Hall,
Stoke-on-Trent.
May 20, 1913. (467)

PARA SEWERAGE.
ASSISTANT DRAINAGE ENGINEER.

Applications are invited for the Appointment of Drainage Assistant, to be under the Resident Engineer, for the Sewerage Works now in course of construction at Para, Northern Brazil.

The duties will be to take charge of the design, construction and testing of the house installations, and to assist the Resident Engineer in the design, construction and maintenance of the main drainage works.

The applicant must have served in the Office of a Municipal Engineer or Surveyor of a large town, and must be fully qualified to design and supervise the construction of house drainage in closely-built areas. He must also be a good leveller.

Applicants should not be more than thirty years of age, and should be unmarried. A knowledge of Portuguese and previous residence in a tropical climate are desirable.

The salary will be £50 a month, and in addition £10 per month house allowance will be paid.

Applications, with copies of recent testimonials, should reach the undersigned by the 30th May, 1913.

SIR DOUGLAS FOX & PARTNERS,
56 Moorgate-street,
London, E.C.
May 20, 1913. (470)

CORNWALL COUNTY COUNCIL.
MAIN ROADS.

Applications are invited for the Appointment of a thoroughly competent Road Foreman, or Ganger, to take charge of Road Reconstruction Works, under the direction of the Assistant County Surveyor, in the Redruth district.

Applicants must have had experience in works of a similar nature, and be thoroughly competent to supervise labour and measure and book up work.

Wages 50s. per week.

Applications, in candidate's own handwriting, stating age, full particulars of previous employment, and enclosing copies of at least two recent testimonials, must be forwarded to the undersigned not later than Wednesday, June 4th, 1913.

ALBERT E. BROOKES,
County Surveyor.

County Hall, Truro.
May 19, 1913. (474)

BOROUGH OF CHELMSFORD.
TEMPORARY DRAUGHTSMAN.

Applications are invited for the immediate Appointment of Temporary Draughtsman for a period of three months, at the rate of Two Guineas per week.

Previous Municipal experience and knowledge of architecture desirable.

Applications, stating age and qualifications, accompanied by copies of two recent testimonials, to be sent to the undersigned not later than Saturday, 31st May, 1913.

PERCIVAL T. HARRISON, A.M.I.C.E.,
Borough Engineer.

Municipal Offices,
Chelmsford.
May 21, 1913. (475)

ROAD-BINDER. Wanted, representatives to push well-known Proprietary Non-bituminous Binder. Generous commission basis.—Address "Z. H. 152," *c/o* Deacon's, Leadenhall-street, E.C. (464)

SOWERBY URBAN DISTRICT COUNCIL.
APPOINTMENT OF SURVEYOR AND INSPECTOR OF NUISANCES.

The Sowerby Urban District Council invite applications for the joint appointment of Surveyor and Inspector of Nuisances at a salary at the rate of £91 per annum.

Applicants must have a good practicable knowledge of road making, and must be competent to keep all the books and accounts incidental to the office.

The Officer appointed will have to perform the duties of Inspector of Nuisances, and to act under the direction and supervision of the Medical Officer of Health for the purpose of the Housing (Inspection of Districts) Regulation Act, 1910. He will also act as Inspector of Dairies, Milkshops and Cowsheds.

It is desirable that applicants should possess a Certificate from the Royal Sanitary Institute, or other approved examining body, and the appointment as Inspector of Nuisances will be upon the conditions laid down by the Sanitary Officers (Outside London) Order, 1910.

The person appointed will be required to give security in the sum of £100.

Applications, in writing, must be sent, with copies of not more than three recent testimonials, so as to reach me not later than the 26th inst.

EDGAR BOOTH,
Clerk.

7 Harrison-road,
Halifax.
May 14, 1913. (460)

LANCASTER CORPORATION.

Wanted, General Surveying and Engineering Assistant; must be a good Surveyor and Leveller, and neat Draughtsman. Municipal experience essential. Salary £120 per annum. Forms of Application may be obtained from the undersigned on receipt of a stamped envelope, and must be returned not later than Monday, June 9th, 1913.

ARTHUR G. BRADSHAW,
Borough Surveyor and Water Engineer.

Town Hall,
Lancaster. (466)

"The Daily Telegraph" (April 26th)
ON THE
BAYARD
the "Quality with Economy" Car.

"So keen is the competition nowadays among motor manufacturers to gain customers, that they are straining every nerve to produce good and reliable cars at a reasonable price. Motor cars of this class do not grow cheaper, but the purchaser is getting better value than ever. Such an example is the 10-h.p. 4-cylinder Bayard, the engine of which is said to develop 18 b.h.p. Fitted with a four-seater torpedo body it is priced at £241. The suspension of the Bayard is particularly good, and the car holds the road in a way not usually met with in the majority of small light cars. In addition the wonderful lasting power of the Clément-Bayard is a matter of comment in motoring circles."

12-horse power 4-cylinder Car

75 × 130, 4 speeds, both brakes on rear wheels, complete with 4-seater torpedo body, hood, screen, 5 lamps, horn, 5 detachable wheels and tyres (one non-skid). £350.

Catalogue Free.

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98 HIGH STREET, MARYLEBONE, LONDON, W.
Telegrams: "Clembayar, Baker, London." *Telephone: 3513 Mayfair.*
Sole Concessionnaires for A. CLÉMENT-BAYARD, Levallois, Paris.

The Surveyor

And Municipal and County Engineer.

Vol. XLIII. MAY 30, 1913. No. 1,115.

Minutes of Proceedings.

Terms Used in Highway Work. In order that American engineers may be fully prepared for the discussion of highway terminology at the London Road Congress, Major W. W. Crosby, chief engineer to the Maryland State Highway Commission, has prepared a glossary of such terms, the definitions given being, in many cases, "the best expressions of thought or the most general understanding of the terms," while in other cases Major Crosby has, no doubt, found it necessary himself to put the idea into suitable words. The list was prepared in readiness for the first May issue of *Good Roads*, and Major Crosby has kindly sent us a copy so that engineers on this side of the Atlantic may also be able to consider his definitions before the congress meetings are held.

There are among these definitions several that will specially attract attention at the present moment, notably those of "asphalt" and "bitumen." It will be observed that Major Crosby uses the word "asphalt" to cover solid or semi-solid bitumen obtained by refining petroleums. Mr. Prévost Hubbard, it will be remembered, considers that these should "more properly be termed oil asphalts." [U.S. Office of Public Roads. Circular No. 93. See THE SURVEYOR, March 10, 1911, p. 383.] We must not miss the important point that both Major Crosby and Mr. Hubbard take "bitumen" as the wider, but in some respects more definite, term which may be used in defining "asphalt." In his definition of "asphaltene" Major Crosby is in accord with Mr. Hubbard, who has stated, however, that it would seem well to substitute for this term the words "bitumen insoluble in paraffin naphtha." We may accept, in principle, the view that in referring to materials of minor importance a descriptive phrase is better than a name, leaving it, at present, a moot point whether asphaltenes are or are not worthy of being among the materials in the more important class. Apart from the question of the relative importance of different materials, it may be observed that a chemist is apt, quite properly, to prefer a precise defining phrase, while an engineer is inclined, also quite properly, to prefer a concise definition. In such cases the name should be the same, and the defining phrase, which may almost amount to a specification, should be in harmony with the engineer's definition. This is the case with respect to the word "bitumen" in the two lists, Major Crosby's more concise definition having the same purport as Mr. Hubbard's. As regards the word "pitch," its root is probably the same as that of "bitumen," a word which was not in use in England when Genesis was translated. As used in ordinary English it applies to a material which is hard at ordinary temperatures, its softening point being indicated by the fact that sailors have always used it, in their tales of the tropics, as evidence of the high temperature of a ship's deck in hot sunshine. In modern English it usually means coal-tar pitch or Norway pitch.

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Other Definitions of Special Interest. There are in Major Crosby's list a number of definitions the wording of which raises important points, and, in some cases, suggests that care must be exercised if we are to avoid, on the one hand, overlapping definitions, or, on the other hand, gaps in our terminology. In the latter respect we may specially note the word "binder," which Major Crosby reserves for the non-mineral binding material. Neither "filler" nor "packing material" is, however, to be found in his list, though he refers to such material under "macadam" and under "bond." As our readers are aware, we use in these pages the word "binder" as a general term, with such adjectives as "larger," "smaller" and "smallest," and when necessary we employ the terms "filling material" and "packing material" for the sake of clearness. We are inclined to the view that the general term "binder," so largely used in the literature of engineering to designate earthy and loamy binding materials, should remain as the general word, and that a term such as "cementing material" should be used for the bitumen or very bituminous binders, and for such other substances as are definitely sticky or develop adhesive properties by chemical changes. In damp climates clay acts as a binder in this sense. We are ready to accept a single word instead of "cementing material" if such can be found, but this term keeps us in line with geologists and is very serviceable. Major Crosby, it may be noted, proposes to retain "cemented" as equivalent to "bonded." Possibly a solution would be found if we substituted "bonding material" for our general term "binder," and employed the latter term for the sticky or cementitious binder—the cementing material proper. This suggests that Major Crosby's definition of "clay" seems inadequate, "finely divided mineral matter" specified as having particles between 0·005 and 0·0001 millimetre in diameter. Clay is a very important substance, and its behaviour in company with and in combination with water is a matter to be reckoned with in highway engineering. It cannot be classed merely as the finest material in a list beginning with gravel.

As regards the distinction between a bridge and a culvert, we believe that most surveyors consider that it would be sufficient to agree that all such structures of more than some defined span should be "bridges," and those of smaller span "culverts." If, however, we consider a wide range of topographical conditions this criterion seems hardly adequate. Consider a bridge of 9-ft. span and 15 ft. in width over a small ravine, with a stream

running 15 ft. below. We cannot imagine an engineer of an Indian or Colonial public works department calling this a "culvert." Or take a structure of 11-ft. span and about the same height, 60 ft. in length under a high embankment. Would this be called a bridge?

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Words Relating to the Carriageway.

Coming now to words relating to the carriageway, we note the absence of "camber" and "crossfall," the word "crown" being offered both for the amount of camber and for the gradient of the crossfall. The word "foundation" is proposed as the equivalent of the term "road-bed," and instead of our word "foundation" Major Crosby proposes the term "artificial foundation." This we do not like at all, and would much prefer to use "road-bed" (discarding the use of "subsoil" in this sense) and "foundation," the latter term applying to the foundation course on soft soils, but not to the lowest course of a thinner crust on hard soils. Another definition pointing to a difference between American and British practice is that of "shoulders." The word is not used in this country as the equivalent of "verges," and it may be suggested that it will be most serviceable if applied to such portions of the crust as are made differently to the central portion, either because they are subject to less wear, or because they are definitely intended for passing purposes only. Possibly, however, British surveyors would prefer to use the word as applying, in any case, to about a quarter of the width of the carriageway on each side of the middle half. Differences between American and British practice do not, however, justify any lack of agreement as to the proper use of the words "crust" and "carpet." The adoption of these words in British highway terminology followed their employment by Mr. Reginald Ryves for the express purpose of definite and precise description. The term "road crust" has thus been largely used in reference to the whole thickness of materials which rests upon the natural surface, the terms "foundation course" and "wearing course" being suitably employed to distinguish different portions of this crust. Similarly, a "carpet" is a surface layer which, as distinct from a wearing course, has no important strength in itself. The old term "foundation" is still applied to the concrete crust which supports a carpet of wood blocks or asphalt, but such a concrete layer is a complete crust in itself, provided with a carpet which protects it from abrasion and fulfils the requirements of traffic as to surface. A word to be applied to the whole thickness of the materials placed upon the road bed is a necessity, and we cannot follow Major Crosby in his proposal to apply the word "crust" only to the portion above the foundation course. Similarly, the word "carpet" is needed as a general word to describe a *form*, and must not be narrowed down by a restriction to certain *materials*. The temptation to a too free use of the names of materials is one of the pitfalls of terminology.

In making the above observations we have selected only those cases in which we find Major Crosby's definitions unsatisfactory, having regard to the meanings usually attached to the words in British highway practice. The list, as a whole, is a very valuable contribution towards the discussions which may be expected to take place at the Road Congress, and many of the definitions are very happily worded. We are grateful to Major Crosby for giving us the opportunity of putting the results of his labours into the hands of British surveyors, and we trust that those who intend to take part in the discussion of the subject at the congress will come prepared with carefully considered comment, and with such additional suggestions as they may think are required to cover the whole ground of the terminology of highway engineering.

Gratuities to Officials.

The question of additional remuneration for special duties performed by officers of local authorities is one which not infrequently causes some friction, either in regard to the amount to be paid or to the particular officials who are to be specially rewarded in any given case. For this reason, we have long held the view that it is highly desirable in the public interest that every official should be paid a salary which is adequate to compensate him for every duty which can reasonably be foreseen. Even if this be done, however, circumstances must arise from time to time when there have to be performed duties of a very special character which in common fairness ought to be made the subject of special payment. In the case of engineers it may be the supervision of some exceptionally large contract, when care must be taken that the *form* of the honorarium does not render the engineer liable to the pains and penalties of those provisions of the Public Health Act, 1875, which forbid officers from being "concerned or interested" in contracts. The words "concerned or interested" have been considered by the Courts on several occasions, and the decisions which have been given (not to go into details) have resulted in the establishment of the broad proposition that such extra remuneration should take the form of a fixed sum, and should not be variable with the amount paid under the contract, as, for example, a percentage on the total cost of the work. Another excellent example of a case in which special work undoubtedly appears to call for payment by honorarium is the promotion of a Bill in Parliament. This is not an everyday occurrence, even in our largest cities, and the amount of labour which it entails upon the officials concerned—and particularly upon the engineer when the subject-matter of the Bill affects his department—is enormous. We were considerably surprised to observe, therefore, that in connection with the Bill successfully promoted by the Sheffield Corporation last year the city engineer was the only official whose extra work in connection with the Bill was not recognised by the payment of an honorarium. A reference to the report of the last meeting of the corporation, which appears in the *Sheffield Daily Telegraph* of May 15th, shows that the reason for this apparent anomaly was that as for some reason it was proposed to grant Mr. Wike a sum equal to just half that given to other heads of departments, he took the dignified course of withdrawing his name from the list of those to whom gratuities were recommended by the committee. The work accomplished by Mr. Wike in connection with the Bill was acknowledged by many members in the course of the debate. It appears, however, from the speeches of Sir Charles Skelton and Alderman Senior (both of whom advocated the payment of the larger sum to the city engineer) that certain members of the council were making the proposed gratuity the occasion of venting some ill-feeling which they had against the city engineer. We entirely agree with the comment of the *Sheffield Daily Telegraph* that the discussion (and, we would add, the whole incident) is not one which has enhanced the dignity of the corporation.

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Deplorable Sanitation at Coseley.

The *Birmingham Post* has performed a public duty in calling attention to the default of the Coseley Urban District Council with respect to the sanitary condition of the district. Coseley, lying between Wolverhampton and Dudley, is an urban district of about 23,000 inhabitants, with an area of 3,700 acres. The houses number 5,000, and a considerable proportion of them consist of one room down and one up stairs, while the majority have no more than four rooms. The average number of persons per house

is 4·4, and Dr. Reid, county medical officer, has condemned the general conditions in the district as "deplorably bad." The fact that these conditions show but little improvement on those that Dr. Reid had occasion to condemn twenty years ago cannot be regarded as other than a serious reproach to the local authority. Dr. Clendinner, medical officer to the council, has been complaining constantly of the primitive sanitary arrangements that are allowed to exist. In many instances there is no spouting to the houses, the yards are unpaved, and the sink slops drain in open gullies over the footpaths in open channels. The channels by the roadside convey the flow from many of the houses to the nearest outfall, consisting, at Coseley, of "brooks, ditches, and the canal." There is no sewerage system in connection with the older houses, and of the newer houses a proportion are built on polluted and damp sites without adequate preparation. "Closets, ashpits, drains and cesspools contravene the by-laws," Dr. Clendinner reports, "and in this manner a load of trouble and responsibility is little by little being added to what the district already has to bear in this matter of housing." The difficulties of the local authority were doubtless considerable, but these ought to have been faced if not surmounted. Instead of doing this, however, the council have virtually ignored the existence of these accumulated sanitary horrors, and Dr. Reid bluntly writes: "It would almost appear that the efforts of the authority to retard progress are greater than those in the opposite direction." Some of the worst of the evils are at length to be attacked, or it is to be hoped they are if only out of tardy respect to the law and order that have been so unblushingly outraged by a succession of local councils. An ultimatum has been delivered to the urban council by the county council to put their house in order, and it is to be hoped that this may succeed in stirring the dry bones of sanitary inaction into an activity more in accordance with the fitness of things than has obtained in Coseley for a generation or so.

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National Health Week. The reports which have been received from various localities in regard to the second annual celebration of National Health Week show that this year—as last—a vast amount of useful educational work has been accomplished in many districts. The movement has again had the benefit of the cordial co-operation of a large number of sanitary authorities, who realise that the formation of a sound public opinion in regard to all matters concerning health and hygiene is calculated to be of material assistance in rendering thoroughly effective the work of their own public health departments. It will be remembered that the institution of National Health Week originated in a suggestion made by Mr. Arthur J. Martin, M.INST.C.E., who is to be cordially congratulated upon the widespread success of the movement. In this connection we were particularly interested to receive a few days ago the account of a very successful celebration at Regina, Saskatchewan, Mr. Martin's idea having been explained by Mr. R. O. Wynne-Roberts, M.INST.C.E. The matter was taken up with great energy, sermons being preached, lessons given in the schools, and the city council voting a sum of money towards the expenses. As might have been expected, some of the methods adopted in the course of the celebration were a little unconventional. For example, on one day from 6 a.m. to 6 p.m. there were "twelve hours of agreeable work, to be participated in by every citizen in an effort to make Regina the cleanest city ever." The example set by Regina is being followed by other towns, and the idea of "Health Week" is now fairly well established in Canada. Great quantities of rubbish, which would otherwise have taken weeks to clear, have been removed; public opinion has been aroused; and attention has been directed to the essentials of public and personal hygiene. The success and growth of the Health Week idea is very gratifying and should have a very real effect on the improvement of the public health.

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The Private Street Works Act. Several interesting points under the Private Street Works Act, 1892, arose in connection with the hearing by the magistrates of certain objections to the specification and apportionment in respect of the making up of Atherley-road North, Southampton. In the first place it was sought to object that in making the apportionment the corporation had not considered the "degree of benefit" to be derived by the various premises from the works. Counsel for the corporation very properly pointed out that under the Act the jurisdiction of the justices only extended to the heads of objection specified in sec. 7. It was held in *Bridgwater Corporation* v. *Stone* (1908), 72 J.P., 487, that, in the absence of a resolution by the local authority, duly passed under sec. 10 of the Act, the justices have no power to reduce an apportionment on the ground that "degree of benefit" should be considered. This is a matter for the local authority, subject only to an appeal to the Local Government Board under sec. 268 of the Public Health Act, 1875. Other objections had reference to the unreasonableness of the proposed works and the excessiveness of the estimated expenses, and in regard to both of these matters the justices decided in favour of the corporation. We have always held the view—and we have on more than one occasion found it necessary to express it in these columns—that in deciding upon what works ought to be done in a private street before it is taken over so as to be repairable at the public expense, the local authority have to hold the balance between the owners on the one hand and the general body of ratepayers on the other. While the owners should not be required to pay for any unreasonable works, they must not be allowed to escape their fair liability at the subsequent expense of the public purse.

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A "New Building." It will probably be within the recollection of our readers that by sec. 159 of the Public Health Act, 1875, the conversion into a dwelling-house of any building not originally constructed for human habitation is to be considered as the erection of a new building within the meaning of the Act. A rather curious case involving an interpretation of these words was recently decided by the High Court in the following circumstances. The appellant had for some three years occupied and used as a dwelling-house two vans, one being a living room and the other a sleeping room. During the whole of this time the vans stood upon a piece of land which was the property of the appellant. Last year, however, he was minded to make certain alterations and improvements in his dwelling, and for this purpose he built a dwarf brick wall about 12 in. high, and placed the vans side by side so that one of them rested partly on the wall and partly on blocks of wood and dummy wheels, while the second van rested on blocks of wood. He then cut out part of the side of one van, and caused this van to be placed up against a brick chimney stack, which was built into the opening in the side of the van created by the removal of part of its side. New brickwork was added to the flue, and a chimney stack erected, built tight into the side of the van. In these circumstances the Court upheld the decision of the magistrate that the work executed by the appellant constituted in law the erection of a new building, and that he was therefore bound to comply with the by-laws. The appeal was accordingly dismissed.

By-Pass Roads.

THE PRINCIPLES WHICH SHOULD COVERN THEIR ALIGNMENT AND CONSTRUCTION.

By REGINALD RYVES, M.CONS.E., ASSOC.M.INST.C.E.

In order that we may fix the principles to be followed in aligning a route for a by-pass road, and in deciding matters of width, gradient and so forth, it is necessary to consider not only the service which the road is to perform, but also the objections which may be raised on account of possible loss of business which may be incurred by retail traders on the old route. It is not so generally recognised, though it is really of equal or greater importance, that the alignment of the by-pass road, and its nature, should be such that its character as a relief road will not be destroyed either by developments to which the by-pass road itself gives rise or by the growth of the town. The character of the road as a relief road will be destroyed and its usefulness impaired if it becomes another "High-street"—which may occur by the development of building estates on the land adjoining it.

Anywhere within some 15 miles or 20 miles of London a good main road, if located in land suitable for the building of small villas or workmen's houses of a good class, is likely to throw out a whole series of side roads, and to be itself lined with shops catering for household needs. Some proportion of the residents will use motor omnibus services direct to London, and others will take the omnibus to the most convenient railway station on the London road. The London suburban railways cross the main radiating roads; very few run directly into London, and this greatly increases the radius to which land is rapidly developed by motor omnibuses.

Having made a careful study of the whole subject of highway developments, the writer proposes in this article to state didactically what are the principles which should be followed in by-pass road alignment and construction, and then to show how the three groups of requirements will thereby be fulfilled.

FINANCE.

There can be little doubt that in the near future there will be some direct Exchequer contribution towards the cost of maintenance of some of the most important of the main roads of the country, and, since a by-pass road is of the nature of a trunk road, however short it may be, such roads will probably be regarded as trunk roads in any comprehensive scheme of road finance. At present, however, the only central fund available—that of the Road Board—may not be used for maintenance except in the case of new roads.

The board may make new roads, and must then pay the whole cost of their maintenance. It may make grants in aid of the construction of new roads, and may then contribute towards the cost of their maintenance, and it may make grants in aid of improvements. The amount which the Road Board will be prepared to contribute towards the cost of construction will probably be dependent upon the extent to which the road will be used by through traffic, and it may therefore be good policy in promoting the making of such a road to provide only for such widths and gradients as are sufficient and suitable for through traffic, asking the Road Board, in consideration of this, to pay towards its cost, not necessarily a larger amount than they would contribute towards the cost of a more expensive scheme, but a larger proportion.

It is no use to regard the road as intended to further local developments and to add to the rateable value of the locality, and at the same time to urge that it is a national enterprise and properly chargeable to central funds. Similarly, as regards county contributions towards the costs of construction and of subsequent maintenance, the more definite the character of the by-pass route as a through road, and the less important its possible effects as developing local areas, the larger is the contribution which the county may be expected to make. If the road is located in an urban or rural district, it should properly be regarded as a main road to be maintained at the cost of the county; but here again it is not reasonable to ask the county to maintain, say, the old 30-ft. road and a new 40-ft. road. It would be clear to the county authorities that a 20-ft. road should be sufficient to take a large proportion of the through traffic of an existing 30-ft. road, and that any further width of the road as proposed is intended either as a luxury for motorists or to give the new road the character of an important local thoroughfare. It might reasonably be demanded, by the Road Board or by the county authority, that the width of land acquired at the outset should be sufficient for any widening of the carriageway that might be needed in the future; but that is a very different matter to the construction of a carriageway with its culverts and bridges to a width in excess of present requirements.

ALIGNMENT.

The acceptance of the principle that a by-pass road should be definitely a road and not a street affects both its alignment and the details of its construction. It should not be so aligned that it will relieve only that part of the present road where congestion is most serious and delays to traffic most frequently occur. If it be so aligned the growth of the town may swamp the entrance at either end, or at both ends, or may so beset the route with definitely urban surroundings that it must perforce become a street proper. It is clumsy engineering and bad finance to meet this by making the new road so wide that it will serve as a main route as well as a shopping street, especially since the actual width necessary in such a case is unknown. In this connection there is a prime fact of geometry which must not be missed—namely, that a loop which must pass at a certain distance clear of the centre of the town adds considerably to the total distance traversed if it be a short loop, but adds very little to that distance if it be a long one. This assumes the old route to be straight, but the same principle holds in every case except when the loop road is on the outside of a fairly sharp bend.

The road should be so aligned that its ends are in places where they are not likely to be affected by the growth of the definitely urban part of the town, and it should, as far as is reasonably possible, run through areas of a rural character, or, at least, where the roads are not in the ordinary sense streets. It should be remembered that the cost per mile of running motor vehicles is greater when the vehicles have to be stopped or slowed frequently than it is where there is a clear run. Substituting convenience for cost, the same applies to ordinary cyclists. To put it more generally, the road should be so aligned that it may be definitely a main road and not a street, and so that the decision to preserve it as such may be justified. It must be understood that if the town prospers and extends its central area of busy and shop-lined streets the by-pass road is not to be swallowed up by such a development, but is to be preserved as a main road in the same way that open spaces are preserved for the benefit of the local population.

THE CHARACTER OF THE BY-PASS ROAD.

In order to give effect to this principle it should be agreed by the promoters of the scheme and those contributing to it that the building line shall be kept well back from the carriageway. Circumstances may justify the building of houses with front gardens, or it may be better to start the side street houses at the building line. In any case, the provisions made for control of the land should be such that there is not likely to be any development of the road as a shopping thoroughfare. If the matter cannot be settled by arrangement with the landowners the Road Board may be asked to exercise its ample powers, which include that of the purchase of a strip of land 220 yds. wide, and the further power to "sell, lease or manage" such of the land as is not required for the highway. The best procedure would seem to be that in such cases the Road Board should lease the land to the local authority under conditions which would ensure that the road would for ever preserve its character as a main road. This applies to roads constructed by the board itself, but the provisions of the Development Act, coupled with the existing powers of local authorities, seem to be sufficient to meet other cases.

The acceptance of these principles of alignment and of the preservation of the road as essentially a main thoroughfare would settle many difficulties encoun-

tered in preparing schemes for by-pass roads, and would greatly lessen the amount of futile discussion in connection with such schemes. When a project of this nature is mooted, the "shopkeepers in the High-street" fear that they may lose some of the casual custom of the passing motorist; but they fear much more that the new road will develop into a great shopping thoroughfare, and possibly shift the centre of importance of the town. If, however, they could be assured that the new route would be permanently a main road proper and not a street, their fears would be largely laid at rest, and the loss of casual custom would be found to be a matter of much smaller importance.

An even more important consideration is that the decision to preserve the main road character of the loop road settles the question of the width of land to be acquired. This width should be sufficient to allow of that moderate widening of carriageways and footways which is all that can be necessary, however far ahead we look. For if the through traffic increase to beyond a certain amount it will then be time to develop other roads which will draw some of it off. If a large local traffic develops, roads must be made for it.

WIDTH OF CARRIAGEWAY.

Those who have not studied country roads would be surprised to learn how large is the amount of traffic which can be carried on a road with a carriageway only 16 ft. wide, especially when the traffic is of a definitely main road character. Traffic of an urban or suburban character requires, in proportion to the numbers of vehicles, much wider roads than those which suffice in the open country. An economic point of importance in this connection is that when the width of a road exceeds some limit, depending on circumstances, it is cheaper to maintain two roads than one for the same traffic. Further, when the cost of maintenance per mile per annum exceeds some limit, it is cheaper to pass it over two roads than over one. Such duplication is almost certain to reduce the numbers of accidents.

Now, a carriageway 24 ft. wide will carry a very large amount of traffic, unless we have the conditions of an urban street or road, with vehicles standing at the kerbs, and frequent stoppings and startings of public vehicles. Tramcars greatly add to the width necessary, partly because they cannot swerve, but also because, in most cases, their passengers have to cross a useful piece of roadway when entering or leaving the car. It is therefore necessary to provide that by-pass roads shall not be occupied by tramways. A by-pass road may be in connection with a main avenue which has the joint character of an urban thoroughfare and a trunk road, and where tramways are in their proper place, but the by-pass road itself must be classed with country trunk roads, and linked with them as far as possible. They should, however, be so made that they will carry motor-omnibus traffic, which forms a useful link between town and country, and is capable of development in definitely rural areas. Where the existing main road is occupied by tramways the tramway service will gain considerably in expedition and in safety by the construction of a relief road, which will withdraw a considerable proportion of the through traffic, including the slower motor vehicles.

A 24-ft. road without trams is sufficiently wide to carry a very large amount of through traffic. The idea that trunk roads need be very wide is a fallacy, and it is unfortunate that there have been so many efforts to put forward proposals for the construction of a system of trunk roads 60 ft., 80 ft., or even 100 ft. in width. Very few trunk roads will need to be more than 30 ft. wide, and for a by-pass road a width of 24 ft. will usually be sufficient, even if there be some local traffic as well as the through traffic, and in some cases a less width will suffice. Every foot of unnecessary width involves not only a waste of capital, but also a waste of money in maintaining the road. The carriageway and footways should be made only of such width as is needed for present purposes, extra width to allow for future widening being provided in the road margins, or in untouched land, or partly in both on the advice of the engineer.

THE WHOLE WIDTH.

To fix our ideas we may take the following figures as typical; Carriageway, 24 ft.; footways, 5 ft. each; margins, 12 ft. each (6 ft. permanent in each case). A further allowance of 12 ft. and upwards for ditches, fences, earthworks, slopes, and so forth, the amount depending upon the heights of embankments and depths of cuttings, upon the nature of the soil, and some other factors. This gives a width varying between 70 ft. and some higher figure. In the future, by reducing the margins to 6 ft. each, we can make a 30-ft. carriageway and two 8-ft. footways. In case of actual need a slight further reduction of the widths of the margins would give us a few feet more for the carriageway.

Such procedure is far better than making a wild guess and estimating for a 40-ft. carriageway, say, and two 10-ft. footways. In some cases one footway might be sufficient. These details need not be further considered, but we must accept a further principle. The whole width, arrived at as above, should be allowed for in the estimate and acquired at the outset. If there are places where the by-pass roads traverse existing roads or streets which do not allow of the desired width of land being acquired except at unreasonably high cost, it may be necessary to regard these pieces of roads as evils which cannot be avoided. In such cases the value of the properties fronting the road may go down considerably during the few years following its construction. At the worst the congestion cannot, on the whole, be as serious a matter when the traffic is divided as it was when all of it had to proceed along the old main route.

It should therefore be accepted as a matter of principle that a by-pass road is not to be condemned because there are narrow places in it, though a large proportion of "narrows" on a proposed route should lead to the consideration of a route which gives the town a wider berth. If a narrower road would then suffice, its cost per mile would be less, but not much less if any considerable amount of earthwork were necessary. For such a road, however, a single footway might suffice.

GRADIENTS.

As regards the earthworks necessary in making a by-pass road, these need not be so costly as those for a road for general traffic on the same line. By-pass roads being intended for through traffic, their gradients need only be kept down to those which can be tackled with reasonable ease by vehicles ordinarily employed for long distance journeys. As to the capacity of ordinary private motor cars in this respect it is beyond question; no gradient less than 1 in 10 need be considered as an impediment. The gradients with which heavy motor vehicles may be confronted on a by-pass road may be decided by two criteria. First, whatever be the gradients which have to be surmounted in crowded streets, where the vehicle has to be stopped and started again on the gradient, a much steeper gradient can be tacked with the same effort, or the same amount of wear and tear of machinery, on an unobstructed road. Suppose, then, that the street on the old main route has a gradient of 1 in 25, a gradient of about 1 in 18, or even steeper, could be tolerated on the by-pass road. The other criterion is more general in its application. A vehicle which can be used economically in the crowded streets of cities, often having to stop, often having to get up speed from rest or from a slow speed as quickly as possible, has to be provided with engines of such power and so robust that it can easily be taken up inclines of 1 in 12, and even steeper. As far as the vehicle is concerned, and assuming that the road is a reasonably strong one, vehicles which are suitable for use in a city are suitable for use in hilly country districts. As regards petrol consumption, this is reduced when the number of compulsory stoppages is reduced, and with careful driving a vehicle need not use much more on a hilly road than it does on the level. This is, of course, taking the route both ways, in which case the amount of uphill is exactly the same as the amount of downhill. As far as cyclists are concerned, the choice of a route is seldom determined by moderate differences in gradients, and alternative routes are preferred by cyclists when, as is often the case, it is easier to go one way and to return by the other. In any case a cyclist usually prefers a route without trams.

It may be noted that for a short slope of 1 in 20 the driver of a commercial motor vehicle does not usually have to change gear, and on the second speed long slopes of 1 in 20, and considerably steeper gradients of no great length, can be taken quite easily. We may, then, accept the general principle that on by-pass roads the gradients which may be allowed are steeper than those of busy streets on the

main route, and somewhat steeper than those regarded as reasonable on main roads carrying mixed traffic in the same part of the country.

If the principles set forth above be followed, by-pass roads can be so aligned and so made that they will serve their local purpose, and play a useful part in the highway system of the country. If, on the other hand, such a road is so treated that its future and even its present character is a matter of hazy speculation, and if it is made so wide and with such easy gradients that the costs of construction and maintenance are very high, then its construction will lead to unhappy complications, financial embarrassment, and vain regrets.

There are other matters in the engineering of such roads which are very important—matters, that is, which need to be specially considered in the light of the special character of the road; but these technical studies would be out of place in an article dealing with main principles and with absolutely vital elements in design. Opinions may differ as to the relative and absolute importance of the principles set forth, but it is submitted that they hold together, and that conclusions based upon their general purport cannot be regarded as unimportant.

THE PROPOSED BY-PASS ROAD FOR CROYDON.

THE GROUNDS ON WHICH THE SCHEME IS OPPOSED.

In last week's issue we gave some account of the first two days' proceedings at the Local Government Board Inquiry which was held at Croydon on May 14th, 15th, 16th, 19th and 20th, an inquiry into the application of the Croydon Corporation for sanction to a loan of £19,743, the borough's share of the estimate of the cost of construction of a relief road to carry through traffic past Croydon. As this is the first important work of the kind to be the subject of a Local Government Board inquiry, some account of the manner in which it was conducted may be of interest.

The scheme was supported by the Corporation of Croydon and by the Roads Improvement Association. The plans for the relief road were prepared by Mr. E. F. Morgan, borough highway surveyor, and evidence in support of the scheme generally, and of the plans, was given by Mr. E. F. Carter, borough engineer. The scheme was opposed by the Croydon Chamber of Commerce and the Federation of Ratepayers' Association. The West Ward Ratepayers' Association was also represented, and other ratepayers opposing the scheme took part in the proceedings. The Croydon Rural District Council were also in opposition to the scheme. Among technical witnesses examined were Mr. Shrapnell Smith, honorary treasurer of the Roads Improvement Association, Mr. C. Chart, an architect and surveyor practising in Croydon, Mr. Jesse Ellis, chairman of the National Traction Engine Owners' and Users' Association, Mr. G. Noble, secretary to the National Cyclists' Union, Mr. A. E. Brassington, traffic manager of the Eastern Motor Wagon Company, and Mr. R. Chart, highway surveyor to the Croydon Rural District Council.

The main road leading through Croydon has consistently the character of a through-route, passing through important places, and, for some 15 miles from London, being a creative road, in the sense that it produces a large amount of traffic to and from the streets that spring up beside it. This feature of the road is a very important one. For a few miles, in the more central portion of the Borough of Croydon, the main road character of the route is at times subordinated to its character as a main street; at other times through traffic predominates, but very frequently local and through traffic are in conflict to an extent which is held to be very serious by the supporters of the scheme, and even by some of those who oppose it, but consider that it is necessary to widen the main street, and possibly to make use of existing roads, by traversing which through traffic could avoid the most congested parts of the existing road.

The length of road which it is proposed to relieve of through traffic is traversed throughout its whole length by a tramway, two tracks where the road is wide and one track where it is narrow. Five other tramways make junctions with this main tramway, either by direct connection or by an interchange of passengers, and in one case there are two such sources of congestion at the same place, one on each side of the road. At certain hours on Saturday and Sunday a mile or so of the main street is thronged with foot-passengers who are obliged to make large use of the carriageway, and there are times when this condition occurs in conjunction with a large traffic, either general or that of motor vehicles.

The case for the council may be put shortly as follows: The road is badly needed to relieve Croydon of through traffic. Whatever widenings may be carried out, the central part of Croydon will never properly accommodate both through traffic and local traffic. There is a frequent service of trams, two services of motor omnibuses, a large amount of "carriage shopping," throngs of pedestrians, a large through traffic, including motor cars and ordinary cycles, and no inconsiderable amount of heavy hauling. The land near the new road is likely to be developed as building land. None of the present possible alternative routes are suitable as by-pass roads. The road will not seriously affect shopkeepers, the casual purchases of passing motorists being inconsiderable. The worst gradient on the new road—one in twenty—is not a serious impediment to motor vehicles of any kind, and is not as bad as the present gradients in Croydon on the existing main road, since it is frequently necessary for drivers of vehicles to come to a dead stop on these gradients and to start again, which would not be the case on the by-pass road.

The case for the opposition may be put as follows: If the road is going to be used it will take away trade from the shopkeepers of the borough, and if it is not going to be used, the money spent on it will be wasted. A really important amount of money is spent by motorists who pass through the borough, and most of it will be lost if the by-pass road were made, because it is casual custom, and not the result of premeditation. The road will cost very much more than £55,000, which is a figure put forward for the sake of getting the scheme through in the interests of "foreigners." Necessary works have been left out of the estimate. The cost of maintenance and lighting would be considerable. There is a narrow entrance, a narrow exit, and another narrow place about half way. There is a long gradient of one in twenty. Some of us would not be against the scheme if it were to be carried out by the Road Board, and if Croydon's contribution were definitely limited to £20,000 or so; but as it is, Croydon takes the responsibility for the road. The exit at Purley is in a bad place—near a tramway terminus. The scheme is really promoted by the motoring associations. There are several existing roads which could be used as alternative routes to relieve the congestion in the centre of the borough.

The two paragraphs above give in bare outline the main contentions of the supporters and opponents of the scheme.

Public Health Law.—This concise little work* has been prepared mainly for the use of all concerned in local government work who may find the larger books too elaborate. In twenty chapters it covers the ground sufficiently for its purpose, including such matters as highways, but omitting rating, elections, &c. For students it should be of assistance in preparing for examinations in Public Health Law, while the practitioner will find its arrangements well suited for easy reference.—*The Law Times.*

Fire Protection at Chiswick.—In his annual report upon the fire protection department of Chiswick, Mr. Edward Willis, the engineer and surveyor to the urban district council, points out that hydrants are placed at the corner of nearly every street in the town, in addition to many others at intervals varying from 80 yds. to 200 yds., according to the nature of the property to be served. The positions of hydrants are indicated by means of plates on the walls of houses or forecourt walls immediately opposite. Dealing with the maintenance of the overhead electrical equipment, Mr. Willis observes that he is not in entire agreement with the council's desire further to extend the wayleaves over the roofs of houses. Not only is the initial difficulty in obtaining these very great owing to prejudices which exist in regard to such attachments, but there is a tendency to cast every burden of a defective roof or broken slates upon the council or their contractor. Mr. Willis suggests it is a point which the committee might well consider in the future as to whether pole lines should not be adopted in certain localities in preference to wayleaves on houses.

* A Manual for Municipal and County Engineers and Surveyors, Town Clerks, Clerks to District Councils, and other officers and members of local authorities. By S. G. Turner, of the Middle Temple, Barrister-at-Law, A.M.I.C.E., &c. London: St. Bride's Press, Ltd. Price 10s. 6d.

Studies of Fish Life and Water Pollution.*

By H. W. CLARK and GEORGE O. ADAMS, Boston, Mass.

The effect of sewage pollution upon shellfish and the areas from which shellfish are taken has been investigated during the past ten or fifteen years, chiefly because shellfish are likely to be the bearers of infectious diseases. From a practical point of view the question of fish life in streams in a settled community is one of the value of such life in a certain stream or lake compared with the cost of maintaining such freedom from pollution or such restrictions in the use of streams as will allow the continuance of this life. It goes without saying that, looked at in this way, the cost of preserving a stream in a condition that allowed such life might be exceedingly large as compared with the value of the fish saved. This would be especially true in manufacturing districts, as in such places the streams are chiefly valuable for power and the carrying away of the waste products of the districts more or less purified. Treating these wastes sufficiently to prevent the stream from becoming a nuisance, moreover, may not keep it sufficiently pure to encourage the life of fish within it. Many streams are fated to become sources of power and the carriers of wastes, and find their chief value when so used. Practically all that can be expected in many instances is that the sewage or wastes entering such streams shall, at all times of the year, be so purified before entrance, or so diluted by the flow of water, that the stream will not be a nuisance to the community through which it flows, but rather a source of enjoyment to such community.

From a scientific standpoint there are a number of questions to be considered in this study of pollution and fish life, the most important being as follows: (1) The amount of pollution that a stream may receive without decreasing the dissolved oxygen of the water to such a degree that fish can no longer live in the water; (2) the effect of the various constituents of sewage and trade wastes upon fish, and the effect of these various constituents upon fish even when a plentiful supply of dissolved oxygen remains in the waters after receiving these wastes; (3) the amount of oxygen consumed by the fish themselves, and (4) the rate of absorption of oxygen by polluted waters.

At the Lawrence Experiment Station of the Massachusetts State Board of Health a series of investigations in regard to these questions has been carried out during the past year. The experiments have been made largely in 5-gallon glass aquaria and the commonest fish of the region—shiners, suckers, chub and carp—have been used. Most of the carp and shiners have weighed from 1 oz. to 2 oz. each, while the suckers have weighed from ¼ lb. to ½ lb.

EFFECT OF SEWAGE.

In the first experiments the fish were immersed in undiluted Lawrence sewage, well aërated, and containing, at the time of immersion, from 50 to 100 per cent of saturation of dissolved oxygen. Notwithstanding the presence of this dissolved oxygen, all the fish in these experiments apparently became crazed when immersed, and died almost immediately —that is, within a few minutes after immersion.

EFFECT OF EFFLUENTS FROM SEWAGE FILTERS.

Following this, experiments were made with the effluents from sand, contact and trickling filters, and with mixtures of sewage and water, contact filter effluents and water and trickling filter effluents and water. In all these series of experiments a supply of dissolved oxygen was maintained when necessary by blowing air through the liquid used. The results were as follows:—

(*a*) It was found that when water and sewage were mixed in equal portions and this mixture kept aërated, fish life could exist almost indefinitely, but with a larger proportion of sewage of the strength used the fish died within a few minutes, or at most in an hour or two after their immersion. Even in the equal mixtures of sewage and water a number of fish died quickly, and only the stronger individuals survived, but such as did survive were kept in this mixture alive and well for fourteen days, and apparently could have continued to live for an indefinite period. The sewage used was freed from matters in suspension before being mixed with the water.

(*b*) It was found that effluents from contact and trickling filters in successful operation, when kept aërated, supported fish life for fourteen days without any apparent discomfort to the fish immersed in these effluents. . . .

EFFECT OF SEWAGE AND EFFLUENTS WHEN NON-AËRATED.

Experiments were next made to determine the volume of water (tap water) necessary to mix with sewage and the effluents from trickling filters in order that fish life might be sustained under what might be called stagnant conditions—that is, sustained without the introduction of dissolved oxygen by aëration as in the previous experiments. After several trials it was found that but 10 per cent of sewage could be mixed with 90 per cent of water, and the fish survive in good condition for fourteen days. Increasing the proportion of sewage above this percentage invariably caused the exhaustion of the oxygen and the death of the fish within a few hours. It was found that only 25 per cent of water was needed in 75 per cent of the best trickling filter effluents in order that fish might live under these stagnant conditions for fourteen days, this mixture always containing enough oxygen to support life, and the effluent present having apparently no harmful effect upon the fish. With the contact filter effluents equal mixtures were necessary —that is, 50 per cent of the effluent to 50 per cent of tap water.

DISSOLVED OXYGEN.

At the beginning of the last experiments described - that is, at the time of the immersion of the fish—the dissolved oxygen in the mixtures was 0·50 part per 100,000. During the experiment it became reduced in the water and effluent mixture to as low a point as 0·11 part per 100,000, and in the mixture of sewage and water to 0·14 part per 100,000, but without any apparent discomfort to the fish in these mixtures.

The greatest consumption of oxygen by the organic matter present in such mixtures occurs in the first few hours, and it was found that if the initial supply of oxygen was great enough to last through this early period, the oxygen would then be increased by absorption from the air.

In a third experiment of this nature, where a mixture of equal portions of tap water and trickling filter effluent was made, the dissolved oxygen at the start was 0·80 part per 100,000, and was not reduced below 0·40 part per 100,000 during the fourteen days of the experiment. . . .

In further investigations in regard to the amount of dissolved oxygen that would sustain fish life the following three experiments were made: Sewage . . . was so mixed with city water that three dilutions containing 5, 10 and 15 per cent respectively of sewage were obtained. In these dilutions the dissolved oxygen was at first 0·88, 1·00 and 0·85 parts per 100,000. In each dilution fish were immersed, and in each of the three dilutions they lived for one week without discomfort—that is, until the end of the experiment. The minimum amount of dissolved oxygen found during this period in each of these dilutions was 0·47, 0·28 and 0·15 part per 100,000 respectively. . . .

EFFECT OF SAND FILTER EFFLUENTS.

In six experiments in which fish were immersed in well-purified, highly nitrified effluents from sand filters receiving sewage, the three fish immersed in each experiment died in from three hours to three days after immersion. All of these experiments but one were clear, but slightly acid, this acidity being due to insufficient base to combine with the nitric acid present. One effluent was alkaline, but contained considerable matter in suspension, this matter being largely silica and alumina. When this suspended matter was removed the fish lived in this effluent without any apparent discomfort for fourteen days, or during the length of the experiment. Other acid effluents from sand filters when neutralised and filtered to remove precipitated $CaCO_3$ and $MgCO_3$, &c., supported fish life. The alkaline suspended matters at times separating from such effluents and from sewage, gathering at the outlet of the fish's gills

* Extracts from paper presented at the Eighth International Congress of Applied Chemistry.

and at the joints in their scales, gave the appearance of a fungus growth upon the fish. . . .

EFFECT OF NITRATES, IRON, POTASSIUM, CARBONATE, ETC.

It would seem without doubt that the alkaline-suspended matter and the acidity of the effluents in the experiments just described were responsible for the death of the fish immersed within them. Fish immersed in water containing 5 parts of nitrogen as potassium nitrate lived without any apparent discomfort, and in water in which organic matter, &c., had been coagulated by the use of 1·5 grains of alum they lived two weeks without discomfort. In water treated with ferric sulphate they became covered with a fungus-like growth, and died in a few days. The iron in solution may have been the cause, as apparently fish are extremely sensitive to iron salts, as will be shown later. Free nitric acid in tap water in amounts equal to 0·7 part per 100,000 $CaCO_3$ was without effect. Very small amounts of hydrochloric acid, not greater than —0·5 part per 100,000, caused the death of fish in a few hours.

When the experiments with nitric acid were made it was found that the small fish used not only neutralised the acid, but made the water alkaline. The water was acidified five times, and each time was rendered alkaline by the fish present. In twelve days the fish experimented with had neutralised acid equal to 2·7 parts per 100,000 $CaCO_3$ in about 1,500 c.c. of water, leaving a residual alkalinity of —1·0 part per 100,000.

"Free ammonia" in sewage is supposed to consist in part of carbonate, and it was found that from 5·5 to 7·0 parts of ammonia as carbonate in well-aërated tap water was fatal to shiners and carp in from a few minutes to a few hours. Ammonia in the form of chloride up to 18·0 parts per 100,000 had no ill-effect on the fish. When used in the form of ammonium hydrate the ammonia was much more deadly, 2·0 parts per 100,000 killing shiners, carp and large suckers in fifteen minutes. The fatal amount was probably slightly over 1·0 part per 100,000, as the fish experimented with were unaffected in water containing 0·94 part per 100,000, but died in water containing 1·3 parts per 100,000.

It should be noted in passing that the ammonium hydrate is soon changed in water to the less injurious carbonate by the free carbonic acid present and by carbonic acid given off by the life of the fish.

The effect of caustic and carbonate alkali was next tried. Pollution of this nature comes from a number of industrial processes, and at times may be serious before sufficient dilution by the water in a stream takes place to render it harmless. It was found that from 25·0 to 30·0 parts per 100,000 $NaCO_3$ per 100,000 killed fish within a few hours. Seven parts of NaOH killed several in two hours, and 9·6 parts per 100,000 killed two in ten minutes. In water containing 5·6 parts per 100,000 fish lived twenty-four hours.

It was noticed in this work that fish immersed in sodium carbonate solutions rendered these solutions less poisonous to fish subsequently immersed in them, this being due probably to the change from carbonate to bicarbonate. As a proof of this, it was found that bicarbonate of soda was the least injurious form of alkali experimented with, fish living easily in water containing 120·0 parts per 100,000.

The effect of iron salts was next investigated, these salts being dissolved in distilled water to prevent precipitation such as would occur in tap water on account of the alkalinity of this tap water. Copperas equivalent to 0·128 part per 100,000 of iron killed fish in from four to twenty-four hours, one fish living without trouble in water containing 0·100 part per 100,000. In such dilute solutions, however, the iron gradually precipitates even when dissolved in distilled water.

In solutions of ferric sulphate fish died in from one-half hour to three hours when 0·1080 part iron per 100,000 was present, and in from twelve to twenty-four hours when as little as 0·0100 part per 100,000 was present.

CONSUMPTION OF OXYGEN BY FISH LIFE.

The large amount of dissolved oxygen breathed by fish is little realised. In studying this point, the following experiments were made: Thirteen small fish, weighing altogether 200 grammes, were placed in a Saltmouth gallon bottle filled with water, and the dissolved oxygen determined at the beginning and at the end of the experiment.

In a second experiment four fish weighing 340 grammes were used. In all, nine experiments of this kind were made. Averaging these experiments it was found, speaking generally, that all the oxygen held in solution in a gallon of water at 60 deg. Fahr.—practically 1 part per 100,000—would be consumed or breathed in one hour by a weight of fish equal to 1 lb. This would mean that 1,000 lb. of fish life would, in about fifteen days, exhaust the dissolved oxygen in a layer of water 1 ft. deep and 1 acre in area, saturated at 60 deg. Fahr., allowing, of course, that dissolved oxygen was not added by absorption from the air.

The oxygen consumed in this way remains in the water as CO_2, and hence the amount of CO_2 in surface waters sustaining fish life must be influenced to a considerable extent by the fish present. . . .

LIBERATION OF OXYGEN BY "GREEN GROWTHS."

It is well known that organisms containing chlorophyll give off free oxygen when growing in the light. Water in which organisms are plentiful is frequently found to be supersaturated with dissolved oxygen as the organisms take the C from the CO_2 dissolved in the water and liberate part of the oxygen. When the dissolved CO_2 is all absorbed, the bicarbonates are attacked and the CO_2 abstracted, leaving carbonates. This happened several times in experiments here. On testing for CO_2 with phenolphthalein a pink colour showed the presence of carbonates, while in the tap water used in the various experiments the alkalinity was due to bicarbonates. In these experiments the "green growths" were largely protococcus, scenedesmus and smaller numbers of monas. In one experiment an aquarium was filled with tap water and seeded with "green growth." The dissolved oxygen and CO_2 at the start were 0·18 and 1·0 parts per 100,000 respectively. At the end of seven days they were 1·14 and 0·0 parts per 100,000 respectively.

In another experiment a small fish was put into a tightly stoppered gallon bottle full of water containing these "green growths." If oxygen had not been liberated by the organisms during this experiment, the oxygen primarily present would have been consumed by the fish in thirty-eight hours. However, it lived eight days, and at its death at the end of this period dissolved oxygen was present in the water in greater volume than at the beginning of the experiment. The growth of organisms increased greatly during this period, and either the presence of these organisms or some body formed during their growth or decay was injurious to the fish.

In a similar experiment made during cloudy weather, when the oxygen-liberating power of the organisms was lowered, the fish present consumed the dissolved oxygen in four days.

In further experiments, not yet completed, upon the effect of such "green growths" on sewage, bottles of sewage were seeded with organisms, then aërated for twenty-four hours, and afterwards allowed to stand twenty-four hours without artificial aëration. The average of sixteen dissolved oxygen determinations then made showed 0·62 part per 100,000 of dissolved oxygen present in these sewages at the end of the period of aëration, and 1·01 parts per 100,000 after the sewage had stood unaërated during an additional period of twenty-four hours; in other words, the "green growth" supplied not only all the dissolved oxygen consumed by the sewage during the period of standing, but, furthermore, increased the volume present 0·39 part per 100,000.

It is probable that the chlorophyll-bearing organisms take a greater part in overcoming sewage pollution in surface waters than is at present generally realised.

Refuse Destruction at Slough.—A new refuse destructor has been constructed at the pumping station at Chalvey at a cost of about £2,000. The contractors were Messrs. Goodridge & Hamlyn, and the builder Mr. H. Street. At the formal inauguration the services rendered by the engineer and surveyor, Mr. W. W. Cooper, in connection with the scheme were publicly recognised. Ten years ago, it was stated, Mr. Cooper put in some furnaces, which had the effect of reducing the coal bill by £180 per annum. He had also done such excellent work in converting the clinker into concrete which was used for paving and channelling the streets that in the last ten years there had been a large saving. On a total capital expenditure of about £120 they had effected a saving of something over £3,000. The work done during the past ten years ought to satisfy everyone in Slough, said one speaker, that they had an exceedingly keen and painstaking surveyor in Mr. Cooper.

Definitions Proposed for Terms used in Highway Work.

By Major W. W. CROSBY, Baltimore, Maryland.

The London congress of the Permanent International Association of Road Congresses is to be held next June, and at it will be considered the subject of terminology in road construction and maintenance.

While it is unlikely that all the expressions used in this connection need definition for a general understanding of their import, in the case of many the general concordance in their use is at present so deficient as to seem to make it desirable that more general agreement be had concerning their meanings. Too often nowadays descriptions of work are confusing because of lack of clearness of meaning of terms used by their authors, and frequently even the individual author will use the same expression with distinctly different meanings. This state of affairs becomes serious when it occurs in the cases of specifications, and may there be productive of unnecessary friction, lawsuits and expense.

With a view therefore of attracting attention to the importance of the matter, of securing the utmost possible consideration of it before the subject comes up for action by the International Congress, and in order that American representatives thereto may be fully prepared for the discussion previous to such action, the writer offers for the consideration of those interested the following list of definitions of terms used in highway work.

It should perhaps be stated that the list given is not supposed to include all the terms used, though the writer has endeavoured to make it fairly comprehensive as regards the more important ones. The writer makes no claim for originality in all of those given. Many are simply collected from what appears to him to be the best expressions of thought, or the most general understanding of the terms, and valuable additions doubtless can and should be made.

DEFINITIONS.

ALLEY.—A narrow street.

ASPHALT.—Solid or semi-solid native bitumens, solid or semi-solid bitumens obtained by refining petroleums, or solid or semi-solid bitumens which are combinations of the bitumens mentioned with petroleums or derivatives thereof, which melt upon the application of heat, and which consist of a mixture of hydrocarbons and their derivatives of complex structure, largely cyclic and bridge compounds.

ASPHALT BLOCK PAVEMENTS.—Those having a wearing surface of previously prepared blocks of asphaltic concrete.

ASPHALTENES.—The components of the bitumen in petroleums, petroleum products, malthas, asphalt cements and solid native bitumens, which are soluble in carbon disulphide, but insoluble in paraffin naphthas.

ASPHALTIC.—Like asphalt, or containing a considerable proportion of asphalt.

BINDER.—(1) A foreign material introduced into the mineral portion of a road crust for the purpose of assisting the latter to retain its integrity under stress, as well as, perhaps, to aid in its first construction. (2) The course in a sheet asphalt pavement, frequently used between the concrete foundation and the sheet asphalt mixture of gravel, sand and asphalt cement.

BITUMEN.—A mixture of native or pyrogenous hydrocarbons and their non-metallic derivatives, which may be gases, liquids, viscous liquids, or solids, and which are soluble in carbon disulphide.

BITUMINOUS.—Like bitumen, or containing a considerable proportion of bitumen.

Bituminous Cement—A bituminous material whose cementing qualities are dependent mainly on its bituminous qualities.

Bituminous Concrete—Concrete whose matrix is bituminous.

Bituminous Concrete Pavements—Those composed of stone, gravel, sand, shell, or slag, or combinations thereof, and bituminous materials incorporated together by mixing methods.

Bituminous Macadam Pavement—A macadam whose smaller voids are more or less occupied with a bituminous cement or binder. (See Macadam.)

Bituminous Pavements—Those composed of stone, gravel, sand, shell, or slag, or combinations thereof, and bituminous material incorporated together.

Bituminous Surfaces—Superficial coats of bituminous materials with or without the addition of stone or slag chips, gravel, sand or material of similar character.

BLANKETS.—See Carpets.

BLOWN PETROLEUMS.—Semi-solid or solid products produced primarily by the action of air upon originally fluid native bitumens which are heated during the blowing process.

BOND.—The combined action of inertia, friction, and of the forces of adhesion and cohesion which helps the separate particles composing a road crust to resist separation under stress. Mechanical bond is the bond produced almost wholly in a well-built macadam road by the interlocking of angular fragments of broken stone and the subsequent filling of the remaining interstices with the finer particles.

BOULEVARD.—An unusually wide street or road, usually constructed with particular attention to æsthetic details, and with extraordinary consideration of pleasure travel.

BOUND.—Bonded.

Water-bound—Bonded with the aid of water.

Bituminous-bound—Bonded with the aid of bituminous material.

BRICK PAVEMENT.—A brick pavement is one having a wearing surface of vitrified paving bricks or blocks.

BRIDGE.—A structure for the purpose of carrying travel over a gap in the road bed, measuring 10 ft. or more in the clear span.

CARBENES.—The components of the bitumen in petroleums, petroleum products, malthas, asphalt cements and solid native bitumens, which are soluble in carbon disulphide, but insoluble in carbon tetra-chloride.

CARPET.—A bituminous surface of appreciable thickness, generally formed on top of a road or pavement by the application of one or more coats of bituminous material with gravel, sand or stone chips added.

CEMENT.—An adhesive substance used for uniting particles of other materials to each other. Ordinarily applied only to calcined "cement rock," or to artificially prepared, calcined, and ground mixtures of limestone and silicious materials. Sometimes used to designate bituminous binder used in bituminous road work, when the expression bituminous cement (q.v.) is understood to be meant.

CEMENTED.—Bonded. Referring to water-bound macadam, the term "cemented" is used to designate that condition existing when, after rolling the stone forming the road crust, the remaining voids have been filled with the finer sizes, and the stone dust or "flour" has, under the action of water, taken a "set," as does cement itself.

CLAY.—Finely divided mineral matter. (See Gravel.)

COAL TAR.—The mixture of hydrocarbons distillates, mostly unsaturated ring compounds, produced in the destructive distillation of coal.

COAT.—A single application.

COATING.—The total result of one or more single surface applications. (See Carpet.)

COKE OVEN TAR.—Coal tar produced in by-product coke ovens in the manufacture of coke from bituminous coal.

CONCRETE.—An intimate mixture of small-sized gravel, shell, slag or stone particles with certain proportions of sand, cement and water, made previous to placing. Asphaltic (bituminous pitch and tar) concretes are those in which asphaltic (bituminous, pitchy and tarry) material is substituted for the cement and water used ordinarily.

Oil Concrete—Cement concrete made as ordinarily, to which a small proportion of oil is added during the mixing.

CONCRETE PAVEMENTS.—Those having a wearing surface of cement-concrete with or without the addi

tion of superficial coats or carpets of bituminous materials.

Course.—The layer of the metal spread and compacted separately for the formation of the road or pavement. They are usually referred to in the order of their laying as first course, second course, third course, &c.

Crown.—The elevation of the centre of the highest part of the finished road metalling above the sides. It may be expressed either as so many inches (or tenths of a foot), or as a rate per foot of distance from side to centre—*i.e.*, "the crown is 4 in.," or "the crown is ¼ in. to the foot."

Crusher Run.—The total unscreened product of a stone crusher.

Crust.—That portion of the roadway designed to carry the vehicular travel, and consisting of the road metal proper with its bonding agent or binder. The shoulders or verges are not parts of the road crust, nor are the sub-grade and the foundation (or artificial foundation).

Culvert.—A bridge of less than 10 ft. in clear span.

Cut-back Products.—Asphaltic, petroleum, or tar residuums which have been fluxed with distillates.

Dead Oils.—Oils with a density greater than water which are distilled from tars.

Dehydrated Tars.—Tars from which all water has been removed.

Drainage.—Provision for the disposition of superfluous water.

Side Drainage—That along the sides of the road.

Sub or Under Drainage—That below the surface.

Surface Drainage—That on the road or ground surface.

V-Drainage—That provided by the construction of troughs in the sub-grade of the road, which troughs are like a V, with flat sloping sides, and are filled with stone, on top of which latter is built the road crust.

Dust Layer.—Material applied to a road surface for temporarily preventing the formation or dispersion under travel of distributable dust.

Earth Road.—A road whose travelled way is composed of its natural material *in situ*.

Emulsion.—A mixture of oily material with water sufficiently intimate and stable to allow its use in road work.

Fixed Carbon.—The organic matter of the residual coke obtained upon burning hydrocarbon products in a covered vessel in the absence of free oxygen.

Flush Coat.—A superficial application of bituminous material during construction to a bituminous pavement in place, and considered sufficiently complete in its construction as only to need this coating for its finishing. A flush coat generally consists of a fraction of a gallon of pitch per square yard of surface, with a certain amount of gravel, sand, clay or stone chips.

Flushing.—Completely filling the voids. ("Flushing" is also used as a term in street cleaning to denote washing with an excess of water.)

Flux.—A liquid bitumen having a penetration (at 25 deg. Cent., with 50 grammes on No. 2 needle for one second) greater than 350, and used in combination with harder bitumens for the purpose of softening the latter.

Foundation.—The portion of the roadway below and supporting the road crust or artificial foundation.

Artificial Foundation—That layer of the foundation underlying the road crust especially placed on the sub-grade for the purpose of reinforcing the supporting power of the foundation itself, and composed of material different from that of the foundation proper. It may be a layer of sand, gravel or broken stone, or a Telford paving, tailings, straw, pine needles, or a mixture of pitch and sand, &c.

Free Carbon.—Organic matter in tars which is insoluble in carbon disulphide.

Gas-house Coal Tar.—Coal tar produced in gas-house retorts in the manufacture of illuminating gas from bituminous coal.

Grade.—(1) The profile of the centre of the road or its rate of rise or fall. (2) To establish a profile by cuts and fills of earthwork. (3) To arrange by sizes, broken stone, gravel, sand, or combinations of such materials.

Gravel.—Small stones or pebbles usually found in natural deposits more or less intermixed with sand, clay, &c. The differentiation between gravel, sand, silt and clay is frequently made on the following basis:—

Diameter of particles in mm.	Conventional names.
Above 1	... Gravel
1 to 0·05	... Sand
0·05 to 0·005... ...	... Silt
0·005 to 0·0001 ...	... Clay

Gravel Macadam.—See Macadam.

Gravel Road.—A road whose crust is formed by compacting gravel taken and spread from the deposit without screening into sizes.

Grit.—Clean gravel, stone or slag chips free from particles under the size of such as would be retained on a screen having openings about ⅛ in. to $\frac{1}{16}$ in. in size.

Gutter.—The artificially surfaced and generally shallow waterway provided usually at the roadside along the surface for carrying surface drainage. Occasionally used synonymously with "ditch," but incorrectly so, as "gutters" are always paved or otherwise surfaced, while ditches are not.

Highway.—The entire right of way devoted to public travel, such as an alley, a road, or a street, including the sidewalks and other public spaces, if such exist.

Macadam.—A road crust composed of gravel, shells, slag or broken stone, or other similar material, in which the largest particles do not exceed a certain maximum size (dependent, to some extent, on the quality of the material, but roughly about 2 in. for the largest dimension), whose particles, having a size preventing their passing through a ¾-in. ring, are compacted together so as to be interlocked and mechanically bound to the utmost possible extent, and the then remaining voids or interstices of which are filled, by the aid of water, with smaller particles and fine material from the same or similar sources. True macadam has no particles in the surface exposed to travel whose size is so great as to render them unstable under the wheels of horse-drawn vehicles. Macadam built on top of an artificial foundation of paving is frequently referred to as "Telford"; q.v.

Bituminous Macadam—Macadam built with a bituminous binder. (See Bituminous.)

Gravel Macadam—Macadam built of screened gravel.

Shell Macadam—Macadam built of shell.

Slag Macadam—Macadam built of broken slag.

Stone Macadam—Macadam built of broken stone.

Malthenes.—That portion of bitumen which is soluble in an excess of petroleum naphtha, and which is not volatilised on exposure to a temperature of 163 deg. Cent. in five hours.

Mat.—See Carpets.

Oil.—An unctuous, homogeneous mixture or compound, fluid, or at least more than semi-fluid at normal temperatures, and usually of mineral origin.

Oil-gas Tars.—Tars produced by cracking oil vapours in the manufacture of oil gas.

One-size Stone.—Broken stone coming, as usually made, between two sizes of screens. For instance, assuming screens to be made generally with perforations of ¼ in., ⅜ in., 1½ in. and 2½ in. in diameters (or 1 in., 2 in. and 3 in.), then one-size stone would be that fraction of a product which would pass the 1½-in. screen and remain on the ¾-in., or pass the 2½-in. and remain on the 1½-in., or pass the 2-in. and remain on the 1-in., &c., in contradistinction to a mixture of two or more fractions. The term should be accompanied by further description to avoid ambiguity.

Palliative.—A short-lived and relatively inefficient dust layer.

Patching.—Repairing or restoring small isolated areas in the surface of the metalled or paved portion of the highway.

Pavement.—The surfacing of the carriageway or footway, when such surface is monolithic, with a

cement or bituminous binder, or is composed of blocks.

Penetration Method.—The method of constructing a bituminous-macadam pavement by pouring or grouting the bituminous material into the upper course of the road metal before the binding of the latter has been completed.

Petrolenes.—That portion of bitumen which is soluble in an excess of petroleum naphtha, and which is volatilised on exposure to a temperature of 163 deg. Cent. in five hours.

Pitch.—A generic name for all bituminous materials, embracing asphalts, bitumens, crude petroleum, oil residuums, tars, &c. Commercial practice in the United States has restricted to some extent the use of the word pitch to describe the harder and at least semi-solid varieties of the above. "Pitch" has also been used to some extent to limit the consideration to the harder tars. No general agreement to this limitation, however, has been reached, and the authorities so inclined have themselves used "pitch" to refer contemporaneously to native asphalts. The older use of the word was wider, and recently the tendency seems to be to revert to the original practice and to use the word "pitch" as synonymous with and more convenient than "bitumen" or "bituminous" in referring to materials, construction, &c., thus following the English practice with "pitch compound" (a mixture of pitch and a flux or other similar ingredients), "pitch macadam" (macadam penetrated with pitch), "pitch concrete" (concrete mixed with pitch), &c.

Pitching.—Applying pitch to a road by penetration or surface treatment.

Refined Tar.—A tar freed from water by evaporation or distillation which is continued until the residue is of desired consistency, or a product produced by fluxing tar residuum with tar distillate.

Renewals.—Extensive repairs over practically the whole surface of the metalled or paved portion of the highway.

Repairs.—The restoration or mending of a considerable portion of the metalled or paved portion of the highway, but not usually of a majority of the surface area. More extensive than "patching," but less so than "renewals."

Resurfacing.—The renewal of the surface of the road crust.

Road.—A highway outside of built-up districts, or that portion of a highway so used.

Road Metal.—Broken stone, gravel, sand, slag or similar material used in road construction and maintenance.

Rock Asphalt.—Rock, such as sandstone or limestone, impregnated naturally with asphaltic bitumen.

Rock Asphalt Pavement.—Pavements composed of broken or pulverised rock asphalt with or without the addition of bituminous materials.

Sand.—Finely divided rock detritus between certain limits as to size. (See Gravel.)

Sand Clay Road.—A road whose crust is composed of an intimate mixture of sand and clay.

Seal Coat.—A flush coat applied to a pitch concrete for the purpose of sealing up any pores remaining in the surface.

Setting Up.—The relatively quick change taking place in a bituminous material after its application to a road surface, indicated by its hardening after cooling and exposure to atmospheric and travel conditions, as opposed to the slower changes later occurring gradually and almost imperceptibly.

Shaping Up.—Trimming up and preparing a subgrade preparatory to applying the first course of the road metal or artificial foundation.

Sheet Asphalt Pavement.—A pavement having a wearing surface composed of sand of predetermined grading, fine material and asphalt cement incorporated together by mixing methods.

Shoulders.—The portion of the highway between the edges of the road metal and the gutters, slopes or watercourses. The verges.

Side Drain.—See Drainage.

Sidewalk.—The portion of the highway reserved for pedestrians.

Stone Block Pavement.—A pavement whose wearing surface is composed of blocks of stone rectangular in shape, or at least nearly so.

Street.—A highway in a built-up district.

Sub-grade.—The upper surface of the native foundation on which is placed the road metal or the artificial foundation, in case the latter is provided.

Superficial Coat.—A light surface coat, and usually without the use of grit.

Superficial Treatment.—A light surface treatment, and usually where no grit has been used.

Surface Coat.—An application of pitch to a finished road surface, and usually with grit added.

Surface Treatment.—Treating a finished road surface with pitch or other compounds. Making a surface coat.

Surfacing.—(1) The road crust. (2) Constructing a road crust. (3) Finally finishing the surface of a road crust. (4) Treating the surface of a finished road crust with a pitch or other compound.

Tailings.—Stone which does not pass the largest openings of the screens.

Tar.—Pyrogenetic pitch, using the latter word in its broadest sense. (See also Coal, Coke-oven, Oil or Water Gas Tars.)

Telford.—Properly an artificial foundation advocated by Thomas Telford (1757-1820), and consisting of a pavement of stone about 8 in. thick, laid by hand, and closely packed and wedged together. The individual stones were desired to be about 16 sq. in. in section, and about 8 in. in length. They were set close together on the prepared subgrade, their longest dimension vertical and on their larger ends, their interstices chinked with smaller stones, and the whole rammed (or rolled) until firm and unyielding.

Telford Macadam.—Macadam with an artificial foundation of Telford.

Underdrain.—See Drainage.

V-Drain.—See Drainage.

Volatile Solvent.—A liquid substance miscible with bitumen, and completely volatile at a temperature of 260 deg. Cent.

Wood Block Pavement.—A pavement whose wearing surface is composed of blocks of wood, now generally rectangular in shape.

Water-gas Tars.—Tars produced by cracking oil vapours in the manufacture of carburetted water-gas.

Modern Architecture.—Lecturing on this subject before the Royal Institute of British Architects on Monday evening, Mr. Thomas Hastings, a Fellow of the American Institute of Architects, prophesied that the time must come when architects of necessity would be educated in one style—the style of their own time—and he expressed the belief that we should one day rejoice in the dawn of a modern Renaissance, in which we should see the architect solving new problems and adapting his art to an honest and natural treatment of new materials and conditions.

Highways Construction Limited.—The constant extension of motor traffic necessitating a wide departure from previous practice in road construction and maintenance has created a large field for work of this character. A new company—Highways Construction Limited—has recently been registered to work the Praed patents for the construction, maintenance and repairs of roads in this country. The offices of the new company are at Finsbury-court, London, E.C., the directors being the Hon. B. C. Pearson (chairman), Mr. H. F. Berry, Mr. H. H. Goldney, Mr. J. Purdy, Mr. C. W. Sharrock and Mr. V. S. Wright. The staff of the Praed Road Construction Company has been absorbed into the new organisation, and it will undertake the construction of roads on the asphalt-macadam principle, which has been such a successful feature of the operations of that company. The material to be used by Highways Construction Limited is the high-grade bitumen which is already well known to surveyors and road engineers generally under the registered name of Mexphalte. This bitumen is claimed to represent the finest material known to science for the construction of dustless, waterproof roads capable of standing the severe stresses of modern motor traffic, and as it is being regularly imported on a large scale by the Anglo-Mexican Petroleum Products Company, Limited, there will be no limit to the supplies of material, or to the extent of the work with which Highways Construction Limited will be able to cope.

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What is City Planning?

By R. O. WYNNE-ROBERTS, Consulting Engineer, Regina.

[The formation of a Saskatchewan Town Planning Association is announced following upon expositions of new civic ideals by Prof. Dobson, of Regina. Mr. Wynne-Roberts, the writer of the subjoined paper—which we quote from "The Municipal and School Journal of Saskatchewan"—is associated with Prof. Dobson in the movement.]

It may occasionally occur that some ambiguity creeps into a discussion as to what city planning means. Tree planting, city gardening, and laying out of parks, or, in other words, the beautification of a city, is sometimes the interpretation. On the other hand, the provision of diagonal roads to a city is contended to be a prominent feature. As such limitations are apt to be accepted, the writer has been impelled to pen a few notes on what he conceives to be a fuller meaning of the term city planning.

If the recorded history of old countries is studied it will be found that the nuclei of ancient towns were located on the banks of navigable rivers or on the shores of inlets of the seas, as water offered a cheap and easy means of transport. Sometimes towns were located in places for strategic reasons, as measures of defence were then so essential. Trade and defence were the two main objects of living in towns, where, by a community of interest, the people could combine for either purpose. In a vast number of old towns the expansion which took place was slow, and—excepting for defence and trade—no preconceived plans were thought of, with the result that, although they are often picturesque and interesting, they have become centres of dormancy or congestion.

As the older cities in recent years have grown in importance and size with the development of modern methods of transport, many of them are now faced with problems which urgently need solution, and which will cost huge sums of money.

Haphazard expansion of a town is acknowledged by the best of European and American authorities to be uneconomical, nonconducive to public welfare, and generally very unsatisfactory.

What, then, is needed to obviate the recurrence of the costly errors of the past? If old towns were laid out in an irregular manner, will new towns, laid out like a chess board with mathematical neatness and skill, together with a few diagonal roads thrown in, tend to improve matters?

The answer to the last question will obviously be in the negative, and to the former it can be stated that a broad and liberal interpretation of city planning will help.

City planning is concerned in everything which will contribute to the material progress and prosperity of a city, to the social and physical welfare of its citizens, to the development of the characteristics of individual cities, to the comfort and amenities of the people generally, to the advancement of art and culture, to the utilisation of all modern inventions, to the economy and efficiency of city government, and so on.

Streets, sewerage, electricity, gas and water works are at least of collateral value with railroads, street railways and other forms of transport. The selection of civic centres as well as the location of public institutions in appropriate parts of the city have a marked influence on the æsthetic development of the city. Every city will, if rightly developed, have a silhouette of its own. Yet hundreds of towns are, have been, and will doubtless be, built on the North American Continent on lines so closely alike that it is difficult to appreciate the difference. The characteristics of a town are simply the reflex of expressions of the tendencies of its citizens. Towns which are blessed with men and women of enterprise and foresight bear an indelible impress of their character. Bourneville is typical of Cadbury, Essen is the result of Krupp's foresight, Port Sunlight has the commercial stamp of Lever, St. Petersburg is the development of Emperor Peter's ideals, Saltaire was the creation of Sir Titus Salt, Paris bears the impress of Napoleon and Hausmann, Washington is the embodiment of L'Enfant.

City planning is by no means a new idea. Nebuchadnezzar had a great city planning scheme, which he developed in a remarkable manner. Carthage, Athens, Rome and other ancient cities also had city planning. Sir Christopher Wren submitted a great scheme for reconstructing London after the disastrous fire. But in these cases the ideals were not the same, and this is where city planning changes and develops with time.

The ideals of leading men and women in Biblical days were not very far removed from some of our own. Beautiful parks and gardens were laid out within the city walls, artificial canals were constructed with the object of enjoying the cooling effect of flowing water, and to add picturesqueness to the scenery, while the fertilising of the country around was not overlooked.

Those, however, were days of abject slavery, when human life was valued at less than that of a cow.

Twentieth century, especially in Canada, means something greater, nobler and more enduring. Beauty spots reserved for kings in days of old must now be for the people, and with beauty there must be utility. Combine beauty with utility, ideals with practicality, and our cities will be modelled on satisfactory lines. Our cities must be an aggregation of attractive home centres, equipped with all that contributes to prosperity and happiness, and possessing those conveniences which are necessary for business efficiency, for public health, and for good civic governance.

The measure of our conception of city planning and civic ideals will be ineffaceably stamped on the city as it is being built, and in generations to come the citizens will be able to judge of the broadness or limitations of our character by the impress left behind.

New School at West Molesey.—A new school at West Molesey for 250 children was formally opened last week. It was built by Mr. E. Potterton, of East Molesey, from designs by the county council architects, Messrs. Jarvis & Richards.

Town Planning Schemes.—The Local Government Board have sanctioned a town planning scheme for an area of 1,800 acres in the Prestwich Urban Council's district. The Stockport Corporation has also received authority for a scheme for an area of 1,000 acres, and the Wirral Rural District Council for about 4,300 acres.

The Disposal of Trade Effluents.—At the annual meeting of the Association of Municipal Corporations, held on Wednesday in the City of London Guildhall, the Mayor of Ossett moved a resolution in favour of local authorities being empowered to impose a charge on manufacturers with regard to the reception and disposal of trade effluents. He said in this matter the local authorities were rendering services to the individual for which the individual ought to pay. The principle he sought to establish was approved by a large number of corporations. After a brief discussion the matter was referred to the Law Committee, who will report to the council.

Manchester Electricity Supply.—The accounts of the Manchester Corporation Electricity Department for the year ended March 31st last were issued on Wednesday. Sales of current produced £467,194, as against £427,701 in the previous year. Hire of motors and sundry rents yielded £10,293, as against £8,616. Working expenditure, other than capital charges, absorbed £253,561; the corresponding figure in 1912 was £215,895, the difference being due partly to additional consumption of coal, expenses of new business, and very largely to inflated coal prices, beyond the control of the corporation. The balance thus left, amounting to £223,926 (against £220,422 in 1912), was appropriated as follows: Interest, £67,745; statutory sinking fund, and voluntary supplementation thereof, £127,850; rate aid, £24,500; loss on India 3 per cent Stock, £3,831. The average costs of production work out at 1·033d. per unit sold, as against 1·045d. in 1912. The cost of coal over the year was 12s. 4d. per ton, as against 10s. 10d. in the year before. The average prices realised in pence per unit sold were as follows: Lighting and power, 1·085; traction, 1·046; all supplies together, 1·075.

Office Conversations.

MORE OR LESS IMAGINARY.

[*Contributed.*]

XIV.—The Local Floods.

Still raining, Kate? What weather, eh? Haven't had a really fine day for nearly three months now. I expect the floods 'll be out again. The brook was running full bore and over when I left the office yesterday and it's been raining hard all the night. Sick of it? Yes, and so am I. Think of what it'll mean afterwards! Well, I mustn't stop talking here. There'll be a crowd of infuriated ratepayers gathered at the offices already, I'm afraid. Good-bye—I'll be back to lunch anyway. Whew, it's coming down in sheets—shut the door quickly, or you'll have the hall flooded—good-bye. Lor, what a lucky thing to be born a woman! Nice, snug, comfortable home—stop in when you like, go out when you like—no business, no worries, no councils—— Eh, what? The Drive flooded? Well, of course it is—I could have told you that. Want it cleared? Yes, I daresay you do, and so do I. Water over your ankles? Yes, and it'll be over your knees and up to your waist if it rains much longer.

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How ever can I help the flood? I don't send the rain. Ought to have the town properly drained? A pipe to carry it away? Now, really, Mr. Branksome, do talk a little sense. Perhaps you aren't aware that the Drive and the streets round it are only about a couple of inches above the level of the brook. No, I thought you weren't. And as all the water of the town drains to the brook it stands to reason that when the brook's running about five feet deep the water can't get away and floods 'll result. A nuisance? Yes, I'll agree to that, a confounded nuisance, and something stronger if you like; but you mustn't blame me or the council. Lower the bed of the brook? Oh, yes, that'd be a simple matter. And then we'd have a go at the river, and—— Laughing at you? No Mr. Branksome, I wouldn't do that; but, to tell the truth, these floods get on my nerves. Don't live in 'em? No, I don't, and you needn't unless you like. Bought your house? Then take my advice and sell it. There'll be such an awful flood some day—and very soon if the weather doesn't moderate—as 'll float you out of bed. No, I don't want to frighten you. Off? Good-day—you'll find it a bit dryer in town, I hope.

* * * *

Phew, that's the first of 'em. I shall be having it all day. I've half a mind to go to town myself and get out of it, but I suppose I can't. Morning, Mr. Heald. Nice drop o' rain—do a lot of good. The Drive flooded? Roads under water? Well, you do surprise me. Why, there was no sign of it last night. Two feet deep? Glad you told me—I must run down and see what can be done. Something ought to be done? You never spoke a truer word, Mr. Heald, never. But you'll excuse me, I must get on. Yes, yes, certainly, certainly. Good-day! Hullo, here comes old Malding. Consequential old idiot! Flooded, Mr. Malding? The Drive flooded? Good heavens! Now, I really thought we *had* stopped all that sort of thing, since I had that eighteen-inch pipe relaid. Very unfortunate, very. Got wet, did you? Over the tops of your boots? Yes, I can see you're wet now. Write to the papers? A rattling good idea, Mr. Malding, but—— What do you pay rates for? Well, really, that's hardly for me to say. Of course—— Demand a Local Government Board inquiry? Excellent, excellent, but meanwhile you see——

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I ought to put an end to it? I ought to see that the town's properly drained? I—— Now, look here, Mr. Malding, between you and me you're talking sheer unadulterated nonsense. If you can show me how to make water run uphill—— Not for you to teach me my duties? Now you're getting personal, Mr. Malding, and angry, and I think I'll get on. Hear more of it? Not the least doubt of it. I can see half-a-dozen infuriated ratepayers already barring my path. Talk about running the gauntlet! Now what do you think you're doing with that broom, Stevens? Sweeping away the flood, I suppose. Can't you see that the gulleys and the connections and the drains are all choke full? What can you do then? Well, it's certain you can't do any good here. Go up to the Drive. Get some planks up there and see if you can't rig up a temporary crossing or two. Take Smith and another man with you and if you see Mr. Gunn send him down to me at once. Whatever you do, look as though you're doing something. The place 'll be like a hornet's nest before the morning's over.

* * * *

Thought I should find you here, Mr. Climson, *What* a day! Floods? Heavens, I've been stopped eleven times on the way up from my house. What're we going to do? Don't ask me that now. We can do nothing, simply nothing, till the brook goes down. Oh, the lies I've been telling the poor ratepayers. What lies? Surely you don't want telling, Mr. Climson. You, as chairman of the Highways Committee, ought to know all about it by now. What do I mean? Why, that the floods are disgraceful—a disgrace to the town. How can we stop them? Really, Mr. Climson, your memory must be conveniently treacherous. Don't you remember the report I submitted four years ago? The cost prohibitive? If you had my experience with the ratepayers every time there's a flood, you wouldn't think of the cost. Six hundred pounds—that was my estimate—and to save that paltry sum—— It's wrong, Mr. Climson, utterly wrong, and what's more it's not fair to me. I've a reputation to sustain, and every ratepayer looks upon me as an incompetent ass, simply because the council won't adopt my report. Oh, yes, it's all very well for you to talk. You haven't to meet the ratepayers and put up with their sneers and abuse. What's the use of my keeping on telling them that the floods can't be stopped? They know—at least, any of them with an atom of intelligence know—that they *can* be stopped. And I tell you what, Mr. Climson, they'll *have* to be stopped, or——

* * * *

Resign? No, I don't go as far as that, but you'll allow it's rough on me, isn't it? What was my scheme? Why, to tap the brook above the town and carry a relief drain meeting it downstream, on the other side of the town. Four feet concrete tubes 'd be enough. This would relieve the portion of the brook which runs in a culvert under the shops in the High-street, and if it didn't stop the floods entirely, we shouldn't have one to speak of in ten years. Bring it up again? Yes, I'll do so willingly; but you know what it means. As long as the floods are on, the council 'll be in favour of immediate action. But directly the floods go—well, their enthusiasm 'll go too, and the matter 'll be shelved as it has been off and on for the last four years. Of course, there'll be an outcry at the expense. There always is. But surely your backs are broad enough for that. Yes? Excuse me a moment, Mr. Climson. Who? Colonel Jubber? What does *he* want? Oh, the floods? Yes, show him in. Now, Mr. Climson, you'll have a good chance of seeing just what I have to put up with. You——

* * * *

Good morning, Colonel Jubber—sit down. This is Mr. Climson, chairman of the Highways Committee. Yes, I suppose you've met him before. The Drive flooded? Do you hear that, Mr. Climson? Obliged for the information, Colonel, but—well, I've already had notice of it. Mr. Climson and I've been discussing the matter and—— Time something was done? Precisely—just what we were saying. And is anything going to be done? Mr. Climson, you can answer that best. The Colonel wants to know if anything is going to be done. Now—at once—immediately? Well, really Colonel, you must be reasonable, you must have just a little patience. Patient too long? Hum, that's one of the virtues I never credited you with. Disgraceful? Quite so. But you see the council are

scarcely responsible for the weather, and rain means water, and—— Palpable to the meanest intelligence? Well, as long as you grasp the fact, that's enough for me. My *dear* sir, do you think I can send a couple of men to sweep the water away? It'll have to wait its time, and subside when the brook assumes a normal level. Wish you had the charge of things? Well, I'm sure *I* do. You'd appreciate my feelings at the present moment then. Had to motor through it? That's no hardship, surely. Think of the poor devils who've had to wade through it on the way to work. Damages? Certainly; have a go for them. I've no objection at all, if you care to throw your money away. Set of ignoramuses? That again's a matter for Mr. Climson. He's one of the council anyway, and I'm not. You include me?

* * * *

Now, look here, Colonel Jubber, I don't want to be rude, and if Mr. Climson wasn't here, I shouldn't be. Your name's come up once or twice before the council lately, and I'm glad you've made an exhibition of yourself now, as Mr. Climson can report as to the kind of man you are. What kind of a man? Well, that was an unfortunate expression of mine, and I retract it. What do I mean? Listen, and I'll try to explain. I was surveyor to the—no, I needn't give the name—to another council, let me say, some years ago. On that council we had a very irascible gentleman. He was a vain, ignorant, blustering numskull, always bullying and making the lives of the officers a miniature hell. One day he fell foul of the reporters, and the editor of a certain local rag remarked that "Councillor Preeson hadn't the brains of an ass." There was the very deuce and all to pay, and the unfortunate editor was haled before the council at the next meeting and requested to apologise. After a long time, he gave a promise that in his next issue he would retract the statement. He did, and what he wrote was—"We regret that in our last issue we said that Councillor Preeson had not the brains of an ass. We humbly apologise. We find that we are wrong. He has." Don't see the point? I never thought you would. Mean to insult you? My dear Colonel—— Complain to the council? No time like the present. Enter your protest to Mr. Climson. I'm sure he'll be pleased to convey a very true and detailed account of the conversation. Eh? No, he'll omit that. Good-bye, Colonel Jub—— Now, what do you think of him, Mr. Climson? Have the relief works carried out? Well, if that's the result of the interview, I shan't grumble.

Motor Traffic on Kent Roads.—It was announced at the Kent County Council meeting last week that, owing to the excessive motor traffic, the expenditure on the main roads of the county during the past year had been £13,435 in excess of the estimate.

Damages Against the Liverpool Corporation.—A jury at the Liverpool Court of Passage have awarded £112 damages against the Liverpool Corporation in respect of an accident which happened to an elderly man who, on Christmas Eve, received injuries by tripping over the edge of a refuge placed between the tram lines in Church-street, one of the city's busiest thoroughfares, for the protection and convenience of people crossing the street. Legal argument was reserved on a contention set up by the corporation that the Public Health Amendment Act grants them immunity from such a claim, or for the consequences of such an accident.

Chartered Surveyors' Golfing Society.—By kind permission of the Purley Downs Golf Club, a one-day competition will be held on that club's course on Tuesday, June 17th. The stations are Purley (S.E. & C.Rly. and L.B. & S.C.Rly.). Sanderstead and Purley Oaks are slightly nearer, being each about ten minutes' walk. In the morning a bogey competition will be played under handicap (optional sweep, 2s.). A prize, kindly presented by Mr. S. J. Chesterton, will be given for the best nett return. In the afternoon there will be a stroke competition under handicap (optional sweep, 2s.). A prize will be given for the best nett return. There will be a limit of handicap of eighteen for the competitions. There will be no entrance fee. Members of the society will be made members of the course for the day. In order to facilitate the necessary arrangements, members who intend to be present for either the whole day or any part of the day, are requested to notify Mr. Sydney A. Smith, 22 Chancery-lane, W.C.—There will be a summer week-end meeting at Hythe on July 19 and 20.

THE CONCRETE INSTITUTE.

ANNUAL DINNER.

The third annual dinner of the Concrete Institute was held in the Crown Room, Connaught Rooms, on Thursday evening, the 22nd inst., Mr. E. P. Wells, J.P. (president), who occupied the chair, being supported among others by the following: Mr. R. J. Thomas, M.INST.C.E. (president Institution of Municipal and County Engineers), Mr. Percy B. Tubbs, F.R.I.B.A. (president Society of Architects), Mr. Gerald C. Horsley, F.R.I.B.A. (president Architectural Association), Mr. Frank Latham (president Institution Municipal Engineers), Mr. Henry Riley (president Quantity Surveyors' Association), Mr. Ernest J. Brown (president Institute of Builders), Mr. H. Greville Montgomery, Mr. Alexander Ross (vice-president Institution of Civil Engineers, past vice-president Concrete Institute), Mr. Leslie H. Robertson, M.INST.C.E. (secretary of the Engineering Standards Committee), Mr. W. E. Riley, F.R.I.B.A., M.INST.C.E. (superintending architect to the London County Council), Sir Henry Tanner, C.B., I.S.O., F.R.I.B.A., F.S.I. (chairman of council, Royal Sanitary Institute, past-president Concrete Institute), Mr. H. Percy Boulnois, M.INST.C.E. (president Institute of Sanitary Engineers, vice-president Concrete Institute), Mr. John Murray, F.R.I.B.A. (Crown surveyor), and Mr. Henry Tanner, F.R.I.B.A. (member of council).

After the submission of the loyal toasts by the chairman, Mr. R. J. THOMAS rose to propose the toast of "The Concrete Institute." He said that to those of them who had not specialised in this marvellous product of the present century—reinforced concrete—it was indeed gratifying to know that there was a Concrete Institute to make a thorough investigation of the properties of that material. To the institution of which he had the honour of being president, the institute had already been of considerable use in that they had had conferences with one of their committees with reference to the standardisation of certain concrete flags, and they had been able to obtain advice which they very much appreciated. He found from the annual report that the institute was growing rapidly, and that they had in fact attained the magical four figures as regards membership. That must be a source of gratification to them, especially as he understood they had been in existence only four or five years. He hoped before long they would have 2,000 members. He also noticed in their report than an enormous amount of work had been done by their committees, and the body he represented looked forward with great pleasure to the prospect of having the advice and recommendations of their two committees (the Practice and the Science Committees) to guide them in the manipulation of reinforced concrete. They had also decided to start examinations. There was no possible better method of advancing this science than by encouraging our youth to submit themselves to examination. He understood the committees were making a large number of researches with the object of improving their knowledge of the material now so much in use. It had been said that man could make two blades of grass from where only one grew before, and he had heard of an individual who obtained a certain amount of kudos from an invention by which he made a hen lay two eggs instead of one. By means of an ingenious trap, when the hen had laid her egg and astonished the world with her cackling, the egg disappeared through the trap. The dumbfounded hen proceeded to make another monolith. (Laughter.) They had there the doubling capacity, and in their institution they were doubling, trebling and quadrupling materials by their scientific application of reinforcing. He wished the institute every success and advancement and the co-operation which was essential to all scientific institutions.

The PRESIDENT (Mr. E. P. Wells), in reply, said he hoped that in the future the Concrete Institute would justify its existence as much as it already had done up to the present time. During the past year they had had a very busy time indeed. Many of them would know that meetings had been held fortnightly, and that the average attendance had been 60 per cent greater than in the previous session. The lectures given by the indefatigable secretary at the end of last year were exceptionally well attended, the average attendance being 100 at each lecture.

They were thoroughly appreciated, and an enormous amount of instruction was given. Last year when he was addressing them he stated that he hoped that this year they would have a membership of 1,000, and it was only two short of that number. He hoped that before the next council meeting they would be in the position of saying that they had 1,000 ordinary members, though if they added the sixteen honorary members they appointed a short time ago, they actually had a membership of all classes now of 1,014. They would see from the report of expenditure that, although their finances were in a very healthy condition at the end of the year, they had not a great amount of money. Owing to the cost of printing and postage, it was proposed when the total membership reached 1,000 to impose an entrance fee and to raise the subscription of members to two guineas. That must be done if they were to carry on experimental work, because they had not, at present, the money to do anything whatever in that direction. During the past year they had gone beyond the subjects of reinforced and plain concrete, and had had papers on other subjects in structural engineering, and they hoped that a great future lay before them.

Mr. F. E. Wentworth-Sheilds, in proposing the toast of "The Visitors," observed that it had often struck him as curious that, although the profession of engineering was so old, the societies which represented it were so young. But if their societies were new and young, at all events they had virtues of youth. They were certainly very vigorous, and their own Concrete Institute was no exception to that rule.

Mr. Greville Montgomery briefly replied to the toast.

"The Health of the Chairman" was afterwards proposed by Mr. E. Fiander Etchells.

ANNUAL REPORT OF COUNCIL.

The annual report of the council of the Concrete Institute, presented at the fourth annual general meeting on the 22nd inst., mentions that the Science Committee, who have already drawn up a standard notation for calculations for reinforced concrete, have the following further matters under consideration: (1) The standardisation of attachments and joints in reinforced concrete; (2) the adhesion of and friction between concrete and steel; (3) reinforced-concrete piles; (4) the effect of sewage upon concrete; (5) the effect of oils and fats on concrete.

The Joint Committee on Loads on Highway Bridges, the report states, have yet to issue their report following the inquiries they have been making among municipal authorities and others respecting the loads that have to be sustained by bridges in various parts of the country.

It is reported that the Investigation Committee have been in communication with the Local Government Board respecting the periods granted by the board for the repayment of loans for works of reinforced-concrete construction. The board have fixed no single period; each case is dealt with on its merits, having regard to the purpose of the work and its position. Generally speaking, however, the following terms are taken as a basis in calculating the periods to be allowed in respect of the more common terms of ferro-concrete construction:—

Bridges with flat superstructure properly protected by a layer of asphalt or other suitable material. Reservoirs and tanks containing liquid.	10 years.
Arched bridges protected from moisture by a layer of asphalt or other suitable material. Chimney shafts. Tubes.	15 years.
Floors of building subject mostly to dead loads and properly protected from electric currents and damp.	30 years.

The Reinforced-concrete Practice Standing Committee, who have already drafted reports on the surface treatment of concrete and cracks in concrete, have the following matters under consideration: (1) The standardisation of methods of taking off quantities for and measuring up variations in reinforced concrete; (2) advice to clerks of works, inspectors and foremen as to methods of executing properly concrete and reinforced-concrete work, and of preventing defects and failures; (3) regulations, recommendations of joint committees, and various methods of calculation with respect to the design of reinforced concrete and the like; (4) forms and centering for reinforced-concrete work; (5) standard concrete mixtures for general purposes; (6) the use of cinder, ash, clinker and breeze in concrete; (7) means of keeping reinforcements in place when concreting; (8) methods of making concrete watertight and of waterproofing concrete.

The following matters are having the attention of the Tests Standing Committee: (1) The effect upon steel of the presence of sulphur in aggregates; (2) the grading of aggregates; (3) the expansion and deterioration of concrete due to changes of atmospheric temperature; (4) the effect of the use of sodium silicate on the surface of concrete as affecting reinforced metal; (5) the erratic results obtained by the Vicat needle in ascertaining the initial setting time of cement; (6) the collection of data regarding the elastic moduli of concrete for stresses within working limits.

SOME RECENT PUBLICATIONS.*

The Field Engineer's Handbook. By G. Carveth Wells, A.C.G.I., and Arundel S. Clay, B.SC., A.C.G.I. Price 7s. 6d. nett. London: Edward Arnold.

The undoubted usefulness of this little book to all who may be engaged in the practical operations of surveying or in setting out engineering works is enhanced by its convenient size for the coat pocket. Commencing with a brief description of the principal surveying instruments and an account of their uses and adjustments, the authors proceed to discuss each of the principal operations which the field engineer is likely to be called upon to perform. This has been done in an exceptionally clear and practical manner. The subjects of chain surveying and levelling are dealt with shortly, and the description of the "collimation" method of booking and reducing levels (which is unquestionably the most useful method in setting out works) is very lucid, as is also the chapter on Traverse Surveying. A separate chapter is devoted to the Simple Curve, and a good explanation is given of the "degree of curve" system of surveying. The subjects of Railway Surveying, Location, and Railway Construction are next dealt with, being followed by an excellent chapter on Tacheometry, descriptive of both field and office work. The book concludes with chapters on the methods of determining latitude, azimuth, and time. Comparing the subject-matter of the present work with that of several well-known books on surveying, one is struck with the fact that most of the latter contain comparatively little information upon many points which very closely affect the work of the field engineer. In our opinion, even considering the present-day multiplication of technical literature, there is plenty of room for a work of this kind, and as a handbook (not professing to be an exhaustive treatise) we have no hesitation in recommending it as a useful addition to the actual impedimenta of the engineer engaged in practical surveying work.

One of the most interesting of the articles in the May-June number of the "Professional Memoirs of the Corps of Engineers, United States Army, and Engineer Department at Large," is that on "The Effect of Storms on Tidal Levels and Minor Irregularities in Tidal Curves," by Colonel F. V. Abbott. The author points out that, contrary to what is often assumed, the reduction of marine soundings in the offing with a tide gauge near the shore may really need the same kind of time allowance as that which is made in the case of an estuary. It may be observed that in English home waters neglect of such a consideration would be very serious, and the strength and size of the tidal currents which sweep our coasts produce effects which are recognised alike by the seaman and the longshoreman. It is no doubt the case, however, that on the coasts of the United States the surface slopes of the sea in the offing are so much less pronounced that the points to which Colonel Abbott draws attention are not generally recognised as of importance in that country. The article is illustrated with storm record diagrams showing the tides, winds and barometer readings during the great storms at Wingah Bay in September, 1894, at Charlestown in the same storm, and at Boston, Massachusetts, in 1909. Municipal engineers in charge of shore works will find these records of interest, and the attention of harbour engineers may be directed to another article on "Tidal Movements in East River, New York," by Colonel W. M. Black.

*Any of the publications reviewed, or referred to as received, will be forwarded by the St. Bride's Press, Limited, on receipt of published price.

Law Notes.

Edited by J. B. REIGNIER CONDER, 11 Old Jewry Chambers, E.C., Solicitor of the Supreme Court.

The Editor will be pleased to answer any questions affecting the practice of engineers and surveyors to local authorities. Queries (which should be written legibly on foolscap paper, one side only) should be addressed to "The Law Editor," at the office of The Surveyor, *accompanied by the writer's name and address, but correspondents who do not wish their names to be published should also furnish a "nom de plume." Where necessary, copies of local Acts or documents referred to should be enclosed.* **All explanatory diagrams must be drawn and lettered in BLACK ink only, and in such style as to be fit for direct reproduction — i.e., without re-drawing or amendment.** *Unless these conditions are complied with we cannot undertake to reply to queries.*

QUERIES AND REPLIES.

In order to avoid confusion querists are requested to use distinctive words as noms de plume. *The letter X, combinations such as* X.Y.Z., *and words such as* "engineer" *and* "surveyor," *should never be used.*

Water Supply.—"Stocidus" writes: My council have at present under consideration the question of the water supply to a row of some fifty houses within its area. The water is not laid into each house, the occupiers having to take their supply from a well which is distant some 75 yds. from the nearest of the houses and some 250 yds. from the farthest. The water in the well has been submitted to analysis, and no serious fault can be found with its condition. The council, being of opinion that the houses are not provided with a proper supply of water, have requested the owners (without serving formal notice) to provide the houses with such a supply. Nothing, however, has been done in the matter. The nearest water main from which a connection can be taken is situate approximately ¾ mile from the houses. The council consider that a supply of water can be furnished to each house at a cost not exceeding 2d. per week, as provided in sec. 62 of the Public Health Act, 1875. I shall be obliged if you can give your opinion upon the following points: (1) Are the houses in question provided with a proper supply of water within the meaning of sec. 62 of the Public Health Act of 1875? (2) If not, can the council compel the owners to bear the whole expense of bringing such a supply from the nearest water main and laying it into each house? If it is considered that the nearest main is not within reasonable distance of the houses, how near should the main be carried to bring it within such distance? (3) Can the houses, with their present supply of water, be regarded as defective from a sanitary standpoint to enable a closing order to be made in reference to it?

(1) I am not aware of any reported case as to what constitutes a proper supply of water within the meaning of this section. Under the Public Health (Water) Act, 1878, the supply is required to be "within a reasonable distance," and the Local Government Board have expressed the opinion that in determining what distance is to be considered reasonable regard must be had to the labour involved in carrying water, and the injurious effects likely to arise if, to avoid this labour, the water used is stinted. Nothing is said about distance in the Act of 1875, and apparently it is left to the authority to determine, on the report of their surveyor, whether the house is without a proper supply. (2) This would appear to be so, subject to the owner's right of appeal to the Local Government Board. See *West Lancashire Rural Council* v. *Ogilvy* (63 J.P., 166). (3) If, on the representation of their medical or other officer, or other information given, it appears to the authority that the houses are in a state so dangerous or injurious to health as to be unfit for human habitation, closing orders can be made under sec. 17 of the Housing, &c., Act, 1909. But the owner has a right of appeal to the Local Government Board.

Stopcock Boxes in Streets.—"Hydrant" writes: A question has recently arisen in this district as to the liability of the local water company to raise or lower their valve or stopcock boxes on the public highways. They (the company) contend that under sec. 153 of the Public Health Act, 1875, the expense connected with such alteration shall be paid by the urban authority, or that the urban authority may themselves make the alteration required; but I am advised that where a company for their own profit make use of the road for laying their mains, paying nothing for the privilege, their rights are subservient to the rights of the highway authority, who are under an obligation to maintain the road for the benefit of the public, and this is so, notwithstanding that the mains have been laid under statutory powers. Who is correct?

This section provides that where for any purpose of the Act an urban authority deem it necessary to raise, sink, or otherwise alter the situation of any water or gas pipes, mains, plugs or other waterworks or gasworks laid in or under any street, they may give notice to the owners to make the alteration at the expense of the authority, and if such notice is not complied with the authority may themselves make the alteration. It has been held that the power to break up streets and lay pipes, &c., given to water companies by sec. 28 of the Waterworks Clauses Act, 1847, extends to covers or guard-boxes to protect stop-valves, such covers or guard-boxes not creating a nuisance or being inconsistent with the substantial reinstatement of the pavement (*East London Waterworks Company* v. *St. Matthew, Bethnal Green*, 17 Q.B.D., 475). I think, therefore, that such covers would be held to be included in the works to which sec. 153 is applicable. It is to be noted, however, that the authority are not bound, under this section, to alter the position of pipes, &c., for the benefit of the water company (*Southwark and Vauxhall Water Company* v. *Wandsworth Board of Works*, 1898, 2 Ch., 603). But when the authority wish to make the alteration for their own purposes it would appear that the section applies.

Sewering Street.—"Interested" writes: Where an owner builds, forms a passage, and lays a drain or sewer, as required by a corporation, has an adjoining owner the right (without payment) to make use of the passage and connect up to the drain or sewer, and can the corporation confer such a right, and can the owner compel the corporation to put such drain or sewer under notice and charge on the adjoining owners according to frontage?

I can see nothing in the by-laws, or in the regulations contained in the extracts from local Acts and provisional orders accompanying this query, authorising the corporation to require the owner of these proposed buildings to construct a sewer in the passage. And in my opinion they cannot enforce this requirement. See *Regina* v. *Tynemouth Rural District Council* (1896 2 Q.B., 451). Under sec. 24 of the local Act of 1847 (page 47 of the regulations), and sec. 15 of the Public Health Act, 1875, it is their duty to construct all necessary sewers. This duty can be fulfilled as regards new streets by exercising the powers conferred by sec. 109 of the local Act of 1853 (page 13 of the regulations), by sec. 20 of the local Act of 1875 (page 45), and by sec. 150 of the Public Health Act, 1875. The passage would appear to be a "street." See the definitions, page 61. It is certainly a street within the Public Health Act. The sewer when constructed (whether by the owner or by the corporation) will vest in the latter, under sec. 13 of the last-mentioned Act, sec. 22 of the local Act of 1847 (page 43). And under sec. 21 of the Public Health Act the owners of any other premises in the district will be entitled to connect their drains with the sewer. If, however, the owner does himself construct the sewer he cannot then compel the corporation to charge the other adjoining owners with part of the cost of its construction, nor would the corporation have power to do so.

Volume of Sewage from Factory.—"Sewage" writes: I shall be greatly obliged by an expression of your opinion upon the following points: In a small town a fellmonger has had a boring sunk on his premises. The water rises in considerable volume above the surface of the ground, and is turned direct into the tanks required in the works, and passes thence into the public sewer at the rate of approximately 40,000 gallons per diem. (*a*) Has the firm the right to call upon the local authority to take so large a volume, and (*b*) could the local authority sustain the refusal to take it?

Under sec. 7 of the Rivers Pollution Prevention Act, 1876, the local authority are bound to give facilities for enabling manufacturers to carry the liquids from their factories or manufacturing processes into the sewers, except where such liquids would prejudicially affect the sewers or the disposal by sale for application to land or otherwise of the sewage, or which would be injurious from a sanitary point of view; or where the sewers are only sufficient for the requirements of the district, or where such facilities would interfere with any Order of any Court of competent jurisdiction respecting the sewage of such authority. It would appear that the authority have some discretion in the matter, and are justified in requiring some payment for the facility, and in imposing conditions and regulations as to the communications to be made with the sewers (see "The Law Relating to Sewers and Drains," by Macmorran and Willis, page 575). Subject to this, I think the local authority are bound to take the effluent, unless excused by reason of the application of one of the exceptions mentioned in the section.

Highway: Cutting Sods from Waste.—"J. A. N." writes: I shall be pleased to learn through your law column whether the surveyor to an urban district council has authority to give persons permission to cut sods from the waste land on the sides of highways for the purposes of making lawns, &c.

If the highways in question are repairable by the inhabitants at large, they and the materials thereof are vested in the urban district council. The council can certainly let the right of pasturage on the waste (*Coverdale* v. *Charlton*, 4 Q.B.D., 104). And although I cannot find that it has ever been decided that they can give permission for sods to be cut, I think, upon the analogy of the above

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case, they would have power to do so. As to highways not repairable by the inhabitants at large, the herbage would, presumably, belong to the owners of the adjoining lands, and in that event the council could not deal with it.

CORRESPONDENCE.

For every ill beneath the sun
There is some remedy or none;
If there be one, resolve to find it;
If not, submit, and never mind it.
—Anon., *circa* 1843.

CREMATION AND PREMATURE BURIAL.

To the Editor of The Surveyor.

Sir,—The allusion to "Cremation in Great Britain" in your instructive journal of May 16th prompts me to remark that, although the regulations of the various cremation societies for medical inspection of persons supposed to be dead are, to a great extent, a prevention of the burial or cremation of people in a condition of trance, catalepsy, and other forms of suspended animation, the security thus afforded is by no means absolute. . . .

It is quite evident that cases of suspension of life occur in which no array of medical talent, or any tests that may apply, can detect the presence or absence of life, and it cannot be too strongly urged that putrefactive decomposition is the only really unequivocal proof of death. This is the mature opinion of all medical authorities who have carefully investigated this painful but highly important subject; and yet decomposition is not often waited for before burial, cremation or embalming takes place. To those of your readers who are interested in the prevention of interment alive I should be happy to send literature on the question free on receipt of an envelope, stamped and addressed.—Yours, &c.,

Jas. R. Williamson.

100 Chedington-road,
Upper Edmonton, N.
May 20, 1913.

Town Planning at Bridlington.—On Wednesday it was resolved by the Bridlington Town Council to apply to the Local Government Board for authority to prepare a town planning scheme. Alderman Mainprize protested against provision being made in the scheme for the construction of a marine drive from the north boundary of the borough to Dane's Dyke—a scheme which, he said, would mean, along with the construction of a sea wall, an expenditure of £150,000.

LOCAL GOVERNMENT BOARD INQUIRIES.

The Editor invites the co-operation of Surveyor *readers with a view to making the information given under this head as complete and accurate as possible.*

INQUIRIES HELD.

Bangor (Co. Down) U.D.C. (May 20th. Mr. P. C. Cowan).—£500 for carrying out street improvements, and £11,360 for installing a system of vertical retorts at the gasworks.—It was stated that the £500 applied for for street improvements was for the widening of an important thoroughfare known as Bingham-street, in connection with which the council proposed to pay £250 for the purchase of property. In the matter of the proposed loan for the gasworks, Mr. J. D. Smith, manager of the corporation gasworks in Belfast, gave expert evidence, and spoke as to the suitability of the Glover-West system of vertical retorts for a town like Bangor. He mentioned that the system had been installed in Belfast, and had given entire satisfaction.

Birmingham T.C. (May 21st. Mr. M. K. North).—£13,682 in respect of the proposed widening of Wheelwright-road, Erdington-lane, and Cotterill's-lane, and for works of paving in Hagley-road.—Mr. H. E. Stilgoe, the city surveyor, explained the details of the scheme, and the town clerk made the customary statement with respect to the legal and financial bearings of the proposed works.

Brighouse T.C. (May 20th. Mr. P. M. Crosthwaite).—£18,500 for works of sewage disposal, £1,140 for a pleasure ground, £1,560 for the purchase of property in Briggate and Bridge End for street improvements, and £1,540 for paving in Mill-lane.—With respect to the proposed loan for sewerage, it was explained that the additional scheme was practically forced upon the corporation by the Local Government Board. The corporation were notified that the land filtration area was only capable of dealing efficiently with about one-third of the dry-weather flow. Mr. S. S. Haywood, borough surveyor, submitted the plans and detailed the proposed new works. Evidence was also given with respect to the other projected works.

Brixham U.D.C. (May 27th. Mr. R. H. Bicknell).—£2,750 for street improvement purposes.—The clerk, Mr. J. L. Arlidge, explained that the works for which sanction was applied might be summarised: Main roads £903, other roads £1,691, contingencies £155. In the course of further evidence he stated that the thoroughfares known as Meads-lane and Nelson-road, which were not highways repairable by the inhabitants at large, but in each of which certain road works had been done by the owners, would probably be taken over by the council. These were not new streets in the strict sense of the word, the former being an old lane now widened, and the latter an awarded road fronting a recreation ground belonging to the council. The inspector asked why the roads should not be taken over at once, pointing out that no money would be granted unless this were done. On it being suggested that new property should be considered the inspector said he did not think that because there was new property the council should immediately take over the road. The abutting owners should put the road in a thorough state of repair, and after that the authority should take it over. It was quite right that the council should lay such drains as were necessary at their own cost. He doubted very much whether it was a wise policy to do the work in streets other than public highways. It might be that some day they would not want to do such work, and it would be very difficult to refuse, having regard to what they had done previously. The clerk remarked that this was the argument he had placed before the council. Continuing, he asked that the loan should be for a period of twenty years, but the inspector said he did not think that would be allowed; they would get only what was usual in other parts of the country. Engineering details of the proposed works were given by the surveyor, Mr. J. Silley.

Calne T.C. (May 15th. Mr. M. K. North).—£500 for the purpose of paving Church-street, New-road, Kingsbury-street, High-street, and the Strand.—The borough surveyor, Mr. G. Drewett, said that to his knowledge neither the paving, channelling, nor kerbing had been renewed for twenty-nine years.

Hartshorn and Seals R.D.C. (May 16th. Major C. E. Norton, R.E.).—£2,200 for works of water supply for the parish of Ticknall.—Mr. G. Farmer, clerk to the council, explained that the present supply of

water was derived from surface wells, many of which had been condemned, and the Local Government Board had, for some considerable time, been inquiring what steps the council proposed to take to provide the village with a wholesome supply of water. After having obtained the general statistics of the parish, the inspector went into the plans and details with the engineer and surveyor (Mr. N. F. Spence). He intimated that the mains should be extended to supply some eighteen houses to which the council had not proposed to lay them at present. On the inquiry being closed the inspector visited the sites of the several works.

Horsham U.D.C. (May 16th. Mr. T. C. Ekin).—£2,000 for the provision of a refuse destructor at the electricity works.—The clerk, Mr. S. Mitchell, explained that the estimated cost of the proposed scheme was as follows: Destructor furnace, £1,450; extension of boiler-houses, £264; retaining wall, £17; architect's fees and sundries, £28; mechanical hopper, £122; incidentals, £118. The amount allowed for incidentals included the cost of an air shaft, which was not included in the provisional contracts entered into. Mr. John B. Morgan, A.M.I.E.E., the electrical engineer, said the makers of the destructor guaranteed 1½ lb. of steam to 1 lb. of refuse destroyed on a steam consumption, or about 84 units per ton. The two cells, jointly, would burn 1 ton per hour easily. He estimated the value of the refuse at £433 per annum.

Mansfield T.C. (May 15th. Major C. E. Norton).—£3,100 for a sewerage and sewage disposal scheme for Rainsworth.—The town clerk (Mr. J. H. White) stated that owing to the sinking of the new Rufford Colliery a number of houses had already been erected at Rainworth, and it was anticipated that many more would be erected there, as well as in the adjoining parish of Blidworth, which was in the Skegby rural district. At present there was no means of taking away the drainage from this part of the borough, and the houses now existing drained into a large cesspool, which was frequently emptied. The scheme suggested was not complete, but, having regard to the number of houses already up and to their nearness to the corporation's water well, it was most important that immediate steps should be taken to deal with the sewage in a proper manner. The corporation did not at present feel justified in incurring the cost of putting down a complete scheme, but when it was necessary to do so the matter would be taken in hand at once.

Paignton U.D.C. (May 27th. Mr. R. H. Bicknell).—£1,600 for the provision of a depot.—The surveyor, Mr. C. O. Baines, in his evidence stated that in consequence of the many appliances of the council not being properly housed, deterioration set in before it otherwise would. The building could be used for the drying of bathing tents, which at present, with several hundreds of chairs and other articles, were kept in various parts of the town and not under satisfactory conditions. The land had been obtained cheaply.

Smallburgh R.D.C. (May 22nd. Mr. W. H. Collins). £960 for the purchase of land and the erection of working-class dwellings at Potter Heigham.—It was stated that the price of the land would be £50 per acre. An estimate of cost of building six dwellings had been prepared by Mr. E. A. Dale, district sanitary inspector, and a tender had been accepted. Any loss from deficiency of rent would fall upon the district. A rate of 1d. in the £ raised £9 4s. 7d. in the parish, and £263 0s. 9d. in the district.

Southampton T.C. (May 21st. Mr. R. H. Bicknell).—£2,200 for the widening and improvement of Highfield-lane, and £4,120 for the construction of a wharf at the depot at Chapel.—In reference to the improvement at Highfield-lane, the town clerk, Mr. R. R. Linthorne, said it was a very busy and growing part of the borough. They had entered into a provisional contract for the purchase of the land on the south-west side on very advantageous terms. With regard to the construction of a wharf at Chapel, the borough engineer, Mr. J. W. Crowther, stated that the old wharf was used for the purpose of receiving granite, and for sending refuse away to sea.

Stafford T.C. (May 21st. Mr. E. Leonard).—£12,200 for the erection of working-class dwellings and for the board's consent to the appropriation of lands vested in the corporation for the purposes of Part III. of the Housing of the Working Classes Act, 1890.—The proposal is to erect sixty houses, twenty in Blackwalls South, twenty in Blakiston-street, and twenty in Harrowby-street. The medical officer of health stated that the scheme did not altogether meet his wishes. The rents of the proposed houses were too high to meet the requirements of the people who were living in the insanitary houses he had condemned. He considered that there were two schemes in one. The plans were satisfactory, but with the exception of those in Blackwalls the houses did not meet the needs of the people living in the insanitary areas, who, for the most part, could not afford to pay more than 2s. 6d. to 3s. 6d. a week in rent.

York T.C. (May 26th. Mr. T. C. Ekin).—£24,440 for the extension of the electricity works.—It was stated that the proposed expenditure was necessary to meet the increased demand for electricity. There had at first been a loss of £8,399 on the undertaking, but of late years it had earned a profit of £8,633. The amounts required were: Generating plant £10,100, two water-tube boilers £4,300, cables £5,250, battery £3,900, buildings £890, total £24,440.

APPLICATIONS FOR LOANS.

Alnwick U.D.C. — £3,500 for ten workmen's dwellings.

Barnes U.D.C.—£480 for the improvement of Upper Richmond-road.

Berks C.C.—£8,100 on account of No. 5 main road reconstruction scheme; £1,860 for a new police station at Cookham.

Burton-on-Trent T.C.—£2,350 for the purchase of property for road improvement.

Dawlish U.D.C. — £2,500 for the purchase of the "Knowle."

Devonport T.C.—£1,548 for paving works.

Dodworth U.D.C. — £1,200 for new municipal offices.

Hipperholme U.D.C.—£1,000 for gasworks extensions.

Wembley U.D.C.—£550 for making up a road.

LOANS SANCTIONED.

Atherstone R.D.C.—£113 for extending the water supply.

Chatham T.C.—£8,990 for a new school.

Colwyn Bay U.D.C.—£480 for a cemetery chapel.

Freebridge Lynn R.D.C.—£750 for building cottages.

Lowestoft T.C.—£3,000 for electricity mains, and £2,000 for house services.

Luton T.C.—£880 for the purchase of a school site.

Oakengates U.D.C.—£15,000 for sewerage extensions.

Smethwick T.C.—£18,925 for a new school.

Stafford T.C.—£7,053 for the construction of a new street.

Uckfield U.D.C.—£12,200 for the purpose of sewage disposal works (conditionally).

FORTHCOMING INQUIRIES.

JUNE.	£
3.—**Bourne.** For the provision of working-class dwellings (Mr. W. H. Collin) ...	4,065
3.—**Clacton.** For improvement purposes and the provision of a convenience (Mr. A. G. Drury)	7,200
3.—**Harwich.** For electrifying the sewage pumping station and drainage works (Mr. P. M. Crosthwaite)	3,400
3.—**Skegness.** For the purchase of a steam roller (Mr. H. R. Hooper)	317
3.—**Swansea.** For sewage disposal works (Mr. A. W. Brightmore)	1,446
4.—**Penybont.** For works of water supply (Mr. A. W. Brightmore)	1,820
4.—**Saffron Walden.** For sewage disposal works (Mr. R. H. Bicknell)	1,250
5.—**Cleethorpes.** For destructor, convenience, bandstand, and shelter purposes (Mr. H. R. Hooper)	6,584
5.—**Pontypridd.** For alterations to reservoirs (Mr. A. W. Brightmore)	9,690
6.—**Kingston-upon-Hull.** For furnishing the Guildhall (Mr. H. R. Hooper) ...	8,159
6.—**Risca.** For works of sewerage (Mr. A. W. Brightmore)	1,205

Assistants' and Students' Section.

Conducted by SYDNEY G. TURNER, Assoc.M.Inst.C.E.

All communications in regard to this page must be addressed to The Editor, St. Bride's House, 24 Bride-lane, Fleet-street, E.C. *Envelopes must be marked "Assistants' Section" in the top left-hand corner. Correspondents are invited to submit questions for consideration and answers to the questions which appear. For the contributions considered to be the most meritorious, one or more premiums in books will be awarded monthly. Diagrams must be drawn to scale on separate sheets, ready for reproduction.*

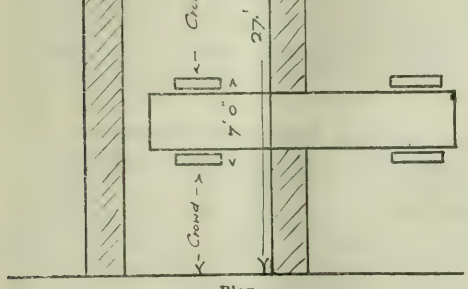
QUESTIONS.

This week answers are invited to the following questions:—

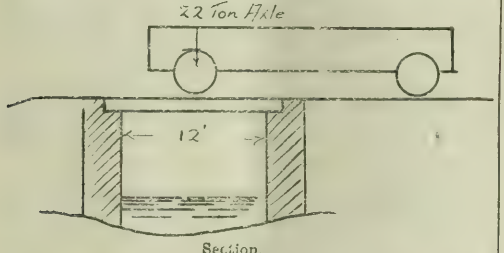
324. Oil Engines.—Assuming two engines of equal horse-power (4-h.p.), one an oil engine and the other a petrol, what would be the approximate cost for running each engine for fuel and repairs? How would the costs compare with each other, including first outlay and oil, repairs, &c.? In regard to efficiency, which engine would be the more efficient from an economic standpoint? ("Griffo.")

325. Air Compressors.—How is the size of an air receiver calculated in connection with an air compressor? Of what thickness of metal would it be made if (1) of cast iron, (2) wrought iron, assuming it had to withstand a pressure of from 15 lb. to 40 lb.? Give any further particulars regarding same. ("Griffo.")

326. Reinforced-Concrete Bridge Design.—Show a suitable design in reinforced concrete, either in a single slab or slab and beams, for a decking to carry a roadway over a bridge; span 12 ft., width



Plan.



Section.

27 ft., cover 9 in. macadam; brickwork abutments. Show the calculations by which the section, steelwork, &c., is arrived at. The maximum live load that can come on the bridge is a 22-ton axle, and the remainder of the bridge covered with a crowd. (G. B. S., *Hove.*)

327. Flow of Sewers.—State the advantages of egg-shaped and circular sewers, and give conditions under which such advantages would occur. Give proofs of velocities and discharge. (D. G. B., *Darlington.*)

328. Concrete Paving.—Give details of the construction of wooden moulds for concrete pavement slabs, and explain the method of using them. ("Beginner.")

329. Sewerage.—Using the generally accepted most accurate formula, at what gradients must 9-in., 12-in. and 15-in. pipe sewers be laid to give a uniform velocity of 4 ft. per second when flowing two-thirds full? ("M. C. E.")

330. Sewage Disposal.—Design a small sewage disposal system for a gentleman's residence, capable of dealing with 500 gallons per day. The sewage is fairly strong on account of the drainage from a small cowshed. The available fall can be neglected, and the earth is of a sandy-clay nature. State approximate cost. The effluent should discharge into a soakaway. ("Inky.")

NOTES.

Some Notes on Contracted Methods in Arithmetic.

In most practical calculations the answer is only required to a reasonable degree of accuracy—say, three or four places of decimals—and arithmetical operations can be much shortened when only such a degree of accuracy is required.

Addition and Subtraction.—To add or subtract numbers to any given number of decimal places it is only necessary to consider the figures *two* places beyond in order to see what has to be carried—*e.g.*, add to three places of decimals.

	a	*b*	
14·618	25		Figures to right of line *b* are rejected.
3·179	24		
·518	47	9	Figures between lines *a* and *b* are added mentally to see what figure to carry.
154·017	23	5	
Answer 172·333			

Multiplication.—Place the multiplier so that its units figure is under the last figure of the multiplicand, and begin the multiplication from the *left* of the multiplier. Draw two vertical lines (as in the above example for addition), one showing the figures to be finally retained, and the other two places beyond. Multiply as usual so long as all the figures are to be retained. Before multiplying by each succeeding digit, strike out one figure on the right of the multiplicand, and put the first figure of the product (adding in mentally what would be carried from the multiplication of the figure crossed out) in the last column. The complete process will be seen from the following example:—

Find to three places of decimals the product of 51·6243 and 112·4167.

51·6243			
11	2·4	167	
5162·43			
516·243			
103·248	6		
20·649	72		
·516	24		
·309	74		
·036	13		
Answer 5803·433			

Division.—A certain number of figures in the quotient must first be found in the ordinary way. This number is the number required *minus* the number of figures in the division *plus* two. For subsequent figures, instead of bringing down a figure from the dividend at every stage to the right of the remainder, we strike out the last figure on the right of the division instead, using the figure so struck out, however, to see what should be carried.

Example: 516·24175 ÷ 123·456 to six places.

Figures to be found in usual way are 7 − 6 + 2 = 3.

```
123·456) 516·24175 (4·18
         493 824
         ---------
          22 4177
          12 3456
          -------
          10 07215
           9 87648
           -------
            19567
            12345
            -----
             7222
             6172
             ----
             1050
              987
              ---
               63
               61
```

Municipal Work in Progress and Projected.

The Editor invites the co-operation of Surveyor *readers with a view to making information given under this head as complete and accurate as possible.*

The following are among the more important projected works of which particulars appear below: Arbroath, Bermondsey £57,000, Hull £17,367, Kensington £6,500, Liverpool, Stirling £19,500; housing and town planning — Hayes £5,925, Launceston, Ystradgynlais; roads and materials — Hampshire, Herts, Northants, Surrey; sewerage and sewage disposal — Earby £4,500, Oakengates £15,000, Ulverston, Wolverhampton £27,157; water, gas and electricity—Hull, Street. Particulars of other works projected will be found on our "Local Government Board Inquiries" pages.

BUILDINGS.

Arbroath T.C.—The city engineer, Mr. James Thomson, acting as judge, has recommended the adoption of the plans of Mr. Hugh Garvin, of Arbroath, for the proposed public baths. Twenty-six sets of plans were sent in. For the baths Mr. Andrew Carnegie has given £7,000, while an Arbroath gentleman has offered to pay for the site.

Bermondsey B.C.—Instead of enlarging the Rotherhithe swimming-bath, as suggested, the Baths and Washhouses Committee propose to reconstruct the old Spa-road baths on a considerably extended scale. The work would entail an estimated expenditure of £57,000. The Finance Committee have called for a definite scheme before consenting to submit the matter to the council.

Birmingham T.C.—It has been decided to accept a tender for sinking a well 700 ft. deep on the site of the proposed public baths in Institute-road, King's Heath. It is expected the work will be completed in about nine months. The Baths Committee have also accepted a tender for the erection of a set of cottage baths at the corner of Lower Dartmouth-street and Watery-lane. There are already three sets of cottage baths in the city—viz., in Coventry-street, Bacchus-road, and Brierley-street, and an extension of the baths in Coventry-street has been undertaken by the committee.

East Lothian C.C.—It has been decided to co-operate with adjoining counties, if it can be arranged, in the erection of a sanatorium.

Greenwich B.C.—Tenders are to be obtained for carrying out the necessary work at the Manor House, Park-place, East Greenwich, which has been purchased for the purpose of a tuberculosis dispensary.

Hackney B.C. — A new Carnegie library is to be erected in Northwold-road, Upper Clapton, at a cost of £6,720, including the site.

Hull T.C.—It has been decided to build a sanatorium on the Cottingham site, at an estimated cost of £17,367.

Kensington B.C.—Sketch plans have been prepared by the borough engineer, Mr. A. R. Finch, Assoc.M. Inst.C.E., showing the proposed enlargement of the Pembroke-road depot, together with approximate estimates of giving effect to three schemes, such estimates being as follows: Scheme A, £6,500; scheme B, £10,100; and scheme C, £9,300. The main difference between these schemes is that while scheme A provides for the necessary workshop accommodation being on the ground floor, such accommodation is, in the other two schemes, placed on the first floor level, thereby leaving the ground floor, as far as practicable, free for garage accommodation. A proposal to adopt scheme A will be submitted at the next meeting of the council.

Kesteven (Lincs) C.C.—Negotiations are to be continued with a view to the formation of a joint scheme with the administrative county of Holland for equipping and maintaining a dispensary system, consisting of a tuberculosis officer and dispensaries, and the provision of a sanatorium, jointly with the administrative counties of Holland and Lindsey, and the county borough of Grimsby.

Liverpool T.C. — The Finance Committee have passed a recommendation to the council to take steps for the purchase of the Love-lane site for the new abattoirs scheme.

Manchester T.C.—Baths and washhouses are to be erected in St. John's Ward at an estimated cost of £4,994.

Masham U.D.C.—The new town hall, built at a cost of £3,751 from a bequest by the late Lord Masham, was opened on Saturday last. The architect was Mr. J. Houfe, of Harrogate.

St. Annes U.D.C.—Two new shelters are to be constructed on the promenade and a revolving wind screen for the bandstand; the old bandstand is to be converted into a shelter, and the ladies' pavilion into a ladies' cloak-room. The surveyor, Mr. H. Gregson, has been instructed to prepare plans and estimates for completing the laying out of the esplanade up to Fairhaven-road.

Seaton Delaval U.D.C.—The tenders of Messrs. Kelly & Dover, Blyth, and Mr. O. Hall, Seaton-Sluice, have been accepted for the erection of a public convenience and a public shelter, at a cost of £195 and £50 respectively, from the plans and designs of the surveyor, Mr. A. Dorin.

Stirling T.C.—New municipal buildings are to be erected at an estimated cost of £19,500.

Surrey C.C.—A sub-committee has been appointed to confer with representatives of the Middlesex County Council as to the improvement of Richmond Bridge. The estimate of bridge maintenance during the current year is £5,000, and for improvements on main and assisted roads £4,000. A sum of £15,693 was received from the Road Board last year.

Whitby and Monkseaton U.D.C.—The surveyor, Mr. A. J. Rousell, has been authorised to obtain tenders for protective works near the Table Rocks bandstand.

HOUSING AND TOWN PLANNING.

Barnes U.D.C.—Plans are to be obtained for the erection of cottages at Malthouse.

Balrothery R.D.C.—As a result of the seven-day inquiry held in January last by Mr. Barnewall Crofton, Local Government Board inspector, into a labourers' scheme promoted by the council, 241 cottages have been passed, and are included in the inspector's order, which will be issued in the course of a week or two.

Hayes U.D.C. — The surveyor, Mr. D. C. Fidler, has submitted plans for building twenty-two cottages at Yeading, at an inclusive cost of £5,925.

Huddersfield T.C.—Three town-planning schemes have been approved, and the erection of fifty working-class houses on the Royds Wood estate authorised. The Royds Wood estate was recently purchased by the corporation for £17,000.

Launceston T.C.—Plans have been approved for the erection of three types of houses for the working-classes, numbered 1, 2, 3. No. 1 house includes a parlour, three bedrooms, and living room; No. 2 house includes three bedrooms, living room, and no parlour; No. 3 house includes two bedrooms, living room, and no parlour. A road 30 ft. wide is to be made through the Race-hill site, and eight houses of Nos. 1 and 2 types, and six or more of No. 3 type are to be built on the eastern side of this road. Each house is to have an equal garden space of from 6 yds. to 8 yds. and the remaining portion of the field is to be reserved for the erection of twenty-four more houses when required.

Oldham T.C.—The borough surveyor, Mr. E. C. Foote, has received instructions to prepare a plan of all the land in the borough available for town-planning purposes.

Redruth R.D.C.—In a letter to the council the Local Government Board point out the urgency of dealing with insanitary and dilapidated property, and suggest that the council should seriously consider the question of themselves providing housing accommodation under Part III. of the Housing of the Working Classes Act, 1890. The board also wrote that Dr. Fletcher, the board's inspector, recommended that the following should receive immediate attention: (1) The doubtful quality and the inadequacy of the various water supplies in many parts of the district; (2) the many

existing nuisances which arise from dilapidated and badly-constructed conveniences; (3) the efficient sewerage of the populous parts of the district, and the disposal of the sewage effluents without giving rise to nuisance.

Swansea T.C.—It has been decided by the Housing Committee to obtain particulars from other towns as to whether the system of housing the working classes by tenements or flats has proved a commercial success.

Ystradgynlais R.D.C.—It has been decided to erect ten working-class dwellings at a cost of £232 each, and ten at a cost of £217 each.

ROADS AND MATERIALS.

Anglesey C.C.—A section of about 24 miles of the projected coastal road to encircle the whole island has been formally opened.

Berks C.C.—The approach to the new bridge, Holyport, is to be raised at a cost of £124.

Camborne U.D.C.—The County Main Roads Committee have voted £750 towards the cost of reforming Trelowarren-street.

Camelford R.D.C.—The question of the purchase of a steam roller is being considered by a committee.

Devonport T.C.—The council have adopted the estimate of the surveyor, Mr. J. F. Burns, for repairing Pembroke-street with granite setts, at an estimated cost of £1,548.

Down C.C.—The county surveyor, Mr. J. Heron, has received instructions to prepare a scheme of road improvement with a view to obtaining a grant from the Road Board. This body have written to the council that they are now considering the selection of schemes in Ireland to which additional grants were to be made, but there was no present intention to make further distributions to all Irish counties. On the contrary, the intention was to select for assistance in the near future schemes which appeared from their general public utility to be those which should first be proceeded with.

East Sussex C.C.—The council have approved a resolution sent from several district councils, submitting that, "in view of the grave damage which is being done to the roads (both main and district) by motor lorry and traction engine traffic, legislation should be immediately introduced whereby the wheels of the engines and vehicles should be a width varying proportionately to their tonnage and to the tonnage drawn by them." This, it was thought, would minimise the damage done to the road surface.

Edinburgh T.C.—Intimation of a grant of £5,000 has been received from the Road Board for widening Willowbrae-road and Wilton-road.

Godstone R.D.C.—The highways surveyor, Mr. G. E. Crowter, has received instructions to proceed with the reconstruction of a portion of Water-lane, at an estimated cost of £600.

Hampshire C.C.—The council have decided to make application to the Local Government Board to borrow from the Road Board £24,600 for four years, and £29,290 for five years, without interest, to enable them to bring all the trunk roads of the county up to a condition to bear the increased heavy traffic which they are now required to carry. The council have already accepted an offer by the Road Board of a grant of £27,000, the repayment of which is to be spread over five years. The amount to be spent out of the rates on the roads during the ensuing year is £75,301.

Herts C.C.—The estimate of the county surveyor, Mr. U. A. Smith, as to the amount of the expenditure likely to be incurred upon each section of main road repairable by the county council during the financial year ending March 31, 1914, is £96,500. The Highways Committee have been authorised to expend a sum not exceeding £7,900 during the ensuing summer in tarring certain lengths of main roads, for which purpose a contract has been signed with the Taroads Syndicate, Limited. The nett increase in the expenditure is £8,000.

Islington B.C.—The London County Council is to be asked to sanction a loan of £5,024 for repaving St. Paul's-grove and Highbury-grove partly with asphalt and partly with wood blocks. A letter has been received from the Road Board promising a grant to the extent of 50 per cent on the laying of an extra thickness of concrete in St. Paul's-road, Canonbury, and New North-road. This has been referred to the Works Committee, together with a further letter offering grants up to £8,000 or £10,000 to assist a comprehensive scheme of substituting wood paving for macadam.

Kent C.C.—An estimate of £13,184 has been passed for laying wood paving in Bromley High-street.—Plans have been passed for widening Folkestone-road and Chatham High-street.

Kesteven (Lincs) C.C.—A discussion took place at the meeting last week in regard to the comparative cost of the main roads in the rural districts under contract with the district councils, and the cost in the rural districts of the main roads under the immediate and direct control of the county surveyor, Mr. W. B. Purser, and it was decided to appoint a sub-committee with instructions to investigate and inquire into the cost of the main roads maintained under contract and under direct control respectively, with a view to determine whether or not it is advisable or desirable to recommend the county council to take over under their direct control the management and repair of the whole of the main roads other than the roads in urban districts, which their respective councils had the right and had claimed to manage and repair.

Langholm T.C.—A strip of land is to be purchased with a view to the widening of Charles-street.

Londonderry C.C.—The county surveyor, Mr. C. L. Boddie, reports, with reference to the proposed improvement of the Derry-Claudy-Park road, that the Derry No. 1 council's proposals included an instalment to provide for the treatment of a total length of 7 miles of road commencing at Derry city boundary, involving a total cost of £5,075, towards which the Road Board have promised to make a grant of £2,537. The board were willing to lend the necessary sum free of interest, and accept repayment in five equal annual instalments. The Derry No. 1 council considered the terms satisfactory, and the necessary proposals had been formulated. No satisfactory tenders had been received for the work, and the district council desired the proposals to be placed in the hands of the surveyor, and this the county council has agreed to. The report further stated that negotiations with the Road Board had indicated that they were now inclined to give grants towards works which formerly they regarded as purely maintenance, and towards which they had declined to give any assistance; but they made it clear that in no case would a grant exceed half the total cost of the work.

Mynyddislwyn U.D.C.—Arrangements have been completed for the construction of a new road at Ynysddu.

Mytholmroyd (Yorks) U.D.C.—The plan of the surveyor, Mr. S. Sutcliffe, has been approved for the widening of the road at Pot House, and a letter has been sent to the county council pointing out the necessity for proceeding with the work as early as possible.

Neath T.C.—The Highways Committee have accepted the tender of Messrs. A. G. Collins & Co., of Barry, for work in several thoroughfares under the Private Street Works Act.

Northants C.C.—The Road Board have consented to grant £5,500 towards the total cost of £18,465 (of which the improvement cost is £10,935) for the widening and reconstruction of the Watling-street main road from Old Stratford through Towcester to Weedon. The board will also loan £10,000 free of interest, repayable in five equal yearly instalments. The Roads and Bridges Committee recommended that the improvement should be carried out, and spread over two years, and that the offer be accepted. The Roads and Bridges Committee report that the Road Board grants towards the various improvements proposed to be carried out during the year totalled £4,755, out of an estimated expenditure of £6,840. The improvements include the widening of the road from Northampton borough boundary and Weston Favell, the cross-roads at Old Stratford, St. Peter's county bridge (Great Houghton) rebuilding, and tar binding and surface tarring.

Northampton T.C.—A grant of £3,000 has been voted by the Road Board towards the cost of the improvement of Houghton-road, and it is proposed to ask the board for a loan of £4,000, the difference between the grant and the cost of the work.

Norwich T.C.—Three pitch boilers are to be purchased at a cost of £225, and a second-hand tar-mixing machine at a cost (including carriage) of £60.

Oakham U.D.C.—High-street is to be widened at an estimated cost of £550, towards which the Road Board will make a grant of £100, and the county council a similar amount.

Perth T.C. — A letter has been received from the Road Board intimating that a grant of £3,000, under the Development and Road Improvement Funds Act, could be got for the ensuing year if a scheme of improvements were submitted, to enable the board to make advances to such an amount. This sum included a grant of £1,500, which had already been indicated, for dealing with the remaining lengths of the main road from Perth to Inverness in the Highland district. The letter had been communicated to the several district committees for their information, so that they might, if so advised, submit a scheme of road improvement.

Richmond (Surrey) T.C.—Part of Petersham-road is to be repaired with bituminous macadam at a cost of £2,004, towards which the Road Board will contribute £768.—The total cost of the wood paving of Kew-road is £18,184.—Sandycombe-road is to be repaired with an improved bituminous macadam, at an estimated cost of £1,850, and Lower Mortlake-road at an estimated cost of £2,000, subject to a grant being received from the Road Board.

Seaton Delaval U.D.C.—The council have approved a plan prepared by the surveyor, Mr. A. Dorin, for the removal of a dangerous corner on the Laverock Hall road, at a cost of £150.

Scarborough T.C. — The borough engineer, Mr. H. W. Smith, has received instructions to prepare plans of a proposed improvement of the Royal Albert-drive.

Shrewsbury T.C.—The road from Cross-street to Simpson's-square is to be repaired with Tarmac at a cost of £700.

Southampton T.C.—It has been agreed to make an allowance of £75 to the road surveyor, Mr. Dixon, to meet the expenses of a motor car. It was stated that Mr. Dixon's itinerary averaged 50 miles a day.

Stirling C.C.—It has been agreed by the Western District Committee to treat two portions of the Glasgow to Aberfoyle road, covering a distance of 1½ miles, in accordance with the specification of the Road Board, and to request a grant for the work from the board.

Stockton R.D.C. — It is proposed to carry out a main highway improvement near Elton, between Stockton and Darlington. The necessary land has been offered, and the rural council are seeking to induce the county council to bear the cost of the scheme.

Stoke Newington B.C.—The Road Board have agreed to make grants amounting to £1,500 towards road reconstructions, and advance a loan of £4,200 free of interest.

Surrey C.C.—£590 is to be spent on renewing the wood paving, laid in 1903, on Kew Bridge.—The Esher and the Dittons Urban District Council have been asked to reconsider their decision not to acquire the land necessary to widen to 50 ft. the main road from Gigg's Hill-green to Window's Bridge.—The final vote in July last for main road maintenance, including improvements in surfacing, contributed by the Road Board, amounted to £99,868, and the actual expenditure was £115 less than that sum. The revised estimates for the current year total £99,838, towards which the Road Board have promised a grant of £14,000 for bituminous surfacings, of which, however, only £13,880 is for main roads, bringing the nett expenditure down to £85,958, which compares with £88,000 last year. The Highways and Bridges Committee have been authorised, if they find it practicable, to come to terms with any local authority as to such authority undertaking the maintenance of any particular roads. A sum not exceeding £23,000 is to be paid to local authorities in respect of the maintenance of assisted roads during the past year. For the current year the expenditure estimated in respect of these roads is £27,500.—£185 has been granted towards widening, at a cost of £555, 400 yds. of the main London-Lewes road, the Road Board and the Caterham District Council each having contributed a similar sum. Two-thirds of the cost of paving the tram margins in Claremont-road is to be paid to the Surbiton Urban District Council, the annual contribution being £156 11s. 6d. for ten years, and £58 10s. 6d. for a further ten years.—With regard to the £27,500 for assisted roads, the council have agreed to assist 150 miles of these roads by paying half the cost of tarring. Experience had shown that it affected a great saving in maintenance.

Swindon T.C.—Akonia is to be again used this season for dust prevention.

Weston-super-Mare U.D.C.—The council have decided to try Akonia for dust prevention on some of their roads.

Withernsea U.D.C.—A new road to the north of the town is to be constructed at an estimated cost of £2,300.

Wolverhampton T.C.—Land and property in Penn-road are to be purchased for £1,770, with the object ultimately of effecting direct communication with Blakenhall. The new road would be in direct line with Oaklands-road on the Penn side, and would cut through the fields to the very heart of Blakenhall.

SEWERAGE AND SEWAGE DISPOSAL.

Earby U.D.C.—Improvements are to be carried out at the sewage disposal works, at an estimated cost of £4 500.

Newport (Mon.) T.C.—The tender of Mr. G. F. Leadbeater at £312, has been accepted for the construction of a convenience in Dock-street.

Norwich T.C.—An underground convenience for both sexes is to be built on Tombland, at an estimated cost of £600.

Oakengates U.D.C.—The Local Government Board have sanctioned a loan of £15,000 for the carrying out of additional sewerage works in accordance with the scheme prepared by Messrs. Berrington, Son & Watney, of Westminster and Wolverhampton, the consulting engineers to the council.

Penrhyndeudraeth R.D.C. — The council have adopted the plans of Messrs. Berrington, Son & Watney, of Wolverhampton and Westminster, for the sewerage of Minffordd, and have applied to the Local Government Board for sanction to a loan for carrying out the scheme.

Portadown U.D.C.—The council have referred to the Sanitary Committee a letter from the Local Government Board stating that they had received the report of their medical inspector, Dr. O'Brien, on the sanitary condition of the urban district, and requesting that the matters referred to in it might receive the careful consideration of the council. They trusted that the recommendations made by their medical inspector to remedy the present defective sewerage system of the town, to which matter the board had directed the council's attention in previous correspondence, would receive early consideration.

Rotherham R.D.C.—Tenders are to be obtained for sewerage extensions to cost something like £2,064.

Sunbury U.D.C.—The tender of Messrs. R. Hornsby & Sons, at £549, has been accepted for the supply of a gas engine, suction-gas plant, and air-compressing machinery at the sewage disposal works, and the tender of Messrs. Hughes & Lankester, at £1,650, for the erection of an ejector station and ejectors.

Ulverston U.D.C.—The surveyor, Mr. C. T. Hague, has prepared a report on the sewerage of the town, for which he has received the congratulations of councillors. His scheme is divided into two parts, and it is understood that what is known as the Chapel-street scheme will be proceeded with first.

Wolverhampton T.C.—Conversions to the water carriage system are to be carried out at an estimated cost of £27,157. — The annual statement of income and expenditure in connection with the farming operations at the Barnhurst shows a balance in favour of the Sewerage Committee of £2,896, as compared with £1,106 for the previous year. The statement revealed the fact that eighty milking cows on the farm yielded 67,500 gallons of milk, £2,475 being realised.

WATER, GAS, AND ELECTRICITY.

Ashbourne U.D.C.—The council have decided to seek an additional supply of water, and have instructed Mr. H. Lapworth, D.Sc., M.Inst.C.E., Westminster, to advise them in the matter.

Bampton U.D.C. — The council have referred to a special committee a report on the water supply of the town prepared by Mr. J. Siddalls, borough surveyor of Tiverton. The quality of the water is favour-

ably commented upon, but Mr. Siddalls states there was a lack of supply to cisterns at the higher parts of the town. The service tanks were practically on the same level as the topmost tanks. A greater altitude was required, and this could best be accomplished by (*a*) a pump, lifting to a small service tank, and a new quick main to houses on the west of the railway. The other scheme (*b*) was to pump the whole supply to a higher surface reservoir, lay a 4-in. main, using the present pipes down the lane, and joining up with the present main at the railway bridge. The report went on to suggest how these schemes could be carried out. They could be done for such amounts as £350, £440, or £820.

Bristol T.C.—The Sanitary Committee have adopted a schedule of streets where cables, from which current will be obtained for street lighting, have been laid. The city engineer, Mr. L. S. McKenzie, informed the committee that under this scheme there were 1,157 gas lamps which could be converted into electric lamps. As the current would be provided to the city free of charge the saving in the gas bill would be 2s. 11d. per lamp, or a total of £797 18s. 6d. per annum. The cost of the conversion could be met by a suspense account for five and a half years, after which there would be a saving of £800 a year.

Cork R.D.C.—The engineer has been instructed to report upon a water supply for Ballinora.

Hull T.C.—A new water main is to be laid in the Cottingham-road, at an estimated cost of £2,000.

Llandudno U.D.C.—The charges for water have been reduced by 3d. in the £, and the Water Committee have been authorised to make a reduction in the price of gas, which is now 3s. per 1,000 cub. ft. Certain reductions in the price of electricity have also been sanctioned.

Pershore U.D.C.—It has been decided to enter into a provisional agreement with Mr. S. Stott for the purchase of 120,000 gallons of water per day from the Stanton Springs on the Cotswold Hills, near Broadway, at a cost of £9,000, with the option of taking any further quantity required on the same terms, and reserving to Mr. Stott 35,000 gallons of water per day as compensation water; also that on the completion of the agreement application should be made to the Local Government Board for sanction to borrow £18,000 for waterworks, repayable in thirty years, and £9,000 for the water, repayable in fifty years.

Salcombe U.D.C.—The tender of the Campbell Gas Engine Company, at £820, has been accepted for an installation of new pumping machinery at the waterworks.

Sandbach U.D.C.—Extensions are to be carried out at the waterworks, at an estimated cost of £1,200.

Selby U.D.C.—It has been agreed, subject to the sanction of the Local Government Board, to supply water to the Riccall Rural District Council at the rate of 9d. per 1,000 gallons.

Street U.D.C.—A supplementary water scheme is to be carried out, in connection with which £2,550 has been paid for land at Rodney Stoke.

MISCELLANEOUS.

Aberdeen T.C.—A sub-committee's report and recommendations regarding the tramways extension in the city have been approved. The scheme involves the running of motor-omnibuses and the equipment and running of trackless trolley cars. The estimated cost is £7,830 and £6,230 respectively.

Bournemouth T.C.—The nett profit earned last year by the tramways undertaking was £10,000.

St. Ives T.C.—1,000 ft. of canvas hose and a hose reel are to be purchased for the fire brigade.—Owing to the high prices of the tenders received for culverting the river the council have instructed the surveyor, Mr. S. Palmer, to carry out the work.

South Shields T.C.—The electric tramway system yielded a nett profit last year of £6,300, which constitutes a record.

Stafford T.C.—The gas undertaking earned last year a profit of £6,437, and the electric lighting works a profit of £212.

York T.C.—The Electricity Committee have received authority to pay their men engaged in laying cables a minimum rate of pay of not less than 6½d. per hour, as from May 1st.

PERSONAL.

Mr. G. Mitchell, of Clare, Cambridge, has been appointed surveyor and inspector to the Shoebury Urban District Council.

Mr. J. Oborn, surveyor and inspector to the Burry Port Urban District Council, has been appointed surveyor and inspector to the Porthcawl Urban District Council at a salary of £140 a year.

Mr. R. O. Wynne-Roberts, consulting engineer, Regina, is writing for the *Municipal and School Journal* of Saskatchewan a series of articles entitled "Notes on the History of the Regina Water Supply."

Mr. Henry Fred Moody, who has just completed twenty-five years' service as chief sanitary inspector of Grimsby, has been presented with a gold watch and an address by the members and officials of the corporation on his approaching marriage.

Mr. George W. Tillson, consulting engineer to Brooklyn Borough, Mr. Alfred E. Steers and Mr. Nelson P. Lewis, chief engineer of the Board of Estimate, New York City, have been appointed to represent the city of New York at the International Road Congress.

Mr. E. J. Lovegrove, borough engineer of Hornsey, has been elected a member of council of the Concrete Institute. Among those who have recently become members of the institute are Dr. John S. Owens, and Mr. C. C. Keep, director of the Adamant Stone and Paving Company, Aberdeen.

Mr. P. A. Willoughby, director of public works in the Island of Jamaica, died recently, we regret to state, at Llandilo. He had in his time filled the offices of assistant to the city engineer of Cardiff, deputy surveyor of Merthyr, and surveyor of Pontypridd. He had been on a visit to Wales for the benefit of his health.

Messrs. A. Winter Gray, borough engineer's department, Lambeth, F. O. Kirby, borough surveyor and waterworks engineer, Doncaster, and W. Wright, borough surveyor, Grantham, have been elected members, and Messrs. W. G. Bartlett, borough surveyor's office, High Wycombe, and L. Raine, surveyor and inspector, Christchurch Rural District Council, associates, of the Royal Sanitary Institute.

Mr. Harold L. Buxton, who has resigned his position as assistant in the surveyor of highways department, Sheffield, to take up an appointment under the Inland Revenue authority, land valuation department, has been presented with a dressing case subscribed for by the members of the surveyor of highways department, as a token of the respect in which he has been held during the past five years. Mr. W. J. Hadfield, surveyor of highways, on behalf of the staff, made the presentation.

Street Lighting in Nottingham.—The annual report of the Nottingham Lighting Committee states that the committee are still experimenting with clockwork automatic lighting and extinguishing apparatus, which continues to act very efficiently. This apparatus is now attached to 486 lamps. There are now 5,362 lamps under the control of the department.

FOR OTHER ADVERTISEMENTS

See End of Paper.

ROAD BOARD.

ASSISTANT SECRETARY.

The Road Board invite applications for the position of Assistant Secretary. Commencing salary, £500. Pensionable. Some knowledge of highway administration desirable. Applications, in writing only, stating age, present occupation, and previous experience, to be addressed to The Road Board, 28 Broadway, Westminster. (503)

WETHERBY RURAL DISTRICT COUNCIL.

The above Council are desirous of receiving Tenders for the supply of one 160-gallon horse-drawn Tar-boiler, fitted with hand-spraying apparatus.

Specifications and Tenders to be delivered to the undersigned on or before Monday, the 2nd day of June, 1913.

The lowest or any Tender not necessarily accepted.

A. GORDON KILNER,
Surveyor.

Council Offices,
Wetherby.
May 28, 1913. (500)

URBAN DISTRICT OF WOOD GREEN.
ENGINEER AND SURVEYOR'S DEPARTMENT.

APPOINTMENT OF—

(A) CORRESPONDENCE CLERK.

(B) TEMPORARY ENGINEERING ASSISTANT.

Applications are invited for the appointments of (A) Correspondence and General Clerk, at a commencing salary of £65 per annum, and (B) Temporary Engineering Assistant, at a salary of Two Guineas per week. Preference will be given to candidates for the position of Correspondence Clerk who have had experience in a Municipal Engineer's Office.

Candidates for the position of Temporary Engineering Assistant must have been engaged in the Office of a Municipal Engineer, and have had some experience in Town Planning work.

Application (on Forms to be obtained from the undersigned), endorsed "Correspondence Clerk," or "Temporary Engineering Assistant," must be received by me not later than 10 a.m. on Saturday, 7th June, 1913, accompanied by copies of three recent testimonials.

Canvassing, either directly or indirectly, will be an absolute disqualification.

(By order)

WM. C. HARDING,
Clerk of the Council.

Town Hall,
Wood Green.
May 29, 1913. (504)

URBAN DISTRICT COUNCIL OF ENFIELD.
BROKEN GRANITE.

The Council invite Tenders for the Supply of 4,000 tons (more or less) of 1½-in. Hand-broken Clee Hill, Dhu, or Best Blue Guernsey Granite, to be delivered free and in such quantities and at such times prior to the 31st March, 1914, as may be ordered by the Council's Surveyor, at the several Railway Stations in the District.

Tenders (on Forms to be obtained only of Mr. Richard Collins, the Council's Surveyor, at these Offices), endorsed "Tender for Granite," together with Samples as to size and quality of the Granite proposed to be supplied (no Tender will be considered unless accompanied by Samples), to be sent to me not later than noon on Wednesday, the 11th day of June next.

The Council do not bind themselves to accept the lowest or any Tender.

(By order)

T. W. SCOTT,
Clerk.

Public Offices, Enfield.
May 29, 1913. (505)

TEDDINGTON URBAN DISTRICT COUNCIL.
TO ROAD CONTRACTORS.

The Urban District Council of Teddington are desirous of receiving Tenders for the execution of the undermentioned works in Station-road, Victoria-road, Albert-road, Walpole-road, Church-lane, Sydney-road, Luther-road and Latimer-road, Teddington—viz.,

2,190 lin. yds. of Channelling, 38 super. yds. of Granite-sett Crossings, and all other works incidental thereto.

Plans and Specifications may be seen, Bills of Quantities and Form of Tender obtained (on payment of Two Guineas, which will be returned on receipt of a *bonâ-fide* Tender), on application to Mr. M. Hainsworth, Surveyor, Council Offices, Teddington.

Sealed Tenders, endorsed "Street Improvements," must be delivered to me on or before Monday, the 16th day of June next.

The Council do not bind themselves to accept the lowest or any Tender.

(By order)

G. H. SALMONS,
Clerk to the Council.

Public Offices, Teddington.
May 26, 1913. (499)

URBAN DISTRICT COUNCIL OF ENFIELD.
TO CONTRACTORS.

The Council invite Tenders for Making Up the following Private Streets in their District—viz.:—

Brimsdown-avenue, Enfield Highway.
Glyn-road (part of), Ponder's End.
Swansea-road, Ponder's End.

Plans and Specifications can be seen, Forms of Tender, and all information obtained, on application to Mr. Richard Collins, the Council's Surveyor, at these Offices, any day (except Saturday) between the hours of 9 a.m. and 5 p.m.

The Contractor will be required to observe Trade Union hours of labour, and to pay the recognised Trade Union rates of wages in force in the district where the work is to be executed.

Separate Tenders for each road (on the Form supplied only) to be sent in to me not later than noon on Wednesday, the 11th day of June, 1913, endorsed "Tender for ——."

The Tenders must be accompanied by a schedule of hours of labour, and of prices and wages to be paid for different classes of work, which schedule will be embodied in the Contract.

The Council do not bind themselves to accept the lowest or any Tender.

(By order)

T. W. SCOTT,
Clerk.

Public Offices,
Enfield, Middlesex.
May 29, 1913. (506)

BIRMINGHAM, TAME, AND REA DISTRICT DRAINAGE BOARD.
COLE HALL SEWAGE DISPOSAL WORKS.
TO CONTRACTORS.

The Board invite Tenders for works comprised in the construction of about one and a-half acres of Bacteria Beds, filling the Beds with upwards of 14,000 cub. yds. of medium, and other appurtenant works in connection therewith.

The site (and similar works in operation which can be inspected at any time) is situated on the Board's land at Cole Hall, in the City of Birmingham, about two miles north of Stechford Station, L. & N.-W. Rly.

Persons desiring to submit Tenders are requested to make application to the office of the undersigned on or after Monday, 2nd June, 1913, where the Contract Drawings can be seen, and a copy of the Specification and Bill of Quantities obtained.

Tenders, duly signed, sealed, and endorsed "Tender for Bacteria Beds, Cole Hall," must be delivered at the Office of Mr. Arnold E. Harris, Clerk to the Board, 117 Colmore-row, Birmingham, not later than 10 a.m. on Wednesday, 10th June, 1913.

The Board do not bind themselves to accept the lowest or any Tender, and parties tendering do so at their own cost.

JOHN D. WATSON, M.INST.C.E.,
Engineer to the Board.

Engineer's Office,
Tyburn, Birmingham.
(Castle Bromwich Station, M.R.)
May 28, 1913. (502)

STAINES URBAN DISTRICT COUNCIL.
PRIVATE STREET WORKS.
TO ROAD CONTRACTORS.

The above Council invite Tenders for the making up, paving and surface draining of Penton-road and part of Wheatsheaf and Pigeon Lane in their district. Plans may be seen, Specifications and Forms of Tender obtained, upon application to the undersigned, to whom Tenders, under seal, endorsed "Penton-road," are to be delivered on or before Saturday, the 14th June, 1913.

The Council do not bind themselves to accept the lowest or any Tender.

E. J. BARRETT, ASSOC.M.INST.C.E.,
Engineer and Surveyor.

Town Hall,
Staines. (501)

THE CHINGFORD RESERVOIR WORKS.

TWO MASONRY BRIDGES.

The works carried out by the Metropolitan Water Board at Chingford, a general description of which will be found in our issue of March 21st, include two masonry bridges—a single span over the intake and a three-span bridge over the river diversion. The type of bridge is in each case shown in the illustration in which it appears, on p. 499. Both bridges belong to the general type, in which a masonry arch carries the roadway and parapets; both have mass abutments and curved wing walls, and in both bridges the arch material is reinforced concrete.

THE BRIDGE OVER THE INTAKE CHANNEL.

This is a single span bridge, with 50 ft. clear span and 5 ft. rise. The clear width between parapets is 10 ft. 6 in., and the arch width is 14 ft. 8 in. The abutments are of mass concrete, nearly 23 ft. long at the bottom, the water faces battered 1 in 4, which is nearly at right angles to the intrados of the arch at the springings. The arch reinforcement consists of Kahn bars longitudinally and round bars transversely. The arch is 2 ft. 6 in. thick at springings, and about 1 ft. 3 in. at the crown. The longitudinal reinforcement ($2\frac{5}{8}$-in.×$\frac{3}{4}$-in. Kahn bars) is spaced at 6-in. centres, the extensions into the abutments being 3-in. and 1-in. bars. The transverse rods, $\frac{1}{4}$-in. diameter, are spaced 3 ft. apart. The parapets are reinforced for stiffness and for distribution of load, but not, of course, as girders of any considerable strength. The spandrel walls are more heavily reinforced with $\frac{1}{2}$-in. diameter rods, 12 in., 9 in. and 6 in. apart, verticals, and $\frac{1}{4}$-in. indented bars horizontally, 9 in. apart, near each face. It remains to be noted that at the ends of the extrados reinforcement there are double-hooked steel ties, 1-in. diameter, 24 in. long, and spaced 12 in. apart. The purpose of these "ties" is by no means apparent. They are at a place where the concrete is under the compression due to the arch thrust, with a load above them including about 4 ft. of mass concrete, more than 3 ft. of filling, and, at the two ends, portals 4 ft.×2 ft. and more than 5 ft. high.

The road crust is 9 in. thick, on a foundation of 9 in. of hardcore. The extrados of the arch is protected by a $\frac{1}{2}$-in. coat of cement mortar with a flushing of bituminous sheeting at the foot of each spandrel wall, and carried nearly up to the hardcore layer. Over each springing there is a transverse drain which empties into the waterway by means of an ordinary farm drain pipe, 3 in. in diameter, carried through the arch ring. Kentish rag is used for the water faces of the abutments, and for the wing walls, but the copings are of concrete. Granite corner kerbs are provided at the portals.

THE BRIDGE OVER THE RIVER DIVERSION.

This is a skew bridge of three spans, 27 ft. 6 in. on the skew and 27 ft. $1\frac{5}{8}$ in. on the square, and 5 ft. rise. It is a massive structure of very great strength. The arch width is 42 ft. 9 in., carrying a 26-ft. carriageway and two footways, the width between parapets being 40 ft. clear. The arch ring is about 1 ft. 8 in. thick at springings, and 10 in. at the crown. The abutments are of mass concrete, carried up nearly to the level of the extrados, to which they are connected by a concrete fill, and the spaces over the two piers are similarly filled, the surfaces sloping to transverse drains over piers and over abutments. Although the concrete of the piers proper and the abutments proper are separated from that of the fill by the concrete of the arch rings at their springings, the construction is, it seems, in each case practically monolithic. The piers are about 5 ft. thick at springings, battered out to 7 ft. 6 in. at bed level. Here small footings bring the width to 8 ft. 6 in. There are two footings below this, to a total width of 12 ft. 6 in. at foundation level, where the length is 47 ft. The three arches are thus very stable; but about half of each span—the middle half—has only a small dead load, and the arch ring is, accordingly, reinforced by longitudinal rods 6 in. apart, centres, the extradosal and intradosal rods being connected by stirruping of $\frac{1}{4}$-in. wire. These continuous rods, with 2-ft. lap joints at the crown, are $\frac{5}{8}$-in. diameter, and they are supplemented by intermediate $\frac{5}{16}$-in. rods in the haunches, these being 7 ft. 6 in. long at the pier ends and 9 ft. long at the abutment ends, reaching about 4 ft. beyond the springings into the abutment. Regarded as a reinforcement of the arch ring to withstand thrust this disposition is logical; but it may be suggested that some of the steel in the haunches, or that buried in the piers and abutment, might have been put to better use in the middle half of the span, partly in the form of transverse reinforcement.

The bridge presents a very pleasing elevation, the main lines giving outward expression to the realities of the massive design, and the structure being devoid of incongruous embellishments. In the case of the single span bridge the central pilasters, though, no doubt, useful in adding to the dead load over the crown, suggest a larger amount of load than is really there, and the bridge would probably look better if the central mass were longer and did not project above the top of the parapet.

THE SURVEYORS' INSTITUTION.

INSTALLATION OF PRESIDENT.

At the annual general meeting of the Surveyors' Institution on Monday evening Mr. Wm. Edward Woolley, of Loughborough, was installed as president in succession to the Hon. E. G. Strutt.

Mr. Arthur Lyon Ryde was elected a vice-president to serve with Mr. H. H. Smith, Mr. G. F. Stewart, and Mr. Howard Chatfeild Clarke, F.R.I.B.A., while Mr. Edwin Walter Rushworth (Savile-row), Mr. J. D. Wallis (Manchester), and Mr. Dendy Watney (Frederick's-place) were added to the council. Lord Alverstone and Sir John Wolfe Barry were re-elected associates of the council.

The annual report of the council, submitted during the proceedings, points to a double record in the statistics of membership. For the first time the total membership has exceeded 5,000; and the increase on the year—395—is far in excess of that recorded on any previous occasion. The number of those presenting themselves for examination shows a further increase, the figures for the preliminary examination being 25, and those for the professional examinations 238, in excess of last year.

Why House Gutters Fall.—At an inquest held at Richmond, Surrey, last week, into the death of a seven-year-old child who was killed by a piece of gutter which fell from a house and struck the child on the head, Mr. F. W. Pearce, surveyor to the Twickenham Urban District Council, voluntarily gave some interesting evidence. The gutters, he said, were ordinary ogee gutters, fixed with the sunken screws commonly used. The guttering was properly fixed, and the initial defect, if any, was a lack of sufficient painting. In his opinion the accident was due to insufficient painting, causing the screws to rust behind the heads, and also, he thought, possibly to the fact that the screws used were not of the best quality. Mr. Pearce then, by the aid of one of the screws used, explained to the jury how the rust would work behind the head if it had not been properly painted when it was fixed, and added that the effects of the rust could not be detected by a cursory examination. The jury returned a verdict of "Accidental death," and exonerated the owner of the house.

Local Authorities and Motor Omnibus Traffic.—Epping Rural District Council are petitioning all the highway authorities in Essex to oppose motor omnibus services to Epping, Chingford, and other places bordering on Epping Forest, on the ground that it is dangerous to the public owing to the narrowness of the roads, and is a great expense to the ratepayers, who have to maintain the roads. The last Essex county rate was increased by 3d. in the £ primarily owing to the effect of motor vehicle traffic. In Epping opinion is divided on the subject. The Epping Urban District Council have declined to co-operate with the rural authority, the opinion of many townsmen being that the omnibuses bring more trade to the town than they take out. It has been argued at meetings of the urban council that motor omnibuses do no more harm to the roads than motor cars, and that they are not so dangerous to the public. The Buckhurst Hill Council have decided to prepare a special report as to the cost of widening the roads in their districts. The Loughton Urban District Council also are preparing a special report on the subject.

THE COEFFICIENT OF FRICTION IN CONCRETE PIPES.

The materials used and the methods employed in making concrete pipes for the carriage of water under a very small head, or under no pressure at all, differ from those which are suitable in the case of a reinforced pipe for water under considerable heads. It is therefore important to note the results of experiments made to find the coefficient of friction in pipes of this class. The value of this coefficient will, of course, depend upon the nature of the surface of the core used in moulding the pipe and upon other factors. If, for instance, the water deposits a smooth coating, the coefficient of friction may be improved; but at the same time the bore of the pipe will be reduced. In other cases the surface may be made smoother by a permanent but very thin skin, or by one of a temporary character, though the latter class of coating is more important in the case of open channels than it is in pipes. Special investigations may be made from time to time with a view to finding what is the influence of each of a number of factors; but, on the whole, the most important results are those given by service tests under conditions the probable effects of which may be, to some extent, judged by hydraulic engineers.

An article by Mr. H. D. Newell, an engineer of the United States Reclamation Service, published in a recent issue of *Engineering News*, contains an account of tests of the flow of water through ferro-concrete pipes of 30-in. and 46-in. diameter, the thickness of the shell being, in each case, 3 in. These pipes were cast in a pipe yard. A distinctly wet mixture was used, and the pipes were "grouted" on the inside.

The 46-in. pipe was in constant use from April to October, 1910. During the winter it was not in use, and contained water only in the lowest depressions. It was again in service from March to October, 1911, the tests being made in July and August of that year, and in June and July, 1912. At the end of the season the inside was smooth and generally in good condition. There was a deposit of ¼ cub. yd. of material in one place and a little gravel at other places. These cannot have much affected the results, as the pipe was more than 9,800 ft. long. The value of N in Kutter's formula was 0·011 in July and 0·0106 in August, 1911. It had increased to 0·0117 in June, 1912, but was only 0·0113 in July. The four corresponding velocity coefficients in the formula $v = C \sqrt{RS}$ are 138, 145, 130 and 135. The experiments, therefore, point to a coefficient of 0·012 as somewhat too high, and probably indicating some other loss of head in such a pipe, while it should be possible to obtain 0·011 without much difficulty, and 0·0106 should be aimed at, or a velocity coefficient of 145.

The 30-in. pipes, the first of which was 5,130 ft. long, provided three tests. In July and August, 1911, the slope of the longer pipe was 0·00107 and 0·00105. In the former case N has 0·0103, and in the latter case two results gave 0·0106 and 0·0108. In June, 1912, the test was on a pipe 3,658 ft. long, and the slope was 0·00086. There was at the end of the season a deposit of 1½ cub. yds. of material over a length of 75 ft. of the pipe, tested in the first two of these three experiments, and this, or some of it, was probably there when one or when both tests were made. The third test was made on a different pipe, which probably contained some deposits of sand. The value of N was 0·0119. We might therefore regard the coefficient proper, including joint disturbance, to be about 0·0103, or take a velocity coefficient of 140 for this size of pipe; but, in the light of the results of the tests with the larger pipe, it might be safer to regard the experiments as pointing to the values 0·0106 and 135. Tests of the flow through a 16-in. pipe were made in June and August, 1912, this being a "cement pipe" in 2-ft. lengths. If we applied Kutter's formula in accordance with the usual text-book procedure, we should use the same value of N—say, 0·011. The actual values were, however, 0·0154, 0·0134 and 0·0125. It must be noted that this pipe, besides being of a smaller diameter than the others, was made of pipes 2 ft. long against 4 ft. for the 30-in. pipe and 8 ft. for the 46-in. pipe. These were made by the wet process, but the 16-in. pipe was made by the dry process. It was not known whether there were deposits in the dips in this pipe.

Since these were service tests of pipes in regular use, it was probably not feasible, or even desirable, to prevent silt from entering them. It is a pity however, that measures were not taken to prevent gravel from entering the 46-in. pipe or to trap it before it had gone far. The different lengths of pipe between joints, the different result attained in the grouting of the 16-in. pipe, as compared with the larger sizes, the unknown quantity of silt, if any, in the 16-in. pipe, and one of the 30-in. pipes—all these are doubtful factors.

The tests may be regarded as affording fresh evidence with respect to the value of N in Kutter's formula (for concrete surfaces), and as suggesting certain further considerations regarding the presence of silt or gravel in pipes used for irrigation water. It may also be pointed out that if a test with clear water were made with each pipe before it began to silt up, it might be possible for the engineers of the Reclamation Service to establish data pointing to the adoption of a certain diameter of pipe with a certain head (total head) as representing the size and slope to be regarded as the starting point when we make the vague statement that Kutter's formula gives values which are too high for pipes of large diameters with steep slopes, and values which are too low for pipes of small diameter with flat slopes.

The statement as it stands suggests that N is a product of three factors—one varying with the nature of the surface, one with the slope, and one with the diameter of the pipe. It is generally admitted that Kutter's formula gives correct values for the discharges of open channels, and if it is too high for large pipes in steep gradients, and too low for small pipes on flat gradients, it must be very accurate indeed for a fair range of diameters and slopes in some middle class.

Roads Improvement Association.—At the last monthly meeting of the Roads Improvement Association it was decided to hold the first Roads Improvement Association conference of the representatives of its branches at the Royal Automobile Club on June 21st. The general principles of the proposed horse-shoe competition, including the suggestion that the £100 presented by the R.S.P.C.A. should be offered as a first prize, were approved. Full details will be issued shortly.

INSTITUTION OF MUNICIPAL AND COUNTY ENGINEERS.

President—Mr. R. J. Thomas, M.Inst.C.E., County Surveyor, Buckinghamshire.

SCOTTISH MEETING.

A meeting of the institution will be held in the Scottish District at Dundee on June 6th and 7th.

Programme.

Friday, June 6th.

12.15 p.m.—Reception by Lord Provost, magistrates and Town Council of Dundee.

12.30 p.m.—Luncheon, kindly provided by the Corporation of Dundee.

2 p.m.—Business meeting.

Paper: "Reconstructed Dundee," by A. H. Miller, LL.D., F.S.A.(Scot.), chief librarian and curator, Dundee.

Paper: "Maintenance of County Roads in Dundee District," by Jas. Bell Roberton, road surveyor, Forfar County Council (Dundee district).

4 to 5.30 p.m.—Municipal works to be visited:—

Group No. 1.—Tar-macadam plant, Craigie Quarry; trackless trolley, Clepington-road; sewage pumping station, Downfield.

Group No. 2.—Electricity generating station, Carolina Port; gasworks, East Dock-street.

Group No. 3.—Central reading rooms Ward-road; central baths, West Protection Wall; esplanade; Blackness branch library and reading rooms, Perth-road; public wash-houses, Miller's Wynd.

7 p.m.—Annual Dinner in Victoria Art Galleries.

Saturday, June 7th.

By kind invitation of the Corporation of Dundee the party will visit Dundee waterworks, Loch of Lintrathen and Glamis Castle per motor chars-à-banc.

9 a.m.—Leave Victoria Art Galleries for Lintrathen.
11 a.m.—Arrive at Lintrathen.
12 noon.—Luncheon.
1.30 p.m.—Leave for Glamis Castle.
2.15 p.m.—Arrive at Glamis Castle.
3 p.m.—Leave for Dundee.
4 p.m.—Arrive at Dundee.

DAVID RONALD,
Hon. District Secretary.

Burgh Engineer,
Falkirk.

ROCHDALE MEETING.

A meeting of the institution in the North-Western District will be held at Rochdale on June 14th (Saturday).

LEEK MEETING.

A meeting of the institution in the West-Midland District will be held at Leek on June 28th (Saturday).

ANNUAL MEETING.

The annual meeting of the institution will be held from July 16th-19th at Great Yarmouth.

THOMAS COLE,
Secretary.

92 Victoria-street, S.W.

INSTITUTION OF MUNICIPAL ENGINEERS.

President—Mr. FRANK LATHAM, M.INST.C.E.I., F.S.E., Borough Engineer and Surveyor, Penzance.

NORTH-WESTERN DISTRICT.

A North-Western District meeting will be held at the Town Hall, Salford, to-morrow (Saturday).

PROGRAMME.

1.30 p.m.—District business meeting.
2 p.m.—Paper, "The Sewage Sludge Problem and its Solution," by Dr. Grossman, M.A., F.I.C., to be presented for discussion.

A meeting of the North-Western District of the institution will be held at Wellington (Salop) on Saturday, June 21st.

PROGRAMME.

1.30 p.m.—Meet at Council Chamber, Walker-street, Wellington.
2 p.m.—Inspect fire station, public baths, library, market, gasworks, water pumping station, Cottage Hospital and recreation ground.
3 p.m.—Drive to sewage disposal works, impounding reservoir and water filtration works at the famous Wrekin. Brake tickets, 2s. 6d. per head.
6 p.m.—Members and friends will be entertained to tea by John Bayley, Esq., C.C., principal of Wellington College, at the college.

Members residing in the southern portions of this district are earnestly requested to make every effort to attend, together with their friends (ladies or gentlemen). All who intend to be present are asked to notify Mr. Riley, Surveyor's Office, Walker-street, Wellington, as early as possible (and not later than the 14th June) to enable him to make arrangements for conveyances, &c.

J. W. GLEAVE,
Hon. District Secretary.

"Brantwood,"
Coomassie-street,
Heywood.
May 27, 1913.

COUNCIL MEETINGS.

A council meeting will be held at the Town Hall, Salford, to-morrow (Saturday) at 4 o'clock.

The following other council meetings have been arranged: June 28th, London; July 30th, London.

B. WYAND,
Secretary.

39 Victoria-street, S.W.
May 1, 1913.

ROYAL SANITARY INSTITUTE.

ANNUAL CONGRESS AND EXHIBITION, EXETER.

The annual congress of the Royal Sanitary Institute will be held at Exeter from July 7th—12th next, under the presidency of Earl Fortescue, K.C.B., Lord-Lieutenant of Devonshire. The order of proceedings will be found set out in our issue of May 23rd.

E. WHITE WALLIS,
Secretary.

INSTITUTION OF WATER ENGINEERS.

EIGHTEENTH SUMMER GENERAL MEETING.

The eighteenth summer general meeting of the Institution of Water Engineers will be held at Wakefield on Thursday, Friday and Saturday, June 5th, 6th and 7th, under the presidency of Mr. C. Clemesha Smith, M.INST.C.E., corporation waterworks engineer.

By kind permission of the mayor and corporation the meetings will be held in the town hall, and at the opening of the proceedings on Thursday the institution will be welcomed to Wakefield by his worship the mayor (Councillor Edwin Lodge Hirst, J.P.).

Ladies will be cordially welcomed at the meetings and visits.

The programme will include the presentation of premiums awarded by the council for papers presented during the year 1912.

PAPERS AND COMMUNICATIONS.

The following papers have been promised for reading and discussion at this meeting, and advance copies will be sent out as soon as printed to members who signify their intention of attending the meeting.

(1) "The Valuation of Water Undertakings on Transfer to Local Authorities," by E. J. Silcock, M.INST.C.E. (held over from winter meeting).

(2) "The Water Supply of Jersey," by Alfred J. Jenkins, ASSOC.M.INST.C.E.

(3) "Animal Growths in Water Pipes," by Samuel C. Chapman, M.INST.C.E.

(4) "Reservoir Storage in Relation to Stream Flow," by W. J. E. Binnie, M.INST.C.E., F.G.S., B.A.(CANTAB.), and Herbert Lapworth, D.SC., M.INST.C.E., F.G.S.

The president-elect (Mr. C. Clemesha Smith) will deliver his presidential address on Thursday, June 5th, and will also supply an illustrated description of the Wakefield waterworks, which will be circulated among those present at the meeting.

A lecture on "The Underground Waters of the Lower Calder" will be delivered by Prof. Percy Kendall, F.G.S.

VISITS TO WORKS.

On Thursday afternoon, June 5th, visits will be made to the Kirkhamgate filtration works and the Ardsley reservoir of the Wakefield Corporation waterworks.

On Friday, June 6th, visits will be made to the Green Withens and Ringstone reservoirs (Rishworth Moors) of the Wakefield Corporation waterworks, and to the works of Messrs. J. Blakeborough & Sons, at Brighouse.

SOCIAL FUNCTIONS.

The annual dinner will be held in the banquet chamber of the town hall on Friday evening, June 6th, when the Mayor of Wakefield and other distinguished guests will be entertained by the institution.

On Thursday evening, June 5th, there will be a reception at the town hall on behalf of the Corporation of Wakefield.

On Friday, June 6th, luncheon will be provided by the Water Committee of the corporation, and on Thursday and Friday afternoons tea will be provided (by invitation) for those taking part in the visits arranged for those days.

PERCY GRIFFITH,
Secretary.

20 Victoria-street, S.W.

APPOINTMENTS VACANT.

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SURVEYOR'S CLERK.—May 31st.—Barnes Urban District Council. £70—£126 per annum.—Mr. G. Bruce Tomes, engineer and surveyor, The Council House, High-street, Mortlake, S.W.

DRAUGHTSMAN.—May 31st. — Corporation of Chelmsford. £2 2s. per week.—Mr. Percival T. Harrison, borough engineer.

BURGH SURVEYOR.—May 31st.—North Berwick Town Council. £150 per annum.—Mr. A. D. Wallace, town clerk.

SECOND ASSISTANT SURVEYOR.—June 2nd.—Burnley Rural District Council. £70 per annum.—Mr. J. S. Horn, clerk.

JUNIOR PRIVATE STREET WORKS ASSISTANT.—June 2nd.—Corporation of Stoke-on-Trent. £65 per annum.—Mr. A. Burton, borough surveyor.

SEWAGE WORKS FOREMAN.—June 2nd.—The Maldens and Coombe Urban District Council. £2 12s. 6d.—£3 per week.—Mr. James W. Johnson, clerk, New Malden, Surrey.

SURVEYOR'S GENERAL ASSISTANT.—June 2nd.—Hayes Urban District Council. £70—£100 per annum.—Mr. Douglas C. Fidler, engineer and surveyor.

SURVEYOR AND INSPECTOR OF NUISANCES.—June 3rd.—Leiston (Suffolk) Urban District Council. £150 per annum.—Mr. H. A. Mullens, clerk.

RESIDENT FOREMAN OF SEWAGE OUTFALL WORKS.—June 3rd.—Wembley Urban District Council. 30s. a week, with house, light and fuel.—Mr. Cecil R. W. Chapman, engineer and surveyor.

ENGINEER-IN-CHIEF.—June 3rd.—Dublin Port and Docks Board. £750 per annum.—Mr. N. Proud, secretary.

INSPECTOR OF NUISANCES.—June 3rd.—Ashwell Rural District Council. £50 per annum.—Mr. Arthur Sharpe, clerk, Royston, Herts.

ROAD FOREMAN.—June 4th.—Cornwall County Council. 50s. a week.—Mr. Albert E. Brookes, county surveyor, Truro.

CLERK OF WORKS.—June 4th.—Haslingden Town Council. £3 per week.—Mr. W. Musgrove, town clerk.

ENGINEER AND SURVEYOR.—June 5th.—Conway and Glan Conway Rural District Council. £110—£150.—Mr. James Porter, clerk.

SURVEYOR OF HIGHWAYS.—June 5th.—Buckingham Rural District Council. £100 per annum.—Mr. Thomas R. Hearn, clerk, 26 West-street, Buckingham.

TEMPORARY ASSISTANT. — June 5th.—Acton Urban District Council. £150 per annum.—Mr. W. Hodson, clerk.

CLERK OF WORKS.—June 5th.—Lymington Town Council.—Mr. J. D. Rawlins, town clerk.

BUILDING ENGINEER.—June 6th—25th.—Municipality of Rangoon. 600—800 rupees per mensem.—The Secretary, Rangoon Municipality, Burmah. The latest date of despatch of letters to reach Rangoon by June 25th is by the Indian mail leaving London on June 6th.

COUNTY ARCHITECT.—June 7th.—West Riding County Council. £500 per annum.—Mr. Francis Alvey Darwin, clerk, County Hall, Wakefield.

BURGH SURVEYOR.—June 7th.—Lerwick Town Council. £110—£140 per annum.—Mr. A. Sanderson, town clerk.

GENERAL SURVEYING AND ENGINEERING ASSISTANT.—June 9th.—Corporation of Lancaster. £120 per annum.—Mr. Arthur G. Bradshaw, borough surveyor and water engineer.

JUNIOR SURVEYING ASSISTANT.—June 10th.—Worcestershire County Council. £75 per annum.—Mr. S. Thornely, clerk, Shire Hall, Worcester.

SURVEYOR'S ACCOUNT CLERK.—June 11th.—East Suffolk County Council. £90—£120.—Mr. W. Jervis, county road surveyor, County Hall, Ipswich.

BUILDING INSPECTOR.—June 14th.—Corporation of Stafford. 45s. a week.—Mr. W. Plant, borough engineer.

ASSISTANT VALUER AND SURVEYOR.—June 30th.—Calcutta Improvement Trust. 600—800 rupees per month.—Mr. C. H. Bompas, chairman, 5 Clive-street, Calcutta.

CITY SURVEYOR'S DEPUTY (ENGINEERING DEPARTMENT).—June 30th.—Corporation of Manchester. £750 per annum.—City Surveyor, Town Hall.

CITY SURVEYOR'S DEPUTY (SURVEYING DEPARTMENT).—June 30th.—Corporation of Manchester. £750 per annum.—City Surveyor, Town Hall.

ASSISTANT ENGINEER.—Public Works Department of Northern Nigeria. £300—£400 a year.—Crown Agents for the Colonies, Whitehall-gardens, London, S.W.

DRAUGHTSMAN. — Survey Department, East Africa. £160—£205.—Crown Agents for the Colonies, Whitehall-gardens, London, S.W. Quote M.6,000 on left-hand top corner of application.

MUNICIPAL COMPETITIONS OPEN.

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NEWCASTLE-UPON-TYNE.—June 14th.—Designs for new public baths at Benwell, Walker, and Heaton.—The town clerk.

DEVONPORT.—June 14th.—Designs for municipal buildings, for the corporation. Premiums, £350, £150 and £100.—The Town Clerk.

NEWCASTLE-UPON-TYNE.—June 19th.—Designs for laying out a portion of the Walker estate, for the corporation. Premiums, £50, £30 and £20.—The Town Clerk.

LIVERPOOL.—June 24th.—Designs for a sanatorium of 250 beds. Premiums, 150, 100 and 50 guineas.—Mr. Edward R. Pickmere, town clerk.

CHEPPING WYCOMBE.—September 1st.—Designs for town-planning the borough and an area immediately adjoining. Premiums, £25, £10 and £5.—Mr. T. J. Rushbrooke, borough surveyor, High Wycombe.

MUNICIPAL CONTRACTS OPEN.

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Buildings.

MARLBOROUGH.—June 2nd.—For the erection of sixteen cottages, for the corporation.—Town Clerk.

BURNLEY.—June 2nd.—For the construction of a R. S. girder and concrete bridge, for the rural district council.—Mr. J. S. Horn, clerk.

SUNBURY-ON-THAMES.—June 2nd.—For alterations to an engine house, for the urban district council.—Mr. Charles E. Goddard, clerk.

SHEFFIELD.—June 2nd.—For the erection of a transformer sub-station, for the corporation.—Mr. S. E. Fedden, Electricity Supply Offices, Commercial-street.

SWANSEA.—June 3rd.—For the erection of a wooden shed, for the corporation.—Borough Surveyor.

WHITLEY.—June 3rd.—For the erection of a retaining wall, for the urban district council.—Mr. A. J. Rousell, surveyor.

TREDEGAR.—June 3rd. — For the erection of an office, stores, and showroom, for the urban district council.—Mr. W. Lloyd Roach, surveyor.

SHEFFIELD.—June 4th.—For the erection of a filter-house, for the Water Committee.—City Architect.

TURTON.—June 4th.—For the erection of a cottage, for the urban district council.—Mr. V. W. Laithwaite, surveyor.

HUNSTANTON.—June 4th.—For additions to the isolation hospital, for the urban district council.—The Surveyor.

PORTSMOUTH.—June 4th.—For the erection of a dispensary, for the corporation.—Borough engineer.

LANCASHIRE.—June 4th.—For alterations and additions to a school, for the Education Committee.—Messrs. Biram & Fletcher, George-street, St. Helens.

MIDDLESEX.—June 6th.—For extensions to the Napsbury Asylum, including additional accommodation for female staff, residence for an assistant medical officer, and alterations and additions to the upholsterer's shop, for the Sub-committee of Visitors.—Mr. Henry G. Armour, clerk, Napsbury Asylum, St. Albans.

HUDDERSFIELD.—June 6th.—For additions to a council school, for the Education Committee.—Mr. K. F. Campbell, borough engineer and surveyor.

CUMBERLAND. — June 7th. — For alterations to master's house, for the Education Committee.—Mr. J. Forster, 13 Earl-street, Carlisle.

TOTTENHAM.—June 7th.—For the erection of three blocks of cottages, for the London County Council.—The Architect, Spring-gardens, S.W.

TRURO.—June 9th.—For the construction of a reservoir, for the rural district council.—Mr. Coulter Hancock, clerk.

STOCKPORT.—June 9th.—For the erection of a wooden store and painting shop, for the Tramways Committee.—Mr. J. Atkinson, borough surveyor.

KENT.—June 9th.—For the supply of standard portable shelters for open-air treatment, for the county council.—County Medical Officer of Health, Mill-street Chambers, Maidstone.

WELLINGBOROUGH.—June 9th.—For the construction of a reinforced concrete bandstand, for the urban district council. — Mr. E. Young Harrison, engineer and surveyor.

BARNES.—June 10th.—For the erection of twenty-eight cottages, for the urban district council.—Mr. G. Bruce Tomes, surveyor, Council House, High-street, Mortlake, S.W.

MILFORD (Co. Donegal). — June 14th. — For the erection of forty-nine labourers' cottages, for the rural district council.—Mr. S. Watters, clerk.

WEST RIDING.—June 16th.—For erecting new constabulary headquarters, for the Standing Committee.—Mr. Percy O. Platts, acting West Riding architect, County Hall, Wakefield.

HEBDEN BRIDGE.—June 19th.—For the erection of new stables, for the urban district council.—Mr. T. Waddingham, engineer and surveyor.

LANCASHIRE.—June 20th.—For the erection of a school, for the Education Committee.—Mr. H. Littler, architect, 16 Ribblesdale-place, Preston.

SOUTHAMPTON.—June 23rd.—For reconstructing a warehouse, for the Harbour Board.—Mr. J. E. Pailthorpe, clerk, Town Quay.

CARDIGAN.—June 23rd.—For the construction and extension of waterworks, consisting of mains, valves, hydrants, and supplemental reservoir, for the corporation.—Mr. D. Morgan Jones, town clerk.

WEST SUSSEX.—June 23rd.—For the erection of an infants' school, for the Joint Education Committee.—Mr. H. P. Roberts, county education architect, Thurlow House, High-street, Worthing.

HERTS.—June 27th.—For the construction of a bridge, for the county council.—Mr. Urban A. Smith, Hatfield.

HERTFORDSHIRE.—June 27th.—For the construction of a new bridge over the Stort Navigation at Bishops Stortford, for the county council. — Mr. Urban A. Smith, county surveyor, Hatfield.

HERTFORDSHIRE.—June 27th.—For the construction of a new bridge over the Stort Navigation at Sawbridgeworth, for the county council.—Mr. Urban A. Smith, county surveyor, Hatfield.

HOLLAND (Lincs).—For erecting new schools and alterations to existing schools, for the county council. —Mr. E. J. A. Christie, county architect, Market-place, Boston.

Iron and Steel.

SALFORD.—June 2nd.—For the supply of 1,000 tons of tramway rails, for the corporation.—General Manager, 32 Blackfriars-street.

KANTURK. — June 4th. — For sinking wells and erecting pumps, for the rural district council.—Mr. T. Guiney, clerk.

DEWSBURY.—June 4th.—For the erection of ornamental wrought-iron railing, for the corporation.—Borough surveyor.

CHEADLE.—June 6th.—For providing and laying cast-iron water mains and sluice valves, for the rural district council.—Mr. F. S. Cox, clerk.

THURNSCOE.—June 7th.—For the extension of the water main, for the urban district council.—Mr. J. Ledger Hawksworth, clerk.

PENBY.—June 11th.—For the supply and delivery of 1,500 ft. of cast-iron pipes of 48-in. diameter, and 922 ft. of 9-in. diameter, also certain special castings, for the corporation.—Mr. G. Lort Stokes, town clerk.

ASHTON-UNDER-LYNE.—June 11th. — For the supply of cast-iron pipes, special castings, bolts, nuts, and washers, for the Waterworks Joint Committee.—Mr. F. J. Dixon, water engineer.

TEDDINGTON.—June 16th.—For the supply and erection of pumping machinery, auxiliary plant, and pipework, at the sewage disposal works, for the urban district council.—Mr. Marshall Hainsworth, surveyor.

Roads.

ESSEX.—May 31st. -For resurfacing certain roads with tarry, bituminous or asphalt macadam, for the county council.—Mr. Percy J. Sheldon, county surveyor.

NORTH RIDING.—May 31st.—For the supply of slag macadam and screenings, for the county council, —Mr. W. G. Bryning, county surveyor, Northallerton.

BURNLEY.—June 2nd.—For work of road reconstruction, for the rural district council.—Mr. H. Pritchard, engineer.

DUNDEE.—June 2nd.—For repaving work, for the corporation.—Mr. J. Thomson, city engineer.

ELY.—May 31st—June 2nd.—For the supply of road granite, for the urban district council.—Mr. W. McKelvie, city surveyor.

MERTHYR.—June 2nd.—For the execution of private street works, for the corporation.—Borough Surveyor.

GODSTONE.—June 2nd.—For the supply of granite, Kentish ragstone, tar-macadam, kerbing and channelling, and laying tar-macadam, and the supply of tools, oils, and iron goods, for the rural district council.—Mr. George E. Crowter, engineer and surveyor.

HITCHIN.—June 2nd.—For making good and repairing certain roads, for the rural district council.—Mr. A. T. Passingham, clerk.

RUNCORN.—June 2nd.—For the supply of granite macadam, setts, kerbstones and sanitary pipes, for the rural district council.—Mr. G. F. Ashton, clerk.

MANSFIELD.—June 2nd.—For making up two streets, for the corporation.—Mr. T. P. Collinge, borough engineer and surveyor.

DOVER.—June 2nd.—For the supply of broken Guernsey granite and Guernsey granite siftings, for the corporation.—Mr. R. E. Knocker, town clerk.

SURBITON.—June 2nd.—For the execution of private street improvement work at Malvern-road, for the urban district council.—Mr. Frederick W. Wood, clerk.

TYNEMOUTH. — June 2nd. — For laying random sett and chip paving, for the corporation.—Mr. J. F. Smillie, borough surveyor.

EALING.—June 3rd.—For making up several roads, for the corporation.—Mr. C. Jones, borough engineer.

SAXMUNDHAM.—June 3rd.—For the supply of broken granite chippings and gravel binding silt, for the urban district council.—Mr. J. E. Hattersley, surveyor.

LOUGHTON.—June 3rd.—For making up a road and a footpath, for the urban district council.—Mr. Leonard W. Liell, clerk.

LEITH.—June 3rd.—For supplying and rolling 3,000 tons of hard whinstone, for the corporation.—Burgh surveyor.

WALSALL.—June 3rd.—For making up a street, for the corporation.—Borough Surveyor.

SKELMANTHORPE.—June 3rd.—For making-up work (labour only), for the urban district council.—Mr. J. Rower, surveyor.

GLAMORGAN.—June 4th.—For widening and improving main roads, for the county council.—Mr. W. E. R. Allen, deputy clerk, County Hall, Cardiff.

SEFTON.—June 4th.—For the supply of road materials, for the rural district council.—Mr. H. P. Cleaver, clerk, Broughton-terrace, West Derby-road, Liverpool.

BARNSLEY.—June 4th.—For making up a street, for the corporation.—Mr. W. P. Donald, town clerk.

FULHAM.—June 4th.—For making up a carriageway, for the borough council.—Mr. F. Wood, borough surveyor.

ST. NEOTS.—June 5th.—For the supply of broken granite, tarred slag and slag dust, for the urban district council.—Mr. J. Edey, surveyor.

ARDSLEY. — June 6th. — For asphalting playgrounds, for the Education Committee.—Mr. Alexander Angus, Education Offices, Wakefield.

JARROW.—June 6th.—For laying tar-macadam in several streets, for the corporation.—Mr. J. S. Weir, borough engineer.

HUNTINGDON.—June 7th.—For taking up and relaying tar-macadam, for the corporation.—Mr. E. Borissow, borough surveyor.

STRETFORD.—June 7th.—For paving work in rock asphalt, for the urban district council.—Mr. Geo. H. Abrahams, clerk.

WANDSWORTH.—June 9th.—For making up and paving part of Wimbledon Park-road, for the borough council.—Mr. Edward J. Ellis, deputy town clerk.

CREWE.—June 9th.—For making up several back passages, for the corporation.—Mr. G. Eaton Shore, borough surveyor.

BARNES.—June 10th.—For paving the carriageway of Sheen-lane from High-street to Upper Richmond-road with creosoted deal blocks laid on a concrete foundation, for the urban district council.—Mr. G. Bruce Tomes, surveyor, Council House, High-street, Mortlake, S.W.

HASTINGS.—June 14th.—For work of road rolling, for the rural district council.—Mr. A. R. Inskipp, clerk.

HEBDEN BRIDGE.—June 16th.—For the reconstruction of footpaths, for the urban district council.—Mr. T. Waddingham, engineer and surveyor.

REIGATE.—June 16th.—For the construction of new streets and walks and surface-water culvert with other works, for the corporation.—Borough Surveyor.

LEWES.—June 20th.—For scarifying and steam rolling, for the corporation.—Mr. Montague S. Blaker, town clerk.

WOKINGHAM.—June 25th.—For fixing Norwegian kerb and channel, concrete slab paving and paved crossings, for the corporation.—Mr. C. W. Marks, borough surveyor and engineer.

Sanitary.

MANSFIELD.—June 2nd.—For laying sewer and manholes, for the corporation.—Mr. T. P. Collinge, borough engineer and surveyor.

MAIDENHEAD.—June 2nd.—For the construction of a public convenience, for the corporation.—Mr. P. Johns, borough surveyor.

EPSOM.—June 2nd.—For the removal of house refuse, for the rural district council.—Mr. F. A. Pratley, surveyor

BIRMINGHAM.—June 4th.—For the construction of about 4¼ miles of stoneware pipe sewer, about 1 mile of 3 ft. 6 in. by 2 ft. 6 in. brick and concrete egg-shaped sewer, 180 yds. of cast-iron pipes, in railway and river crossings, river outlets, and other works, for the corporation.—Mr. Henry E. Stilgoe, city engineer and surveyor.

SKELTON AND BROTTON.—June 4th.—For laying pipe sewer, with manholes, for the urban district council.—Mr. R. S. Moon, surveyor.

CHELMSFORD.—June 5th.—For the scavenging of pail closets, for the rural district council.—Mr. W. Edser, sanitary inspector.

RAWTENSTALL.—June 5th.—For the erection of public conveniences, for the corporation.—Mr. J. Johnson, borough surveyor.

WIGTON.—June 7th.—For laying sewers, manholes, lampholes, flushing chambers, and the construction of purification works, for the rural district council.—Mr. J. F. W. Ritson, clerk, 4 West-street, Wigton.

WINDSOR.—June 9th.—For works of drainage, for the rural district council.—Mr. J. B. Gale, clerk.

SEDGHILL.—June 9th.—For the removal of ashes, for the urban district council.—Mr. T. Spencer, clerk.

RIPLEY. — June 10th. — For the construction of sewage disposal works, for the urban district council.—Mr. G. W. Bird, surveyor.

ULVERSTON.—June 11th.—For the construction of sewers and manholes, for the rural district council. The Engineer, Town Hall.

LAMBETH.—June 12th.—For the erection of an underground convenience, for the borough council.—Mr. H. Edwards, borough engineer.

MADRAS.—September 9th. For the supply and delivery of English stoneware pipes and specials, varying from 4 in. to 21 in. internal diameter, and aggregating a total length of about 143 miles, for the corporation.—Messrs. James Mansergh & Sons, agents, 5 Victoria-street, Westminster, S.W.

Stores.

SKELMERSDALE.—June 2nd.—For the supply of coal, seconds lime, granite kerbs, cubes or grit setts, broken granite macadam, and carting, for the urban district council.—Mr. E. Huntington, surveyor.

ASHTON-IN-MAKERFIELD.—June 7th.—For the supply of road and sanitary materials, gas meters and galvanised steam tubes and fittings, for the urban district council.—Mr. Albert Sykes, clerk.

KEIGHLEY.—June 30th.—For the supply of ironmongery, iron castings, pitch, oil, broken limestone, granite, earthenware pipes, and cement, for the corporation.—Borough Engineer.

Miscellaneous.

EDINBURGH.—June 11th.—For the supply of 6,000 tons of clean Arran sand for filters, for the Water Trustees.—Mr. W. Boyd, clerk, 12 St. Giles-street, Edinburgh.

TENDERS FOR MUNICIPAL WORKS OR SUPPLIES.

The Editor invites the co-operation of Surveyor *readers with a view to making the information given under this head as complete and accurate as possible.*

* Accepted. † Recommended for acceptance.

ALDERSHOT.—For making up a roadway, for the urban district council.—Mr. W. E. Foster, clerk:—

Martin, Wells & Co., Aldershot	£106
A. Streeter & Co., Shalford	82
W. Norris, Upper Hale*	69

BRADFIELD.—For the supply of hand-picked field-dug flints, and gravel, for the rural district council.—Mr. J. Forrester, district surveyor, Theale, near Reading:—

T. Street, Ashampstead.—Pangbourne, 6s. per yard; Tidmarsh, 6s. per yard.

CRAMLINGTON.—Accepted for the supply of broken whinstone, whin chippings, slag chippings, and tarred slag, for the urban district council.—Mr. W. I. Coulson, surveyor:—

2-in. Hand-broken Whinstone.—H. Reid & Co., Newcastle-on-Tyne, 7s. 10d. per ton.
2½-in. Machine-broken Whinstone.—Northumberland Whinstone Company, Newcastle-on-Tyne, 7s. 2d. per ton.
Tarred Slag.—Jarrow Slag Company, South Shields, 11s. 6d. and 13s. per ton
Hire of 15-ton Roller, &c.—W. Bland, Gosforth, 2s. 6d. per hour.

RICHMOND (Surrey).—For making up under the Private Street Works Act, 1892, Ruskin-avenue and Defoe-avenue, for the corporation:—

Ruskin-avenue.

Swaker & Co., Hounslow	£674
Fry Brothers, Greenwich	563
H. Farrow, Brixton	529
Free & Sons, Maidenhead	504
Wimpey & Co., Hammersmith	480
Parry & Co., Putney	451
Mowlem & Co., Westminster*	443

Borough surveyor's estimate, £486.

Defoe-avenue.

Swaker & Co., Hounslow	£1,193
Fry Brothers, Greenwich	1,116
H. Farrow, Brixton	1,070
Wimpey & Co., Hammersmith	1,025
Free & Sons, Maidenhead	994
Parry & Co., Putney	904
Mowlem & Co., Westminster*	892

Borough surveyor's estimate, £1,011.

POOLE. For surface-water drainage at Parkstone, Southroad, and Layland-street, for the corporation:—
G. Maidment, £2,131.

POOLE.—For private street works in Parkside-road:—
G. Maidment, £222.

POOLE.—For building a boundary wall at Rossmore-road:—
A. B. & S. A. Burden, £45.

STEVENAGE.—For the supply of Guernsey, Leicester or other granite, clean chippings and gravel, for the urban district council.—Mr. W. O. Times, clerk:—

	1½-2 in. Per ton.	1½-1¾ in. Per ton.	1¼ in. Per ton.	Chippings per ton.
	s. d.	s. d.	s. d.	s. d.
Croft Granite, Brick & Concrete Company, Limited	11 5	11 2	11 2	8 10
Groby Granite Company, Ltd.	11 5	11 2	8 3	8 9
Ellis & Everard, Limited (Botts Hill quarry)	11 8	11 8	9 8	9 4
Ellis & Everard, Limited (Bardon Hill quarry)	12 5	12 5	10 5	9 4
British Macadams, Limited	14 0	—	—	13 0
W. Griffiths & Co., Limited (Guernsey quarry)	17 0	17 6	15 6	14 9
W. Griffiths & Co., Limited (Leicestershire quarry)	11 3	10 9	9 11	9 9
Lavender & Bateman (Mountsorrel quarry)	12 3	12 3	12 9	8 9
Lavender & Bateman (Stoney Stanton quarry)	11 10	11 10	12 4	7 10
Jee's Hartshill Granite and Brick Company	11 0	10 6	10 3	—
J. Mowlem & Co., Limited	17 3	17 9	16 0	15 3
Enderby and Stoney Stanton Granite Company, Limited†	11 6	11 6	11 6	8 10
Cliffe Hill Granite Company, Limited	11 11	11 5	9 9	9 6

UXBRIDGE.—For the construction of a stoneware sewer, for the rural district council.—Mr. J. W. Harrison, engineer and surveyor :—

E. Free & Sons, Maidenhead	£151
T. Hancock, Yiewsley	145
W. Wright, Chesham	135
Langley & Johnson, Slough	126
Stunt & Son, Yiewsley	108

WANDSWORTH.—Accepted for making up and paving part of Cavendish-road, Clapham South, for the borough council.—Mr. P. Dodd, borough engineer :—

S. Lane, £2,511, and 15 per cent above schedule prices for extras or omissions.

WEYMOUTH.—For the wood paving of St. Thomas-street and King-street, for the corporation :—

	Per yard super. s. d.
J. Vallance	14 4½
W. Griffiths & Co., Limited	13 8
Jesty & Baker	12 11½
C. L. Duke	12 9
J. Mowlem & Co., Limited	12 8½
Acme Flooring and Paving Company, Limited	12 5
Improved Wood Pavement Company, Limited *	12 0

YORK.—For the erection of two lock-up shops, for the corporation.—Mr. F. W. Spurr, city engineer :—

Harrison & Co., York, £184.

MEETINGS.

Secretaries and others will oblige by sending early notice of dates of forthcoming meetings.

MAY.

30-31.—Royal Sanitary Institute: Sessional Meeting at Chester. Discussion on "Modern Methods for the Purification and Softening of Water Supplies." Visit to Waterworks.
31.—Institution of Municipal Engineers: Dr. Grossmann, M.A., F.I.C., on "The Sewage Sludge Problem and its Solution." Salford Town Hall. 1.30 p.m.

JUNE.

4.—Royal Institute of British Architects: Annual Dinner, Whitehall Rooms
5-7.—Institution of Water Engineers: Summer General Meeting at Wakefield.
6-7.—Institution of Municipal and County Engineers: Meeting at Dundee.
14.—Institution of Municipal and County Engineers: Meeting at Rochdale.
23-28.—International Road Congress in London.
28.—Institution of Municipal and County Engineers: Meeting at Leek.

JULY.

7-12.—Royal Sanitary Institute: Annual Congress and Exhibition at Exeter.
16-19.—Institution of Municipal and County Engineers: Annual Meeting at Great Yarmouth.

APPOINTMENTS OPEN.

ACTON URBAN DISTRICT COUNCIL.
TEMPORARY ASSISTANT—SURVEYOR'S DEPARTMENT.

Applications are invited from persons who have had experience in a Municipal Engineer's Office for the appointment of Temporary Assistant in the Surveyor's Department, for a period of 12 months, at a salary of £150 per annum.

Applications, stating age and qualifications, accompanied by copies of not more than three recent testimonials, to be delivered, addressed to the Surveyor (Mr. F. Sadler), and endorsed "Temporary Assistant," on or before the 5th June next.

Canvassing Members or Officers of the Council, either directly or indirectly, will disqualify.

WM. HODSON,
Clerk to the Council.

Council Offices, Acton, W.
May 24, 1913. (487)

CORNWALL COUNTY COUNCIL.
MAIN ROADS.

Applications are invited for the Appointment of a thoroughly competent Road Foreman, or Ganger, to take charge of Road Reconstruction Works, under the direction of the Assistant County Surveyor, in the Redruth district.

Applicants must have had experience in works of a similar nature, and be thoroughly competent to supervise labour and measure and book up work.

Wages 50s. per week.

Applications, in candidate's own handwriting, stating age, full particulars of previous employment, and enclosing copies of at least two recent testimonials, must be forwarded to the undersigned not later than Wednesday, June 4th, 1913.

ALBERT E. BROOKES,
County Surveyor.

County Hall, Truro.
May 19, 1913. (474)

RURAL DISTRICT COUNCIL OF BUCKINGHAM.
SURVEYOR OF HIGHWAYS.

The above-named Council invite applications for the appointment of Surveyor of Highways for their District, in which there is about 125 miles of metalled roads.

The person appointed will be required to give his whole time to the duties, and to maintain and to keep in repair all Roads, Paths, Bridges and Watercourses for which the Council are or may become responsible, and to reside at Buckingham.

The salary will be £100 per annum, to include travelling expenses.

The Surveyor must give the security of a Guarantee Society for £100.

Applicants must be between 22 and 40 years of age, conversant with the duties of Surveyor of Highways, and capable of making estimates and plans and keeping the necessary books and accounts.

The appointment will be determinable by 3 months' notice on either side.

Applications, in the candidate's own handwriting, stating age, qualifications and experience, accompanied by copies of not more than three recent testimonials (which will not be returned), to be sent to me on or before Thursday, the 5th June next, endorsed "Surveyor."

Personal canvassing will be deemed a disqualification.

Notices will be sent to selected candidates, whose personal attendance is required on the day of election, and reasonable expenses will be paid.

(By order)

THOMAS R. HEARN,
Clerk to the Council.

26 West-street,
Buckingham.
May 26, 1913. (489)

CONWAY AND GLAN CONWAY RURAL DISTRICT.
ENGINEER AND SURVEYOR WANTED.

The Conway and Glan Conway Rural District Councils require the services of an Engineer and Surveyor.

Requirements: Thorough knowledge of Road-making, necessary accounts under the Highway Acts and as required by the Councils, experience in the preparation of Plans, Quantities and Estimates, Surveying and Levelling, and a general knowledge of the duties of an Engineer and Surveyor to a Rural District Council.

Candidates should hold the diploma of a recognised Institute of Engineers or Surveyors, and a certificate of the Royal Sanitary Institute or other similar examining body approved by the Local Government Board.

The person appointed will be required to devote his whole time to the duties of his office (which will be strictly enforced), and to give such security as the Councils may require.

A knowledge of Welsh desirable.

Salary commencing at £110 per annum, rising by annual increments of £10 to a maximum of £150.

Applications, to be in Candidate's own handwriting, stating age, past experience, with copies of three recent testimonials, to reach me not later than 10 a.m. on Thursday, the 5th day of June, 1913.

Canvassing members, directly or indirectly, will be deemed a disqualification.

JAMES PORTER,
Solicitor, Conway,
Clerk to the Rural District Councils.

May 9, 1913. (468)

IMPROVER ASSISTANT wanted in County Road Surveyor's Office, South of Scotland; ample opportunity to gain experience in all latest methods of road maintenance and bridges. State experience and lowest salary required.—Apply Box 1,252, office of THE SURVEYOR, 24 Bride-lane, Fleet-street, London, E.C. (463)

ROAD-BINDER. Wanted, representatives to push well-known Proprietary Non-bituminous Binder. Generous commission basis.—Address "Z. H. 152," c/o Deacon's, Leadenhall-street, E.C. (464)

CITY OF MANCHESTER.

The Corporation of Manchester invite applications for the position of Deputy of the City Surveyor in the Surveying Department. Salary, £750 per annum.

Candidates must be Fellows of the Surveyors' Institution.

The Candidate appointed will be required to devote the whole of his time to the duties of the Office, to become a contributor to the Manchester Corporation Officers' Thrift Fund, and to execute their Deed of Service.

Printed forms of application, to be obtained from the City Surveyor, Town Hall, Manchester, stating particulars as to age, health, articles, appointments, qualifications, &c., and accompanied by copies of four testimonials, and, in addition, the names of three referees, must be delivered to me, the undersigned, endorsed "Deputy of the City Surveyor in the Surveying Department," on or before June 30th, 1913.

No application which is not on the printed form above referred to will be considered.

Canvassing, directly or indirectly, is prohibited.

THOMAS HUDSON,
Town Clerk.

Town Hall, Manchester.
May 23, 1913. (494)

CITY OF MANCHESTER.

The Corporation of Manchester invite applications for the position of Deputy of the City Surveyor in the Engineering Department. Salary, £750 per annum.

Candidates must be Corporate Members of the Institution of Civil Engineers.

The Candidate appointed will be required to devote the whole of his time to the duties of the Office, to become a contributor to the Manchester Corporation Officers' Thrift Fund, and to execute their Deed of Service.

Printed forms of application, to be obtained from the City Surveyor, Town Hall, Manchester, stating particulars as to age, health, articles, appointments, qualifications, &c., and accompanied by copies of four testimonials, and, in addition, the names of three referees, must be delivered to me, the undersigned, endorsed "Deputy of the City Surveyor in the Engineering Department," on or before June 30th, 1913.

No application which is not on the printed form above referred to will be considered.

Canvassing, directly or indirectly, is prohibited.

THOMAS HUDSON,
Town Clerk.

Town Hall, Manchester.
May 23, 1913. (495)

WEMBLEY URBAN DISTRICT COUNCIL.
RESIDENT FOREMAN, SEWAGE OUTFALL WORKS.

The above Council invite applications from persons with previous experience for the position of Foreman at the Sewage Outfall Works. Wages 30s. per week with house, light and fuel free. For further particulars apply to the Surveyor to the Council, Public Offices, Wembley.

Applications to reach me on or before Tuesday, the 3rd proximo.

CECIL R. W. CHAPMAN,
(483) Engineer and Surveyor.

LANCASTER CORPORATION.

Wanted, General Surveying and Engineering Assistant; must be a good Surveyor and Leveller, and neat Draughtsman. Municipal experience essential. Salary £120 per annum. Forms of Application may be obtained from the undersigned on receipt of a stamped envelope, and must be returned not later than Monday, June 9th, 1913.

ARTHUR G. BRADSHAW,
Borough Surveyor and Water Engineer.

Town Hall,
Lancaster. (466)

WORCESTERSHIRE COUNTY COUNCIL.

Applications are invited for the appointment of Junior Surveying Assistant in the County Road Surveyor's Office. Commencing salary, £75 per annum. All information relating to the appointment and forms of application can be obtained from the undersigned, to whom applications must be delivered by the 10th June, 1913. Canvassing in any form will disqualify. S. Thornely, Clerk of the County Council, Shirehall, Worcester, 24th May, 1913. [T 239] (490)

EAST SUFFOLK COUNTY COUNCIL.

Wanted, in the Office of the County Road Surveyor, a surveyor's Account Clerk. Salary, £90 per annum, rising, for approved service, to £120 per annum.

Applicants must have a good knowledge of bookkeeping, and be quick and accurate at figures.

Applications, stating age and experience, and accompanied by copies of not more than three recent testimonials, to reach me here on or before the 11th June, 1913.

W. JERVIS,
County Road Surveyor.

County Hall,
Ipswich.
May 27, 1913. (497)

COUNTY BOROUGH OF STOKE-ON-TRENT.
BOROUGH SURVEYOR'S DEPARTMENT.

The Corporation invite applications for the Appointment of a Junior Private Street Works Assistant in the Borough Surveyor's Office, at a salary of £65 per annum.

Applicants must be neat and expeditious Draughtsmen, and accurate Surveyors and Levellers.

Applications, stating age and experience, accompanied by not more than three recent testimonials, and endorsed "Junior Assistant," must be sent to me on or before Monday, June 2nd, 1913.

Preference will be given to candidates who have had experience in a Borough Surveyor's Office.

Canvassing, directly or indirectly, will be a disqualification.

A. BURTON, A.M.I.C.E., F.S.I.,
Borough Surveyor.

Town Hall,
Stoke-on-Trent.
May 20, 1913. (467)

APPOINTMENTS WANTED.

A FULLY QUALIFIED LAND SURVEYOR, of wide experience, open to accept engagement, temporary or otherwise; moderate salary.—Address Box 1,242, office of THE SURVEYOR, 24 Bride-lane, Fleet-street, E.C. (391)

MISCELLANEOUS.

FOR SALE, CHEAP.—Surveyor's Hanging Reflecting Level; Pocket Compass, Silver Hunter, 100-ft. new Steel Chain; Ivory Offset Scales; Drawing Board—antiquarian.—Apply "Civil," office of THE SURVEYOR, 24 Bride-lane, Fleet-street, E.C. (498)

TENDERS WANTED.

THE BOROUGH OF TENBY (PEMBROKESHIRE).

NEW SEWER OUTFALL WORKS.

TO CAST-IRON FOUNDERS.

The Corporation of the Borough of Tenby invite Tenders for the Supply and Delivery at Tenby of the following Cast-iron Pipes—viz.: 1,500 ft. of 48-in. diameter, 38 ft. of 2-ft. 6-in. diameter, 102 ft. of 18-in. diameter, and 922 ft. of 9-in. diameter (more or less), also certain Special Castings.

A copy of the Specification and Drawings and Form of Tender may be obtained on application in writing to Mr. T. J. Moss-Flower, Civil Engineer, 28 Victoria-street, Westminster, S.W., and Carlton Chambers, Bristol, on and after Monday, June 2nd, 1913, on payment of the sum of Five Guineas, which will be returned, provided a *bonâ-fide* Tender be received and is not withdrawn before the acceptance by the Corporation of one of the Tenders.

Sealed Tenders, endorsed "Tender for Cast-iron Pipes," are to be delivered at my Office at Tenby at or before 10 a.m. on Wednesday, June 11th, 1913.

The lowest or any Tender will not necessarily be accepted, and the letting of the Contract is subject to the sanction of the Local Government Board for the loan.

Dated this 26th day of May, 1913.

(By order)
G. LORT STOKES,
Town Clerk.

Town Hall,
Tenby. (488)

The Surveyor

And Municipal and County Engineer.

Vol. XLIII. JUNE 6, 1913. No. 1,116.

Minutes of Proceedings.

Fish Life and Water Pollution.

The question as to how sewage effluents discharged into rivers affect fish life is one which has received considerable attention in the past when legal proceedings have been taken against persons or authorities by whose action injury is alleged to have been done to fishing interests. It has been popularly accepted that the reason why fish have disappeared from streams in which they were formerly abundant is sewage pollution. Scientific investigation has shown, nevertheless, that the injury to fish is more likely to be caused by the discharge of manufacturing refuse than by ordinary domestic sewage, which, unless it is of very large volume in comparison to the stream, or unless it contains some harmful constituent such as petroleum or acid, is not harmful to the fish. The paper read by Messrs. H. W. Clark and George O. Adams before the International Congress of Applied Chemistry in New York City last year, and of which some extracts appeared in last week's issue of THE SURVEYOR, gives the result of certain experiments carried out at the Lawrence experiment station of the Massachusetts State Board of Health in order to discover the effect of sewage, trade wastes and effluents upon fish life.

Although it was found that when fish were immersed in undiluted sewage well aërated they died almost immediately, it appeared that when water and sewage were mixed in equal proportions and this mixture was kept aërated, some fish life could exist in it almost indefinitely. It should be noted, however, that a number of fish died quickly, and that only the stronger fish survived. They, however, lived for fourteen days without coming to harm. Effluents from contact beds and filters when kept aërated supported fish life also for fourteen days, a fact which had already been demonstrated years ago in this country, when goldfish were kept in pools supplied with effluent from contact beds. Other experiments showed that where 10 per cent of sewage was mixed with 90 per cent of water the fish could survive indefinitely under stagnant conditions, and that only 25 per cent of water to 75 per cent of the best filter effluent was needed in order that fish might live under the same stagnant conditions, while with the effluent from contact beds of the type used at the Lawrence experiment station 50 per cent of effluent had to be mixed with 50 per cent of tap water to produce the same result. It appears that the fish could not live in sand filter effluents. All these effluents but one were slightly acid, and one was alkaline and contained matter in suspension. When this suspended matter was removed the fish were able to live in the effluent. Thus it is clear that in the one case the acidity and in the other alkaline suspended matter caused the death of the fish. It appeared also that iron salts were exceedingly harmful. The presence of caustic and carbonate alkali killed fish within a few hours.

Another important point demonstrated by these experiments is that certain green growths giving off free oxygen when growing in light appear to take a greater part in overcoming sewage pollution in surface waters than has yet been realised. A small fish put into a tightly stoppered gallon bottle containing these green growths lived eight days, whereas if the growths had not been present the oxygen must have been consumed by the fish in thirty-eight hours. Bottles of sewage were seeded with these green organisms and then aërated for twenty-four hours, and afterwards allowed to stand for twenty-four hours, and it was found that there was considerably more dissolved oxygen present in the sewage at the end of the whole period than immediately after the twenty-four hours of aëration, the green growth having supplied all the dissolved oxygen consumed by the sewage during the period of standing, and further having increased the volume of dissolved oxygen considerably. The lessons to be learned from the paper are the improbability of sewage effluents entering a river being injurious to fish life, the value of certain green growths in water for the purification of sewage, and the great harmfulness of various chemicals present in trade wastes—such as acids, nitrates, iron, potassium, caustic and carbonate alkali, and so forth.

* * *

Self-propelled Cars.

Some time ago a deputation was appointed by the Edinburgh City Council to visit certain places and to report upon the use of self-propelled cars. The deputation, which included Mr. A. H. Campbell, M.INST.C.E., the burgh engineer, visited Morecambe, Birmingham, Coventry and London, the first-named town possessing the earliest tramway in this country operated on the self-propelled principle. A trial run was made in a new car on this route with the members of the deputation as passengers, the result being satisfactory as regards speed, hill climbing, comfort of transit and freedom from shock or excessive noise. The report particularly states that the ascending gradients were taken with ease, and did not appear to tax the power of the car. Special inquiry was made on the question of tyres in view of certain criticisms which had been made regarding abnormal wear of wheel and of rail. It was found, however, that such defects as existed were not peculiar to the self-propelled car,

but were such as have been experienced in other tramway systems, and are avoidable by ordinary care in the selection of material, the laying of lines, and the correct adaptation of tyre base to rail tread. To sum up, the deputation consider the running of the cars inspected by them at Morecambe satisfactory from a mechanical point of view, comfortable and pleasurable for passengers, free from objectionable noise or smell, and in respect of running costs fairly comparable with either the cable or the electric tramcar. At Birmingham inspection was made of the fleet of motor omnibuses owned and operated by the Birmingham and Midland Motor Omnibus Company, Limited, and in comparing the running cost of these with that of the London omnibuses, it is observed that the rougher-surfaced roads of a great provincial city do not influence the final operating cost to any appreciable degree. The motive power of these omnibuses is derived, in the first place, from a petrol engine, the main shaft of which forms also the shaft of an ordinary electric dynamo. The result of this arrangement, which is described fully in the report to be found in another column, is that the car is free from jerk or jolt at stop or start or change of speed, smooth in running, and freer from vibration than any other road vehicle. On visiting London it was explained to the deputation that the introduction of the self-propelled car on the county council's system is due to the very high cost for local or branch services of the electric conduit system, coupled with the refusal of certain borough councils to permit the use of overhead wires for the trolley system. As at Morecambe, particular inquiry was made as to the wear of wheels and rail of a self-propelled car as compared with an ordinary electric car, and the report states that there appear to be no new factors or forces called into play to cause any extraordinary wear and tear either of the wheel or the rail beyond that experienced on an electric tramway. The conclusions of the report are entirely favourable to the self-propelled car, and the petrol-electric combined motive power, and the deputation recommend an experimental introduction of this type of vehicle into Edinburgh.

* * *

The Brentford By-pass Road.

As recorded on another page, the County Council of Middlesex have decided to proceed with the construction of the Brentford by-pass road, an important work, the immediate purpose of which is to divert through traffic from the London-Bath road between Kew Bridge and Bell Corner. At Bell Corner the present road forks, south-west by west to Staines, and north-west by west towards Bath, the new road being so aligned that it joins the latter about a mile further on. It thus fits smoothly into the general main road system, and will probably carry a considerable portion of the Staines road traffic as well as that of the Bath road, the extra distance in the former case being unimportant in view of the time lost in getting through Brentford and Hounslow. The alignment seems to be a good one, except as regards the portion passing between St. Mary's Church and the adjoining college, where the road is very near the church. We do not know whether there would be any special difficulty in aligning the road so that it might pass at a greater distance from the church; but it is worth noting that the hours during which there is a large amount of Sunday motor traffic to or from London coincide, more or less, with the usual hours of divine service.

We have not yet seen the estimates of the cost of making this new road, and we are at present unable to explain to our readers how the large total of £517,000 is reached. The engineering cost cannot, of course, go far towards such a total, and except as regards the junction with the existing road near Kew Bridge and a small part of the route at this end, there is no part of the route where the land or property to be acquired looks costly on the map; but no doubt the property at Kew is very costly. Probably but few highway engineers will adversely criticise the proposal to make the road 80 ft. wide, but there is no obvious need to make the carriageway 50 ft. wide at the time of construction, and the width of 4 ft. for each turf margin seems insufficient for a road of this character. Since the road will run nearly east and west, it seems worth while to consider the advantages offered in such a case by a twin road with a row of trees down the middle, providing on the south side a road which obtains the full drying effect of sunshine, and on the north side one which is protected from rapid drying in hot weather and from sun-thaw in frosty weather.

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Institution of Water Engineers.

The installation of Mr. C. Clemesha Smith, M.INST.C.E., the water engineer to the Corporation of Wakefield, as president of the Institution of Water Engineers took place yesterday in the presence of the mayor and a large gathering of members. The new president delivered a very interesting inaugural address, in the course of which many subjects were touched upon. The provision of an efficient water supply to all sections of the community is a matter of such vital importance and demands the attention of experts in so many branches of science that Mr. Smith suggested that the institution should aim to include in its membership not only engineers and managers, but representatives of every branch of science connected with the solution of the water problem. He further indicated that the institution's sphere of interest might be enlarged by undertaking the official collection and arrangement of data and statistics obtained upon some standardised plan so as to be strictly reliable and comparable. For example, comparative data in regard to incrustation could not fail to be of immense value at the present time; and a similar observation might be made with regard to many other matters. Having dealt with the methods of purification adopted at Wakefield, and the plumbo-solvent action of water and its prevention, the president passed to the question of the control and allocation of sources of supply. He pointed out that the Fifth Report of the Royal Commission on Sewage Disposal, in dealing with the question of pollution of surface water, suggests the formation of a central administrative authority and of local rivers boards, and that their duties should include the protection of water supplies from pollution, and the collection of information as to available supplies, and as to the need for water in the various parts of the country. This is a question upon which we have expressed our views on many occasions. There can be no doubt that if the water resources of the country are to be used in the most economical manner something must be done to prevent the present competition for sources of supply. The water question is a national one, and must be treated in a statesmanlike manner, so as to secure a maximum benefit to the community from the various supplies which are available.

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The Garioch District Surveyor's Salary.

It is not, perhaps, desirable indeed, we sincerely trust it is not the case—to suggest that the members of the Garioch District Committee of the Aberdeen County Council are afflicted with a double dose of parsimony, yet it is difficult to reject the impression, gathered from the impassive agency of a local newspaper report, that a majority of them are liberally dowered with ideas of dour and unflinching economy in the matter of the salary to be paid to their district surveyor. A vacancy having occurred in this office, the committee proceeded to the business of filling it, and the proposition was made by Provost Smith, of Kintore, that the salary offered be £160, including travelling expenses. "They would get,"

he added, "a really good man to start on these terms." Whether the provost here struck a note of sorrow or satire it is difficult to say. Possibly it was sorrow, for he proceeded to remark that the "surveyorship involved a lot of expense, and rendered the living not much better that that of a journeyman mason." Yet we must, perforce, "hae oor doots" about such a possibility, seeing that Provost Smith subsequently demurred to the appeal of the chairman, Mr. H. D. McCombie, to raise the salary to £160 a year, "as £150 was scarcely a living wage." The provost's seconder offered to withdraw his support in favour of the higher remuneration, but Kintore's chief magistrate detected an insuperable difficulty in the fact that several members had expressed themselves in favour of the motion, and it must therefore go to the vote. If it is not easy to reconcile either the statements or the action of Provost Smith in this matter, it is almost impossible to understand how a majority of nine to four members of the committee could vote for a salary which the proposer himself appeared to regard as insufficient, and which their chairman criticised as scarcely a living wage. Garioch would seem to have an affinity with ancient Sparta which is not quite appropriate to the requirements of these more modern times.

* * *

Sanitary Fittings. At the last Manchester Assizes a case of considerable interest was tried before Mr. Justice Rowlatt and a jury, the firm of Sanitaries Limited being sued for slander in the following circumstances. The Corporation of St. Helens had passed a resolution "that Dr. Quine's stationary tipping ashbin be approved for use in the borough." The plaintiff, who, during a temporary lapse of patent, manufactured an ashbin similar to Dr. Quine's, was alleged to have sold a quantity of these bins to a builder as "Dr. Quine's ashbins," and as "the bins approved by the St. Helens Corporation." Thereupon a representative of the defendants saw the builder, and told him that if he had bought the goods with these descriptions they had been sold under a misrepresentation. This was the alleged slander, and the action resulted in a verdict for the defendants. In the course of his summing up, however, the learned judge made some observations in regard to the expression of opinion by local authorities that certain sanitary appliances are approved (to the exclusion of others) for use in the district. This is a matter of some importance to builders and others, who naturally desire to know what fittings they may safely use. In our view, however, it would be unfortunate if this procedure were to result in the creation of quasi-monopolies in favour of certain articles; but it does appear to be desirable that *standards* should be set up to which sanitary appliances, of whatever make, must comply. Of course, in the case of patent articles it might be necessary to mention the specific appliance. This should be done with great care, however, as the duty of a sanitary authority seems to be confined to securing the use of sound and suitable fittings of whatever make they may happen to be.

* * *

The Removal of Algæ from Water. Recent experience in London has given us a practical illustration of the occurrence of disagreeable tastes and odours in water, and this is but a small example of the manner in which the value of safe water may be greatly reduced. That this deterioration is almost always due to the growth of algæ or fungi in the reservoir, lake or river, or even in the pipe lines themselves, has been pointed out by Mr. Karl F. Kellerman in a paper read before the Congress of Applied Chemistry at New York. Mr. Kellerman, from extended experience, has been able to give tables showing the occurrence of the twelve genera of algæ which have been found to be most troublesome in America, as well as the quantity of copper sulphate required to kill the various forms of these odour-producing organisms. Further, he gives a table showing the safe limit of copper sulphate that may be used without injury to certain fish, and it is notable that a very small proportion—namely, ·14 part per million—is the safe quantity to use when trout are present, though some of the algæ require as much as from 5 parts to 10 parts per million in order to kill them, whereas 2·10 parts per million will kill the strongest fish—namely, the black bass. It is a fact that since the year 1904 copper sulphate has been used with considerable success to eradicate or to reduce the development of algæic growths, and Mr. Kellerman is of opinion that the method should be adopted wherever the tastes and odours in water are caused by algæ. We give elsewhere extracts from this valuable paper, together with the tables referred to.

* * *

The Gospel of Fresh Air. In opening Kelsey Park, Beckenham—recently acquired by the urban district council at a cost of £5,000—Mr. John Burns made some very pertinent observations in regard to the wisdom of taking time by the forelock in the matter of the provision of open spaces. A moment's reflection is sufficient to show that those authorities who neglect to lay out parks and gardens until the land in their district has acquired a building value must, in the long run, pay very much more dearly for sites which are probably smaller and less desirable than those which might have been obtained by seizing opportunities as and when they occurred. Moreover, if open spaces are secured and laid out in good time they will possess all the charm of maturity when the period arrives for the development of the surrounding district, thus considerably enhancing its amenities. The President of the Local Government Board further pointed out that capital invested by a local authority in open spaces cannot fairly be regarded as unremunerative. There can be no doubt that the cultivation of open-air habits, particularly by the inhabitants of working-class districts, has a direct effect upon the public health and the death rate. The laying out of Kelsey Park has been carried out by Mr. J. A. Angell, ASSOC.M. INST.C.E., the surveyor to the council, and the manner in which this work has been executed met with unstinted praise on the part of Mr. Burns. The Beckenham Council and their surveyor are to be congratulated on the successful inauguration of the new park.

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Institution of Municipal and County Engineers. The success which attended the two conferences on the subject of housing and town planning which have already been held by the Institution of Municipal and County Engineers has encouraged the council to arrange for a third, which will take place at Great Yarmouth next month under the presidency of Mr. J. W. Cockrill, M.INST.C.E. Several papers on various aspects of the question will be submitted for discussion, and an important exhibition of plans of town-planning schemes, kindly lent by authorities in various parts of the kingdom, will be on view during the meeting. Another important gathering is the annual Scottish meeting which opens at Dundee to-day. This is always a well-attended and highly successful meeting, and it is hoped that members will be present in full force again this year. In another column, too, will be found the programme of the forthcoming meeting at Rochdale on the 14th inst.; but the meeting which had been arranged at Leek for the following Saturday has been postponed until July 5th, doubtless having regard to the fact that a large number of members will be in London on the earlier date in connection with the International Road Congress. It will thus be seen that the activities of the institution are being well maintained.

Self-propelled Tramway Cars.

EDINBURGH DEPUTATION'S INVESTIGATIONS AND REPORT.

A deputation of Edinburgh City Council, which included Councillor Harrison, Bailie Rusk, Dean of Guild Carter, Judge Fraser, Councillor M'Michael, and the burgh engineer, Mr. A. H. Campbell, paid visits recently to Morecambe, Birmingham, Coventry, and London, with the object of obtaining information with regard to the operation of self-propelled tramway cars. Although the reference was limited to the "self-propelled" car, the deputation thought it well to include within the scope of their inquiry certain types of motor 'bus, the driving of which, they point out, is so germane to the subject-matter of their report, just issued.

The deputation had the advantage, in the course of their inspections, of meeting the English representative of the self-propelled car which has been operating in Paris for the past two years, also with skilled technical experts, and representatives of various engineering firms whose products they inspected—notably the Leyland Motor Company, Leyland, Lancashire; the Daimler Company, Coventry; and the Tilling-Stevens Company, London and Maidstone.

MORECAMBE.

At Morecambe, on May 7th, the deputation were received by Messrs. Sutton & Nixon, on behalf of the Leyland Motors, Limited, and by Mr. Wilkinson, the local representative of the tramway company.

The route which is served by the "self-propelled" or "auto" tramcar was opened for service in January, 1912. It is the first tramway in the country operated on the self-propelled principle, if the pioneer efforts represented by the steam car of earlier days are excepted. It extends from Morecambe (South Bay) towards the village of Heysham, a distance of 1 1-5 miles, and serves a purely local area of but sparse resident population. The remainder of Morecambe, including the long sea front of about 2 miles, is served by horse cars, now owned and operated by the local authority, who recently acquired the borough tramways from the tramway company.

The Heysham route is partly outside the district of the local authority, and was not therefore acquired by the council. It was left—a small residuary section—in the hands of the Morecambe Tramway Company, a mere fraction of a line, which by reason of limitation of length and paucity of traffic it was impossible to work by horse haulage without heavy financial loss. Two alternatives were thus open to the company left with such lean heritage—either to close down altogether or reform the method of traction. The latter alternative was chosen. The old horse tramway was reconstructed and equipped in January, 1912, with single-decker enclosed cars of the "self-propelled" type, seating about thirty-seven persons.

Notwithstanding the unfavourable character of the line from a traffic point of view, that it is isolated and short, and works disconnectedly from the major Morecambe system, in the first year's working the trams have paid their way, met all costs, including depreciation, and show a surplus over all expenditure.

The deputation had placed at their disposal a new car—the fourth which has been delivered for service. This car is of the open single-deck type, delivered from the Leyland Company's works the day before the visit. The trial run of this new car was thus made in the members' presence as passengers, and with satisfactory results in so far as relating to speed, hill-climbing, comfort of transit, freedom from shock or excessive noise.

The new car is seated to hold thirty-seven persons, its weight is 8 tons unloaded, and about 10½ tons loaded. Its overall length is 31 ft. 4½ in., and it has an overall width of 7 ft. 2 in., and a tram gauge of 4 ft. 8½ in. Height of floor above street level is 2 ft. 10½ in. It is propelled by a 40-horse power petrol engine—4-cylinder—of the standard "Leyland" type, acting by a "Cardan" driving shaft and chain-drive upon the two axles. It is driven from either end, according to the direction in which car is going, by sprocket wheels and chain-drive connecting the two axles. When the car is moving in the reverse direction the change is obtained by a simple movement of a lever.

The consumption of petrol is given as 7 to 8 miles per gallon, which, stated in terms of pence, is the equivalent of about 2d. per car-mile (at current market price of petrol).

The car is fitted with two brakes—*i.e.*, the pedal brake and the hand brake—acting upon a drum and wheels respectively.

The road route is undulatory, having gradients of 1 in 15 and 1 in 17 down to level.

The report of the deputation states that the ascending gradients were taken with ease, and did not appear to tax the power of the car (indeed, it was stated that frequently in the busy season the car carried seventy persons up the inclines with a gross load of 11 to 12 tons, and without apparent exertion). The descents showed the efficiency of the brakes for speedy stoppage on emergency.

As evidence of the reliability of the engine, &c., it was ascertained that the percentage of interruptions by temporary breakdown was practically *nil*, and that with a mileage per car during July of 2,200, and during August of 1,975, representing an average daily run for each car of approximately 70 miles. The covered cars are lighted internally by eight electric lights, with two canopy and head and tail lights for platform. The car is fitted with four sets of springs of the laminated type, with link suspension at ends, and auxiliary side spring of flexible coil type.

Costs are approximately as follow: New open car and chassis, £985; covered car and chassis, £1,050; chassis only, £900; double-decked car to seat about sixty-five persons, say £1,150.

The arrangement for operating the cars is a joint one between the Leyland Motor Company and the Morecambe Tramway Company, the former building and selling the car, and guaranteeing to the local tramway company (as owners of the track and car) the working of the cars and operating of the system at a rate of 3½d. per car-mile, covering costs of petrol (up to 9d. per gallon), lubricants, maintenance and upkeep of metal tyres and chassis, the tramway company paying the wages of drivers and conductors, body upkeep, management and administration, and of petrol beyond 9d. per gallon. This guarantee of 3½d. per car-mile covers a period of five years.

The petrol tank has a capacity of 20 gallons, which is equal to (at least) 140 miles journey of the car, so that one replenishment per diem during the hours when the car is off duty maintains the charge of motor spirit without interruption of running.

On the question of tyres, special inquiry was made by the deputation. The first sets of tyres were of chilled, soft-tempered steel, with the result that somewhat abnormal wear of the tyre occurred; further, the plane of the wheel tread did not coincide with the cant of the rail, with the result that the wheel did not bear uniformly over its width upon the tread of the rail, causing the outer rim of the tyre to "bead over" and to ride uneasily upon the rails. The report states: "Those two defects (which have now been corrected) explain the criticisms made regarding 'abnormal wear of wheel and of rail.' They are defects not, however, peculiar and inherent to the 'self-propelled' car, but are such as have been, and are to-day, experienced in other tramway systems, and are avoidable by ordinary care in the selection of material, the laying of lines, and the correct adaptation of tyre base to rail tread. As regards the alleged wear of the rail tread, this was not apparent on the Morecambe lines. The principle, however, of the 'self-propelled' vehicle upon rails—even for a street tramway—is not new, and the application of the internal combustion engine as the motive power of a street tramcar introduces no new forces beyond those common to an electric tramway."

The deputation consider the running of the cars

inspected by them at Morecambe satisfactory from a mechanical point of view, comfortable and pleasurable for passengers, free from objectionable noise or smell, and in respect of running costs (under the terms of the "Leyland" contract) fairly comparable with that of either the cable or the electric tramcar.

BIRMINGHAM.

At Birmingham, on the following day, an inspection was made of the fleet of motor omnibuses owned and operated by the Birmingham and Midland Motor Omnibus Company, Limited.

The motor-'bus service was inaugurated here about twelve months ago, and has had rapid expansion, there being at present thirty-five 'buses in daily active service, and this number is being steadily increased to a probable 150 'buses. They are run supplemental to, but quite independent of, the Birmingham Corporation electric tramway system, along city routes not at present served by the tramways, and in select suburbs (such as Edgbaston and Hagley), where the proposal for tramways has evoked opposition. The routes so operated extend over about 10 miles. The roads traversed by the 'buses vary in their formation from the wood-paved city streets to the ordinary macadam surface of the suburban and country road. "Those," the deputation point out, "are the highway conditions which correspond more nearly with the streets of Edinburgh than the finely surfaced streets in London, and it was from this standpoint of comparison that the experience of Birmingham would be of guidance to Edinburgh in the operation of the corporation motor-'bus powers now passing through Parliament. It does not appear from the inquiries made that the rougher or less finely surfaced roads of a great provincial city influence the final operating cost to any appreciable degree, the probable explanation being that the obviously greater wear and tear of the 'bus due to the provincial roads is neutralised in the less frequent 'stop-and-start' which is so characteristic of the Metropolitan 'bus; there are also the lower rates and easier wages of the provinces, which balance and tend to equalise the finally resultant costs."

Those 'buses are of the "Tilling-Stevens" design (standard London pattern), and are propelled by the petrol-electric combination of motive power, the engine being one of 40-horse power. The motive power is obtained primarily from the petrol engine, the main shaft of which forms also the shaft of an ordinary electric dynamo. The mechanical power of the engine is therefore converted into electric energy, which, being transmitted to an electric motor or motors, is again reconverted into mechanical energy, operating through a "Cardan" shaft and worm-gear fitted on the axle of the back wheels of the vehicle. By this arrangement the engaging clutch and the gear-box of the petrol car for change of speed is dispensed with, the engine speed being regulated by varying the resistance of the magnetic field of the generator, with the result that remarkable control in change of speed is obtained, unaccompanied by the invariable jolts and jerks which result from the operating of speed changes through a gear-box (the starting and stopping of the car can likewise be accomplished with remarkable smoothness).

It is those discomforts and objections that the new petrol-electric car is designed to avoid, by substituting for the clutch and gear-box of the petrol-driven car a simple electric controller for the silent transmission of power. No storage batteries are needed, the petrol engine—which is still the initial mechanical power—being coupled direct to the dynamo and motors.

Although it would appear that this change of mechanical into electric energy would be accompanied by loss of efficiency, any such loss is stated as either dissipated or more than neutralised by resultant economies in other directions, and in the upkeep of the vehicle, but chief of all, the deputation observe, is the complete elimination of the defects alluded to, "and in their place we have a vehicle free from jerk or jolt at stop or start or change of speed, smooth in running, and freer of vibration than any other road vehicle."

The report includes the following statement of average running costs of "Tilling-Stevens" petrol-electric omnibuses in London for nine months from January 4 to September 25, 1912:—

	Pence per Bus Mile.
Running, *i.e.*, day-to day cleansing and adjustments whilst car is in service	·898
Maintenance and repairs, *i.e.*, chassis and all mechanical parts	·240
Tyres	1·098
Drivers	1·251
Conductors	·847
Petrol	1·067
Lubricating oil	·078
Grease	·018
Paraffin	·021
Lighting	·069
Depreciation, rent, rates and taxes	·849
Trade vehicles	·151
Body upkeep	·235
Traffic expenses	·270
Clothing	·001
Total, being pence per 'bus mile, of ...	7·063

The deputation made a journey into the suburbs of Birmingham in one of those double-decked 'buses on roads of varying formation, and they report that the intentions and anticipations of this car are fully realised in the ease and comfort of riding, in the elimination of jolt and jerk in stopping or in variation of speed, and in the extreme simplicity of driving.

PARIS SELF-PROPELLED CAR.

The English representative of the firm who introduced a petrol-electric driven tramcar into Paris met the deputation in Birmingham, and explained fully the extent and nature of the Paris installation.

The motive power is petrol, driving an engine of the usual petrol type, and transmitting its power through a dynamo and two motors placed upon or within the perimeter of the rear wheels of the car. This form of transmission has at least the attraction of novelty, but as it is as yet installed to only one street tramcar, doing only occasional service in the City of Paris, it was not deemed necessary at this stage to follow up the inquiry. It was learned, however, that a second car of this design is being built for service in Belgium.

The information supplied was as follows:—

Gross weight of car	13 tons.
Gross weight of car with trailer .	22 ,,
Consumption of petrol or benzol per ton per mile	·01 gallon.
Consumption of oil	1 gallon per 135 miles.
Upkeep	·8 pence per mile.
Maximum horse power	50 horse power.
,, speed	24 miles per hour.
,, gradient	36 millimetres per metre.

LONDON COUNTY COUNCIL.

In London it was explained that the introduction of the self-propelled tramcar on the county council's system is due to the following causes—viz., the very high cost, for local or branch service, of the electric conduit system, and the refusal of certain borough councils of the Metropolis to permit the overhead electric wires needed for the electric trolley-driven tramcar.

The immediate route which it is proposed to operate by the self-propelled tramcar is that between Victoria Park and West India Docks, a distance of fully 2¼ miles. This route is at present operated by horse-drawn cars upon a paved tramway track laid many years ago. The question of the early reconstruction of this track, or possibly of its retention till later, is at present engaging consideration.

The equipment for three cars is on order as a first instalment by the county council for this route. The cars used are, as regards body and frame, of the double-decked horse-drawn kind, with seating for about twenty in and twenty-eight out. The car is mounted upon a new chassis and four-wheeled single-truck base, which does not give the smooth motion of a tramcar mounted upon the double bogie. The motive power is the petrol-electric "Tilling-Stevens" combination, almost exactly as applied to the Birmingham motor 'buses, and operated, as in the case of the Morecambe car, from either platform, according to the direction in which the car is moving. The engine is placed beside the platform, and the other machinery is fitted beneath the floor of the car, the radiator, fans and driving levers being conveniently disposed on and about the platforms. There are two electric motors of 20 h.p. each, instead of one 40-h.p. motor in the case of the 'buses, the object being the better distribution of power and flexibility of the wheels, particularly in the taking of sharp curves. The wheels are tyred with hard steel, and it is not anticipated that the wear of tyres will be above the average. The car is braked at present by a hand brake. An additional brake is proposed in order to satisfy the licensing authority.

The weight of the car is 9 tons 2 cwt.—nearly similar to that of the Edinburgh cable car.

During a run of between 7 miles and 8 miles which the members of the deputation made on the car particular attention was paid to the following points—viz., (1) ease of starting and stopping; (2) steadiness of running; (3) noise, smell and heat in car; (4) brake power of car; (5) climbing power; (6) speed of running; (7) working costs. Upon each of those points the report contains the following observations—viz.:—

Ease of Starting and Stopping.—This test was satisfactory, and seemed to show to advantage the merits claimed in these respects for the petrol-electric combination. Upon starting off, the motion was one of a gentle glide, in contradistinction to the sudden jolt and jerk of the cable, and of some petrol-driven cars. In stopping the action was unattended with sensation.

Steadiness of Running.—The permanent way of the county council's tramway being good, it was anticipated that no unsteadiness of motion would be felt, and in this we were not disappointed. In changing into one of the new electric cars of the London County Council the difference in favour of the electric cars was apparent, but this was due rather to the weight and the unique perfection of the latter vehicle than to any defects—not objectionable in degree—of the adaptation of the old horse cars to this new form of motive power.

Noise and Smell inside the Car.—With regard to this, we had to bear in mind that the body of the car was one of the old horse-drawn type, but, notwithstanding this disadvantage, the travelling was quite comfortable, and the sound caused by running was not inconvenient to passengers. There were occasional slight whiffs of smell, but whether caused by petrol fumes or by new paint was difficult to say. We believe that any slight inconvenience from these causes can be overcome by suitable ventilation and by improvement to minor details of the equipment.

Brake Power of Car.—This was tested several times in the course of the run, and brought the car speedily to rest. Future cars can be fitted with any additional brake power needed to resist the momentum acquired upon a down grade, such as the magnetic slipper brake.

Climbing Power.—The car made the chief ascent of the run—viz., that at or near the Woolwich terminus—and although towards the summit the retardation of speed was apparent, it was explained that the engine power of the car had been designed for a comparatively level route, and any seeming insufficiency was a matter of easy correction, when the gradients of the routes to be served were known, and the engine power of the car proportioned to the gradient.

Speed of Running.—The speed was good, a maximum of 18 miles to 20 miles per hour being obtained on the quieter parts of the routes traversed, and that without any rocking or swaying of the car. Towards the securing of this result the good state of the permanent way is a substantial contributor.

Working Costs.—There has not yet been time to test these—even experimentally—but the makers do not anticipate the entrance of any new factors relative to the motive power or its upkeep which will increase the table of costs already given; indeed, the running upon rails instead of upon the road surface is expected to result in lower consumption of petrol, less tear and wear of machinery, and consequently lower operating costs.

Wear of Wheels and Rail.—On the question of wear of wheels and rail of a self-propelled car, as compared with an ordinary electric power (conduit or overhead) car, the deputation made particular inquiry, and report that there appear to be no new factors or forces called into play to cause any extraordinary tear and wear, either of the wheel or the rail, beyond that experienced upon an electric tramway.

CONCLUSIONS.

Reviewing the information set forth in their report, and the impressions they have formed in the course of their visits to the various places, the deputation are of opinion:—

(1) That the self-propelled tramcar has attained such a degree of efficiency as to render it a reliable, safe and suitable vehicle of public transit.

(2) That, as regards first cost of car, it is necessarily dearer than an electric car deriving its power from without, but this is counterbalanced (*a*) by savings in construction of tramway, dispensing with electric bonding, and with any wires above or conduits beneath the street; (*b*) by absence of any central generating station; (*c*) by the advantage that each car is an independent unit of power, one breakdown not involving the complete stoppage of the system or section of the system; (*d*) by the avoidance of any overhead work, which would affect the amenity of the city.

(3) That the reliability of the car in its freedom from breakdown is assured is evident from the experience at Morecambe, and in a larger measure by the immunity of the Metropolitan motor 'bus from interruptions.

(4) That, as regards working costs of tramcars automatically propelled, experience in this country is as yet too restricted to state with exactness. The guarantee of makers, however (of this particular speciality), and comparison with the motor-'bus costs which are so similar in their form of motive power, would appear to offer the prospect of close comparison, in the final results, with the cable or the electric tramway car.

(5) That as regards the relative merits of the direct-driven petrol engine, and of its compeer the petrol-electric combination, we are led to believe the latter an improvement upon the former, giving (*a*) ease of locomotion, (*b*) simplicity of control and drive, (*c*) silence of working. We were, however, impressed with the results obtained at Morecambe, and these cannot be discarded in the maturing of our proposals.

(6) That the success already obtained with the self-propelled car justifies its introduction (experimentally) to the City of Edinburgh. It apparently affords the prospect of adaptation to the existing tramway service of the city.

NEW APPROACH ROAD TO LONDON.

MIDDLESEX COUNTY COUNCIL'S DECISION.

The County Council of Middlesex, at its meeting on Thursday of last week, unanimously resolved to proceed with the construction of a new western approach road through Middlesex.

The scheme has been prepared by Mr. H. T. Wakelam, M.INST.C.E., county engineer of Middlesex, who will be responsible for the work, the estimated cost of which, excluding law, engineering and surveying charges, is £517,000.

In moving the adoption of the recommendation the chairman of the County Highways Committee stated that the matter had been under consideration many months, and the committee had now got the Road Board to agree to contribute 75 per cent of the entire cost. He thought a great deal of credit for this result was due to Mr. Wakelam, adding that an advance of 25 per cent in a contribution from the Road Board towards a scheme to cost half a million was a noteworthy achievement. It was proposed that the road width should be 80 ft. between fences, with 15 ft. reserved on each side for sidewalks. Of the latter 10 ft. would be for a footpath, 4 ft. for greensward with a belt of trees planted along it, and the remainder kerbings. If at any time it should be found necessary it would be easy to throw the 4 ft. of greensward into the highway.

The chairman of the council, in supporting the recommendation, stated that the new road would be one of the greatest Middlesex and London had ever seen.

Motor Ambulances for Willesden.—Eight motor ambulances have been purchased by the Willesden District Council, and £1,000 is to be spent on a garage.

Motor Omnibuses on Country Roads.—It would seem, in view of the rapid extension of motor omnibus services into the country districts, that the county authorities will have to receive some annual contribution from the companies towards the maintenance and repairing of the roads. In this connection it seems that the toll-gate might be revived. Fixed as in the old days at convenient and defined places on the various routes, each motor omnibus that passed should pay a certain amount—this at the end of the year would go some way towards paying for any road repairing that was necessary. It is a suggestion possibly worth consideration in the general problem of the invasion of the country districts by the motor omnibus—an invasion that will inevitably extend to all parts of England.—Frederick Heath in the *Daily Mail*.

Institution of Water Engineers.

SUMMER GENERAL MEETING AT WAKEFIELD: PRESIDENTIAL ADDRESS.

Mr. Charles Clemesha Smith, M.INST.C.E., water engineer to the Corporation of Wakefield, was yesterday installed as president of the Institution of Water Engineers at the eighteenth summer general meeting of that body. Following an official welcome by the mayor (Councillor Edwin Lodge Hirst, J.P.), and the transaction of the usual preliminary business, Mr. Clemesha Smith delivered his inaugural address.

Returning thanks for the honour conferred upon him by the institution, he observed that it was an honour which had its duties as well as its privileges, and he would endeavour to show his appreciation of their action by performing the manifold duties of the office to the best of his ability. The efforts of an individual in the work of an institution such as that were of little avail; success could only be achieved by the widespread interest of the whole of the members in their meetings and proceedings. He claimed with confidence their sympathetic support, knowing the extent to which it was given to his predecessors, and though he might not hope to rival them in the manner in which they realised the dignity and duties of their office, he trusted that at the close of the year it would be found that the prosperity and usefulness of the institution had not declined.

THE WORK OF THE INSTITUTION.

The growth in the membership during the past ten years (the president continued) is a sufficient indication of prosperity, the total number of members, &c., having increased during that period by 115, or 40 per cent.

Primarily, this institution was founded as an association of water engineers and managers in charge of works, but it has expanded until the membership now embraces engineers acting under companies and corporations controlling works supplying over 22,000,000 people within the United Kingdom, and others in similar positions in many parts of the world. It also includes consulting engineers engaged in the design and construction of waterworks, and (as associates) geologists, chemists, and other workers in the various branches of science intimately connected with the problem of procuring and maintaining a pure and plentiful water supply for the use of the inhabitants of this country.

I think that most of you will agree with me when I say that one of the ideals to be aimed at by this institution is a membership which will include not only engineers and managers of waterworks of every degree, but which will also be representative of all branches of science contributing towards the solution of the problems involved in providing efficient water supplies to all sections of the community. It cannot be denied that the nearer we are to the attainment of this ideal, the more useful will our meetings and discussions become, not only to ourselves, but to the community at large. The institution has now completed its first year as a corporate body, and it seems more than probable that under the fuller powers now possessed its activity will be increased and its sphere of usefulness enlarged. . . .

During the seventeen years which have elapsed since our first meeting at Nottingham, under the old title of "The British Association of Water Engineers," much good work has been done, many valuable papers have been read and discussed at our meetings, and many opportunities have been given us, by the inspections of works, both completed and under construction, of seeing how others deal with the problems we have to face; the result has been not only an increase in individual knowledge, but the saving of considerable sums of money to the communities we serve.

CO-ORDINATION ON EXPERIMENTAL WORK.

Thinking over what has been achieved has led me to consider in what manner the utility of the institution might be increased. I have long thought, and indeed it must be obvious to all who reflect upon the subject, that a great mass of experimental work is lost to the community because the results in many cases are not properly recorded, and even when complete records are kept the results remain with the investigator. Further, it seems clear to me that the value of experimental research would be greatly increased if the experiments were made under a variety of conditions and by different persons, because a comparative analysis of the results so obtained would reveal truths which are lost sight of when the experiments are made without such systematic co-ordination. It therefore occurs to me to ask whether it is possible to make this institution a "clearing house" for the handling of some at least of the many problems to which we devote time and thought. Let me illustrate my point with an example:—

I do not think that anyone who has had experience in the distribution of water will venture to say that the pipes now in use can be looked upon as having reached perfection. We are constantly faced with difficulties arising from the reduction of the carrying capacity of our mains by incrustations of various kinds; pipes which have been laid for periods as long as eighty or ninety years are found to be affected by internal incrustation and by internal and external corrosion. Would not more complete information as to the composition and methods of manufacture of these old pipes, as well as a specification of the coating applied, be of considerable value? It should not be difficult to arrive at some standard method of keeping records of the chemical composition of the iron and of the coating, of the method of manufacture of the iron and application of the coating, together with analyses of the water conveyed and sundry other data. If such records were kept by a large number of our members, and if certain mains in each town or district were examined at stated periods, portions being cut out and kept for reference, it would be possible to collate the information so obtained and throw considerable light on a common, but none the less important, problem.

The multiplication of observers and observations, and the variation in the conditions under which the pipes were used would enhance the value of the records, and the latter would not be lost sight of as are those obtained by individual observers. If this idea could be adopted in the case of this and other kindred problems, I feel sure the beneficial results would be apparent both to water engineers and consumers of water.

METHODS OF PURIFICATION ADOPTED AT WAKEFIELD.

With your permission, I will now direct your attention to two phases of our local water question, which I think may be of general interest. The first is in connection with the purification of water as practised by the waterworks company which supplied Wakefield from 1839 to 1879.

Water was drawn from the river Calder, at a point 1¼ miles below the city, and was at first considered pure enough for use without filtration. Subsequently (about the year 1850) sand filter-beds were constructed, but by the year 1860 the rapidly increasing pollution of the river (due to the growth of manufacturing towns and villages) rendered additional means of purification necessary. The water was described as being "as black as ink," and a few years later a letter written in the water of the Calder was put in as evidence before a Committee of the House of Commons. In the year 1863 a filter-bed (the first of a series of four) was constructed, embodying a process recommended by Mr. Thos. Spencer. This filter-bed consisted of a layer of 1 ft. of gravel under 2 ft. 6 in. of sand, and in the sand, about 12 in. below the surface, a layer of 12 in. of material described as Spencer's magnetic carbide of iron was placed. Mr. Spencer described this material as consisting of protoxide of iron in chemical combination with carbon, and stated that it was "produced by keeping hæmatite for twelve or sixteen hours at a certain red heat in contact with carbonaceous matter." According to Mr. Spencer's instructions one bed was to be allowed to lie fallow while the other three were in use. The beds were cleaned in the ordinary manner, the carbide of iron never being touched or even uncovered. The rate of filtration adopted was 600 gallons per square yard per

day, or 5½ in. per hour. Mr. Spencer laid stress on the necessity of carrying on filtering operations intermittently, and, speaking of the effect of his magnetic carbide before a Committee of the House of Lords in 1870, made the following statement: "It (the magnetic carbide) acts combustively upon the organic matter which is held in solution in the water, the matter in suspension being previously intercepted; so that all the organic matter in solution can be taken out."

Incidentally, I might mention that Mr. Spencer proposed to adapt his filter-beds for the treatment of sewage, and stated that, in his opinion, precipitation combined with subsequent filtration would be better than irrigation.

I have been unable to obtain a complete analysis of the water supplied in Wakefield after it had passed through the double set of filters, but I discovered a partial one, which stated that no trace of organic matter remained. The medical officer of health for Wakefield of that day gave evidence that after the installation of the system a remarkable reduction of epidemic disease took place; during the cholera epidemic of 1866 only one case occurred in the town, and that proved to be imported.

Mr. T. Netten Radcliffe, in a report to the Local Government Board, dated 1869, on the sanitary administration of Wakefield, described the condition of the water at the intake from the Calder as having "a black opaque appearance," and stated that the banks were covered with a black slimy mud; he goes on to say, "The change which the aspect of the water undergoes in the subsidence reservoirs (capacity two-months storage) is remarkable." After the water had been passed through the preliminary sand filters and Mr. Spencer's sand and "magnetic carbide" filters, he says, "the water is almost uniformly bright, clear, and well-tasted." It is only proper to add that while expressing a certain admiration for the results obtained, Mr. Radcliffe disapproved of the policy of continuing to draw water from such a foul source.

I have referred to this matter at some length in order to draw attention to the use which was made some fifty years ago of subsiding reservoirs, preliminary sand filtration and secondary sand filtration, combined with the use of an oxydising substance in the purification of an exceedingly bad water.

Notwithstanding the measure of success achieved by this system, neither the water company nor the corporation were content to continue the use of water from such a source, and for over twenty years attempts were made to obtain a purer supply, which, however, was not secured until the year 1888.

PLUMBO-SOLVENT ACTION OF WATER AND ITS PREVENTION.

The second local matter which I take this opportunity of referring to is the treatment rendered necessary by the plumbo-solvent action of the water. The present supply is obtained from peat-covered moorlands at Rishworth, on the Pennine Chain. The raw water has a strong action upon lead, being capable of taking up from 1 grain to 2½ grains of lead per gallon in twelve hours. When this supply was first used it was not filtered, but was decanted and delivered direct to the town. On the advice of Dr. Percy Frankland treatment was commenced in 1892, carbonate of soda being added at the rate of 3½ grains per gallon. Dr. Frankland advised this treatment for temporary use only, and suggested the use of lime and chalk as a more permanent measure. The soda treatment was efficient though costly, averaging 21s. per 1,000,000 gallons. As it was found desirable to filter the water in order to remove a clay stain which at times made its appearance, the question of treatment to neutralise acidity was considered in 1898 together with that of filtration. At that time it was generally understood that filtration through sand was sufficient to prevent plumbo-solvency; but in order to gain accurate information I carried out a series of experiments.

From these I found that filtration through river Ouse and river Trent sands was, at the outset, as efficient as the soda treatment in neutralising the acidity, but after constantly filtering the water at the rate of 4 in. per hour, through the same sample of Trent sand for three months, the filtered water was capable of dissolving lead to the extent of 0·35 grains per gallon in twelve hours when placed within a sealed lead pipe, the unfiltered water being capable of taking up 1·30 grains under the same circumstances. Water filtered through a fresh sample of Leighton Buzzard sand had its affinity for lead reduced so that it took up 0·42 grain per gallon, the raw water dissolving 1·10 grain per gallon, and at the end of two months' constant use the water filtered through this sand still took up 0·42 grain per gallon. Laboratory experiments showed that if a turbid, peaty water was allowed to stand until it was partially clear, or if it were passed through filter papers, the plumbo-solvent action was reduced. It was inferred that the action of the Leighton Buzzard sand, as regards the reduction of plumbo-solvent action, was mechanical, and that the action of the Trent and Ouse sands was at the outset chemical and mechanical; the chemical action, being reduced as a neutralising substance, was gradually eliminated from the sand. It was obvious that some treatment would be necessary in addition to filtration, and as the result of a long series of experiments the water is now treated with about 1½ grains of carbonate of lime per gallon before filtration, and about 1½ grains of quicklime per gallon (in the form of a clear solution of lime water) after filtration.

The addition of lime water after filtration is due to a circumstance which I have not seen noted elsewhere. Wakefield water, when treated with lime and chalk, must be rendered definitely alkaline in order that it may not take up lead. It was found that although the alkalinity of the water might be raised to such a point as to preclude plumbo-solvent action in passing through the filter bed, the alkalinity was reduced to below the safety limit. This reduction in alkalinity was not due to the removal of lime and chalk in suspension, since there was no loss when the water was passed through many filter papers. As far back as 1888 Mr. W. H. Power suggested that the plumbo-solvent action of soft moorland waters might be related to the agency (direct or indirect) of low forms of inorganic life. Dr. Houston, in the second of his able reports on this subject to the Local Government Board, dated 1901-2, makes the following statement: "While in moorland waters the cause of plumbo-solvency is to be traced to the presence of acid in the water, and the source of the acid to contact with the peat, the antecedent cause of the acidity seems to be associated, at all events in part, with the presence of acid-producing bacteria in the peat itself." It appears to be probable that at some seasons, if not at all times, these acid-producing bacteria lying in the film on the sand are responsible for the partial neutralising of the alkalinity previously imparted to the water.

The cost of treating the water with 1½ grains each of carbonate of lime and quicklime is from 3s. 6d. to 4s. per 1,000,000 gallons, against a cost of 21s. per 1,000,000 gallons for the soda process.

The carbonate of lime has been largely obtained from the Stockport Corporation, it being a waste product from their softening works at Wilmslow. This was, I believe, the first instance of the use of carbonate from a softening plant for the reverse process ("hardening").

CONTROL AND ALLOCATION OF SOURCES OF SUPPLY.

I now turn to a subject of wider interest—namely, the control and allocation of sources of supply. Much has been spoken and written on this subject, but I will only briefly recapitulate one or two of the recommendations already made.

The Fifth Report of the Royal Commission on Sewage Disposal, in dealing with the question of pollution of surface water, suggests the formation of a central administrative authority and of local rivers boards, and that their duties should include the protection of water supplies from pollution, and the collection of information as to available supplies, and also as to the need for water in the various parts of the country.

The Joint Committee on the Water Supplies Protection Bill, 1910, reasserted and emphasised the above recommendations, and in November, 1910, the House of Commons ordered a return to be made giving various particulars of water undertakings in every district in England and Wales, the results of which have not yet been published.

The Water Areas and Statistics Committee of our own institution issued a report on this subject in November, 1911, expressing general agreement as to the necessity for the creation of a central authority and local representative boards to deal with questions of water supply, such boards to be composed of experts in engineering, geology, chemistry, bac-

teriology and other sciences bearing on the subject. In the opinion of the committee it is advisable that such boards should be independent of authorities interested in the local undertakings, and that they should be charged with the duty of collecting and collating information as to existing works, areas of supply and possible sources from which water may be obtained, making reports to the central board, the latter being called upon to advise Parliament as to any scheme brought before it.

These recommendations have, I believe, the approval of the majority of those interested in the subject. The time has arrived when it is necessary that the fullest possible information as to our national supply should be carefully collected and considered by competent men, so that all questions relating to the protection and allocation of surface and underground waters may be dealt with in the light of the best available knowledge and on the broadest possible lines, having in view the interests of the community as a whole, rather than by the present method of piecemeal legislation, which often results in a conflict of interests of neighbouring communities and in unnecessary expenditure to defend them.

Cautious people may ask, What will be the result of the formation of the suggested boards? Is the tendency towards Government ownership? It may be so, but the difficulties are great, and if it comes at all it will, I think, be the final stage in an evolutionary process. The phase which we are approaching will, I believe, be the division of the country into areas supplied by water boards. The areas will in most cases be much larger than many of the existing units of supply. In laying out the limits of such areas it is of primary importance that the position and yield of all available sources, as well as the present and future requirements of the inhabitants, should receive careful consideration. Up to the present time the needs and resources of the country have not been considered from the point of view of the community at large.

In many cases it has been found desirable to form joint boards, or in some way to combine two or more districts in one area of supply, the arbitrary boundaries of municipal corporations or other local bodies rarely being ideal limits for the supply of water.

The financial advantages of combination are great; not only are expensive Parliamentary contests avoided, but it may be almost universally assumed that large works are cheaper to construct than small works. Another way in which economy can be secured by combination may be illustrated by a hypothetical case of three neighbouring towns each about to construct a reservoir at a cost of £100,000, the yield in each case being estimated to provide for the next twenty-one years. The total capital expenditure will be £300,000, and the total annual charges, including sinking fund and interest, will amount to about £15,000, or £315,000 in twenty-one years. Providing the physical conditions are such that the supplies are interchangeable, it would not be necessary, if the three towns combined, to construct the three reservoirs at once—the first only would be made immediately, the second at the end of seven years, and the third at the end of fourteen years; the annual charges for the first seven years would be reduced by £10,000, and for the next seven years by £5,000, a total saving of £105,000 to the present generation. This case is, of course, hypothetical, but it would not be difficult to find parallel cases in actual practice.

In existing cases where supplies are used jointly, the financial arrangements between the several parties vary considerably, each method having its own peculiar advantages and disadvantages; the following are the principal methods adopted:—

(1) The construction of works by one corporation, water being subsequently sold in bulk to other administrative bodies.

Here an attempt is made to render the supply of water merely a commercial transaction between the promoting authority and the others interested, and as the ordinary rules of supply and demand cannot apply, it is possible that one or other of the parties may ultimately find that the bargain is not satisfactory. If the prices to be charged for the supplies have been fixed before the works were completed, the agreed price of the water may bear no relation to the actual cost, and one side or the other will suffer. If the agreement be perpetual and no provision is made for a revision of price, a rise or fall in the cost of the water places one or other party at a disadvantage. On the other hand, the insecurity of terminable agreements is a weighty argument against them.

(2) The construction of works by one authority, water being supplied directly to the inhabitants of other districts, the water rents in the latter being usually higher than those charged within the area of the constructing authority.

Here the burden is unequally borne, the consumers in the outside districts assisting to pay off the debt on an undertaking in the ownership of which they will not ultimately share. On the other hand, if a heavy deficit occurs, as is sometimes the case, even when the rates charged are at the maximum, the ratepayers within the area of the owning authority will be called upon to make good the deficit.

(3) The construction of works by a joint board in which all the districts supplied participate, the water being supplied in bulk to each separate partner, the proportional payments to be made being determined prior to the supply being given.

This method has advantages over those described above, each of the districts being ensured a supply at cost price. In cases where the needs of all the districts grow at the same rate this arrangement is satisfactory. It will commonly be found, however, that the ratio of increase in demand will vary considerably, and frequent adjustments of the maximum quantities which may be drawn and the individual liability of each district will be necessary.

(4) The construction of works by a joint board, water being supplied directly by the board to all the inhabitants of the several districts on a uniform scale of charges.

The main argument against this scheme is that, although the consumers in all districts pay on the same scale, the cost per 1,000 gallons delivered may vary. This objection applies in a greater or lesser degree to all existing cases where a common scale is in force, and it would be necessary to have this point in view when defining the area of supply. Nevertheless, this method appears to be the best so far devised; the grave disadvantages incidental to terminable agreements are avoided, the cost of the supply is borne by all who have the use of it, and the whole of the consumers are assured of water for all time up to the capacity of the source or sources of supply.

THE CALDER VALLEY.

In order to illustrate the manner in which available sources are being appropriated, the interdependence of towns and rural areas, and the arbitrary limits of the areas supplied in the more densely populated areas, I have prepared two plans of the Calder Valley, one showing the catchment areas appropriated for public supply and other purposes, and indicating also the areas still unappropriated, and the other showing the areas supplied by eight authorities which share the duty of supplying practically the whole valley.

The Calder Valley has an area of 236,160 acres, or 369 square miles. The lower half is on the coal measures and the upper half on the millstone grits. The population in 1911 was 735,000, mostly engaged in industrial pursuits, the chief occupations being coal mining, engineering, and the manufacture of heavy woollen goods. The upper reaches of the Calder and its most important tributaries drain the moorlands and uplands of the Pennine Chain. The water is naturally soft, and its characteristics render it not only of service as a supply for domestic use, but also invaluable for many of the processes of the woollen trade. The catchment areas, from which a pure supply of water is to be obtained, have already been for the most part appropriated.

The main authorities concerned in the supply of water are the county boroughs of Bradford, Huddersfield, Halifax and Dewsbury, the boroughs of Wakefield, Batley, Morley and Todmorden. Of these Bradford and Dewsbury obtain their water from catchment areas outside the valley; only a small portion of the borough of Bradford and its area of supply are within the Calder watershed; but Dewsbury, and its area of supply, are entirely within its limits.

Population within valley supplied from catchment grounds within valley	568,000
Population outside valley supplied from catchment grounds within valley	74,000
Total population supplied from upper reaches of the Calder	642,000
Population in Calder Valley supplied from small works, wells and springs	29,000
Population within Calder Valley supplied from outside the valley	138,000

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The acreage of the catchment areas appropriated and unappropriated are shown below:—

	Acres.	Approximate yield for supply, million gallons per day.	Quantity required at present, million gallons per day.	Quantity available for future increase, million gallons per day.
Appropriated for public water supplies	21,677	21	16	5
Unappropriated	11,993	12	—	12
	33,670	33	16	17
Appropriated for use of canals and millowners	11,741	—	—	—

It would appear that there are still some 17,000,000 gallons per day available, but this is on the assumption that it will be possible to utilise the whole of the unappropriated catchment areas. It must, however, be remembered that during the past fifty years the best reservoir sites and gathering grounds have been selected for use; of those remaining a superficial investigation leads to the conclusion that in some cases the cost of the necessary works would probably be quite disproportionate to the quantity of water to be obtained. On these and other grounds it is advisable to reduce the available yield to 13,000,000 gallons per day. With the information at present obtainable, I estimate that this quantity will, at the present rate of consumption, provide for the next fifty years.

A forecast made for such a period may easily be vitiated by an increase in quantity of water required for sanitary purposes, or by alterations in the commercial processes of the district. The general tendency is for the consumption of water per head (apart from waste) to increase; hence it is possible that the resources of the watershed may be exhausted within thirty or forty years.

Now forty or even fifty years is a very short period when considering the needs of a large community. It is obvious, therefore, that in this case it is prudent to suggest, not only a careful examination of the upland sources of supply, which I have dealt with in my hasty survey, but also of all possible means of providing water from surface and underground sources within and without the watershed.

It is true that there is a considerable body of water in the coal measures, but apart from the disturbance and possible pollution caused by mining, the character of the water is variable, and it is often unsuitable for domestic and even trade uses. Through the kindness of Dr. McLean Wilson, chief inspector of the West Riding Rivers Board, and Dr. E. M. Chaplin, city analyst, Wakefield, I have inspected the analyses of nearly 100 samples of water from collieries, &c., in this neighbourhood; the water is often saline, the total solids are usually high, in many instances upwards of 100 grains per gallon, and in one case over 2,000 grains per gallon (largely sodium chloride). The hardness is often high, ranging, in a large number of cases, from 30 deg. to 60 deg., and in one case running up to over 400 deg. In a few cases water from the coal measures is used for trade purposes, but it requires softening before it can be applied to many of the local industries, and is liable to fluctuate in quality.

The boundaries of the areas supplied have not in all cases been formed on well-defined principles; the present situation is the outcome of competition, compromise and sporadic growth. The trunk mains cross and recross one another, and in one instance three such mains, owned by different authorities, are laid side-by-side in the highway for a considerable distance. A study of the two maps will, I believe, make clear the possibilities in the directon of co-operation and co-ordination, and will lead to the conclusion that such co-operation will be necessary before the resources of the watershed can be fully developed on the most economical lines to the general advantage of the inhabitants.

CONCLUSION.

I have ventured to bring these facts, figures and diagrams before you because I believe that, slight as they are, they afford better evidence than general statements or expressions of opinion as to the necessity for the adoption of some scheme whereby full and complete information as to the country's water supply may be obtained and properly considered. It is, I think, obvious that a central board in possession of this information would be in a position not only to advise as to the desirability of schemes before Parliament, but would be able to indicate broadly the lines of development which would make for the economical conservation and distribution of this prime necessity of life in any particular area.

[Our account of the meeting at which the foregoing address was delivered will be continued next week.—Ed. Surveyor.]

LAND SETTLEMENT IN VICTORIA.

POSSIBLE EFFECT OF THE COUNTRY ROADS ACT.

According to the *Age*, Melbourne, one of the chief difficulties in the way of the effective administration of the Country Roads Act lies in the existence of "areas of unoccupied lands, involving wasteful expenditure before reaching the occupied country beyond," and our contemporary expresses the hope that the chairman will be encouraged to adopt the enlightened policy of New Zealand, where road making and land settlement go together, and "selectors" are allowed to go at once on to areas which have been surveyed, and to do their own clearing at so much an acre. In Victoria "the settlers are kept off the land and made to stand by, looking on while the land, in miserable driblets, at long intervals, is being 'made available.'" Our contemporary points out that by making a firm stand with respect to the blocking of an irrigation project by the owner of a grazing estate of some 40,000 acres, the head of the Irrigation Department succeeded in converting the Government to a liberal and far-sighted policy with regard to the development of the country by irrigation, and it is suggested that similar principles should be recognised in the development of land by roads. It may be pointed out, however, that there is a vital difference in principle between the two kinds of development. In the case of irrigation, that which is conveyed along the channels, the irrigation water, has to be provided as a part of the project, and its amount is defined between minimum and maximum limits. In the case of a road carried across waste lands, that which is conveyed is traffic which is free to come and go, and may gradually make more and more use of the road, beginning at one end or both. A suitable width of land, sufficient for future needs, being acquired at the outset, it is only necessary to make a hard carriageway of some 9 ft. in width, widening proceeding from the ends as the land gradually develops. If the policy of the Government as regards the development of such lands is unsatisfactory, it is, of course, to be desired that it should be amended; but it does not seem necessary or desirable that Mr. Calder should be called upon to take heroic measures in the matter. Surely the existence of a good road, made with the minimum of initial outlay as regards the carriageway and the larger bridges, but well provided with culverts and all necessary drainage—surely such a road would in itself be the best of arguments in support of a liberal policy of land development.

Apart from matters of general policy, and the construction of roads in unsettled areas, the board has plenty of work to do in the immediate future in putting into good order roads which already carry a considerable amount of traffic when they are in good condition, and would carry much more traffic if they were always in good condition. Another Melbourne journal, the *Argus*, points out that many important main roads are in a very bad state, citing as an example the road from Melbourne to Geelong, which, though it is only 45 miles in length, includes stretches which are almost impassable for any kind of vehicle. The motor car reliability trial between Melbourne and Sydney showed that the main roads were in many places in a very bad state, a place only 12 miles from Wangaratta bearing the ominous name of "the gluepots."

It is encouraging to find in the Melbourne papers these well-reasoned articles, pointing on the one hand to considerations of general policy, and on the other hand to works of immediate necessity which may be undertaken by the board pending their general study of the needs of the State as a whole. It is clear that the creation of the board is welcomed as tending both to relief from obvious evils and to the development of a general policy of road improvement which will have an important influence upon the welfare of the State.

THE RATIONAL USE OF DISINFECTANTS AND ALGICIDES IN MUNICIPAL WATER SUPPLIES.*

By KARL F. KELLERMAN,
United States Department of Agriculture.

The usefulness and hence the actual value of even a safe water may be greatly reduced, as Whipple† has pointed out, through the occurrence of disagreeable tastes and odours. This deterioration is almost always due to the growth of algæ or fungi in the reservoir, lake or river, or even in the pipe lines themselves. Since 1904 copper sulphate has been used to eradicate or to reduce the development of these troublesome organisms, and the method of copper treatment‡ outlined in 1904 and 1905 has been not materially changed. The large number of samples from ill-smelling water supplies sent to me for identification and advice as to treatment has enabled me to tabulate the occurrence of the more troublesome species, as well as to determine suitable treatment for each of these.

The following table shows the occurrence by States of the twelve genera of algæ most frequently reported to me during the past eight years as troublesome. The use of copper sulphate for the control of these algal pollutions has now been thoroughly tested, and I believe this method should be adopted wherever tastes and odours in water are caused by algæ.

TABLE SHOWING THE OCCURRENCE OF GENERA OF ALGÆ MOST FREQUENTLY REPORTED AS CAUSING TROUBLE IN RESERVOIRS AND PONDS.

	Anabaena	Beggiatoa	Asterionella	Chara	Cladophora	Clathrocystis	Conferva	Crenothrix	Fragillaria	Navicula	Oscillatoria	Spirogyra
Arkansas	—	—	—	—	+	—	—	—	+	+	—	—
California	+	+	—	—	+	+	+	—	+	+	+	+
Colorado	-	—	+	+	—	—	+	—	—	—	+	+
Connecticut	+	—	+	—	—	+	+	+	—	—	+	+
Dist. of Columbia	-	—	—	—	—	—	+	—	—	—	+	—
Georgia	—	—	—	+	—	—	—	—	—	—	—	—
Idaho	-	—	—	—	—	—	—	+	+	—	+	+
Illinois	-	—	—	—	+	+	+	+	—	+	+	+
Indiana	-	+	+	-	—	—	+	—	—	—	+	+
Kansas	-	-	—	—	—	—	+	—	—	+	+	+
Kentucky	+	+	—	—	+	+	+	+	—	—	+	+
Louisiana	-	—	—	—	—	—	+	—	—	—	—	+
Maine		—	+	+	—	—	—	—	—	—	—	—
Maryland	+	-	—	—	—	—	—	—	—	+	+	+
Massachusetts	-	+	—	+	+	+	+	—	+	—	+	+
Michigan	+	—	—	+	—	+	—	—	—	+	—	—
Minnesota	-	+	-	—	+	+	—	+	—	—	+	—
Missouri	+	—	—	+	+	+	+	+	+	+	+	+
Montana	+	—	—		—	—	—	—	—	—	+	—
Nebraska	-	—	—	—	—	+	—	—	—	+	—	+
New Hampshire	-	+	+	—	—	—	—	+	—	—	—	—
New Jersey	+	+	—	+	+	+	+	—	+	—	+	+
New Mexico	-	—	—	+	—	—	—	—	—	—	+	—
New York	+	+	+	+	+	+	+	+	+	+	+	+
Ohio		+	-	+	+	—	+	—	—	+	+	+
Oklahoma	-	—	—	—	—	—	+	—	—	+	—	—
Pennsylvania	+	+	+	+	—	—	+	—	+	+	+	+
Rhode Island	-	—	—	—	—	+	—	-	—	—	—	—
South Carolina	-	—	—	—	—	—	+	—	—	-	—	—
South Dakota	—	—	-	—	—	—	+	—	—	+	+	+
Tennessee	-	—	—	+		—	—	-	—	-	—	—
Texas	-	—	-	+	—	—	+	—	—	+	+	+
Vermont	-	—	-	-	—	—	—	—	—	+	+	+
Virginia	-	+	—	—	—	—	+	+	+	+	—	+
Washington	-	-	—	—	—	—	—	—	—	—	+	+
West Virginia		—	—	—	—	—	—	-	—	—	—	+
Wisconsin	-	—	—		+	—	+	+	-	+	+	+

For the convenience of those who wish to superintend personally the treatment of water for removing algal pollutions, I have prepared tables showing the quantity of copper sulphate required to eradicate the more common forms, and also the concentration beyond which copper sulphate may be dangerous for several kinds of fish.

TABLE SHOWING QUANTITY OF COPPER SULPHATE REQUIRED TO KILL VARIOUS FORMS OF ODOUR-PRODUCING ORGANISMS.

Copper sulphate expressed as parts per million.

Anabaena,	·09	Kirchneriella,	5·00 to 10
Asterionella,	·10	Leptomitus,	·40
Beggiatoa,	5·00	Microspora,	·40
Chara,	·20 to 5	Navicula,	·07
Cladophora,	1·00	Oscillatoria,	·10 to ·40
Cladothrix,	·20	Peridinium,	2·00
Clathrocystis,	·10	Scenedesmus,	5·00 to 10
Coelosphaerium,	·30	Spirogyra,	05 to ·30
Conferva,	·40 to 2	Ulothrix,	·20
Crenothrix,	·30	Uroglena,	·05
Euglena,	1·00	Volvox,	·25
Fragillaria,	·25	Zygnema,	·70
Hydrodictyon,	·10		

TABLE SHOWING SAFE LIMIT FOR TREATING WATER WITH COPPER SULPHATE WHEN CERTAIN FISH ARE PRESENT.

Copper sulphate expressed as parts per million.

Black bass,	2·10	Pickerel,	·40
Carp,	·30	Suckers,	·30
Catfish,	·40	Sunfish,	1·20
Goldfish,	·50	Trout,	·14
Perch,	·75		

* Extract from paper submitted at the Eighth International Congress of Applied Chemistry.

† Whipple, Geo. C., "The Value of Pure Water," p. 39. New York, 1907.

‡ Moore, Geo. T., and Kellerman, Karl F., "A Method of Destroying or Preventing the Growth of Algæ and Certain Pathogenic Bacteria in Water Supplies" Bulletin 64, Bureau of Plant Industry, U.S. Department of Agriculture, 1904

Moore, Geo. T., and Kellerman, Karl F., "Copper as an Algicide and Disinfectant in Water Supplies." Bulletin 76, Bureau of Plant Industry, U.S. Department of Agriculture, 1905.

THE SURVEYORS' INSTITUTION.

PRIZE WINNERS IN INTERMEDIATE EXAMINATION.

The pass lists in the recent professional examination of the Surveyors' Institution were issued last week, the prize winners being as follow:—

PRELIMINARY EXAMINATION.

George Back, 19 Harley-street, Cavendish-square, W.

INTERMEDIATE EXAMINATION.

Quantities.—Thomas Cuthbertson Hill, Helvellyn, Ambleside-avenue, Streatham, S.W.; Sydney Vernon Drew, 14 Lavender-sweep, Clapham Junction, S.W.

Constructive and Working Drawings.—Morris Leedham, 25 The Crescent, Hipperholme, near Halifax.

Beadel Prize. Agriculture.—Percy Edward Clarke, 6 Carlyle-road, Lakenham, Norwich; Colin Gordon, South-Eastern Agricultural, Wye.

Institution Prize. Highest Student.—Noel Ward King, 53 Talgarth-road, West Kensington, W.

Special Prize.—Goodman George Winebaum, 13 Shiplake-buildings, Calvert-avenue, Bethnal Green, N.E.

Driver Prize. Highest Non-Student and Penfold Silver Medal Highest Intermediate.—Henry Moulton Hodson, Rhyddington, Clifton Drive, Lytham, Lancs.

FINAL EXAMINATION.

Crawter Prize. Principles Valuation.—Frederick Stewart Eden, 18 Bowes-road, Palmer's Green, N.

Penfold Gold Medal. Highest Final.—Maurice Kershaw Matthews, 77 Tottenham Court-road, W.

Galsworthy. Highest Inter. and Final.—Louis Michael Dell, District Valuer's Office, Windsor House, Shrewsbury.

SCOTTISH EXAMINATIONS.

Highest Intermediate.—Stewart Salmond, Sandilands, Limekilns, Fife.

Royal Institute of British Architects.—At a meeting to be held on Monday evening next, consideration will be given to a motion suggesting that the Board of Professional Defence should be instructed forthwith to prepare a detailed scheme for the creation of a fund for mutual aid and advice (legal) for members of the institute as necessity may arise.

Models of Old London.—Mr. John B. Thorp, whose well-known models of Old London are now being permanently exhibited at the London Museum, has received a commission from Colonel Leetham to prepare a model of Whitehall in the reign of Charles I. Not only has the year been fixed upon, but the actual day, as in the model will be shown the scaffold on which Charles I. was executed on January 30, 1649. The model, which is to be made to about $\frac{1}{100}$ full size, is to be presented to the Royal United Service Institution by Colonel Leetham.

Office Conversations.

MORE OR LESS IMAGINARY.

[*Contributed.*]

XV.—A Day Off.

You called to see me yesterday, Mr. Marrion? Surprised that I was away? Where was I? Well, there's no harm that I can see in telling you. I was attending a meeting of the professional society which I honour with my membership. Away all day? Yes, I left by the 8.35 and didn't return until the last train Had a shave for that, too. Oh, a rattling good day—thoroughly enjoyed myself in every way. Inconvenient? For the district? Fail to grasp your meaning, Mr. Marrion. Surely the district can do without me one day. Goodness knows, it gets enough out of me. I dance dalliance upon it, week in and week out, and can scarcely get even an occasional Sunday off to myself. Work all the day, committees three evenings a week—and then just because I have a few hours off—— You weren't complaining? No, I credit you with more sense, Mr. Marrion. You think that, as chairman of the council, you should have been acquainted with the fact that I was going away? Yes, I know it's the practice in small one-man districts; but surely here, with a competent deputy and two or three assistants, it's not necessary.

* * * *

Always understood it was the custom? No, Mr. Marrion, it's quite the reverse, except in the case, as I have said, of one-man districts, and even then it's only a chairman here and there that'll expect it. To come to the point, what useful purpose does it serve? There's Mr. Verstall in the adjoining district. I believe he always does it. And the result is that he can't call his soul his own. He spends half his time attending upon the chairman. His very reports are gone through, all of them, by the chairman before he dare so much as to commit them to form for presentation. It's a bad practice, Mr. Marrion. The surveyor's the servant of the ratepayers—so far, that is, as he's a servant at all—and anyway he's not a servant either of the chairman or of the council. As I've endeavoured more than once gently to impress upon the council, he's their technical adviser; and a meeting once over, no councillor—not even the chairman, saving your presence, Mr. Marrion—has the least right to endeavour to exercise control over him. Of course, I'm not one of those idiotic sticklers for what people call their rights. I'm always willing to consult a councillor—you know that, Mr. Marrion—but the line must be drawn somewhere, and I can't have any formal control of my actions. If you think I ought to have given you notice, well and good; bring the matter before the council, and if they give me their instructions to do so in future, there's an end of it.

* * * *

You don't wish to do anything of that sort? Right then, Mr. Marrion, and we can cry quits. By the by, did it ever strike you that in attending a meeting such as that of yesterday I was consulting the best interests of the ratepayers? No, I suppose it never did. Will I explain? Willingly—it'll be a pleasure to me and, I hope, a bit of an eye-opener to you. This town's not what we could call exactly a progressive one. True, there's been a bit of good work done recently, but things have fallen flat again and I've not much on beyond routine work. The trams? Oh, yes, it'll be a bit of a lift when they come along. Anyway, there's not much on now, and if it wasn't for the one professional organ which I read weekly, and an occasional attendance at a meeting, why I should rust entirely out. What do we do at these meetings? Mutual admiration society? Oh, no, Mr. Marrion, we're hardly that. We meet largely for the purpose of discussing papers bearing upon the matters with which we have to deal in our work. Yesterday, for example, we had a splendid paper on the treatment of road surfaces, and the discussion was most animated: in fact, I think I learned more from the discussion than from the paper. Did I enter into it? Yes, I did, and got pretty considerably sat on. The discussion, for quite a long time, switched right off from the actual points in the paper, and the attack was diverted upon some of the points I raised. Still, I flatter myself that I held my own. Pleased with myself? Yes, I must feel guilty to a little feeling of elation when I recall——

* * * *

But there, you don't want to hear that. My contention is that what I learned yesterday is mine only on trust. I'm not going to write a book or an article on it. I'm merely going to use my added knowledge for the benefit of the district. Expect to see some startling improvements? No, you won't have anything of the kind. A little extra efficiency with a trifling saving in cost will be about the sum total; but repeat these items a score of times in a year and they bulk pretty considerably. Sludge disposal comes up for discussion at our next meeting, and you know the trouble we're experiencing with our sludge. I don't say that I shall come back—I suppose I *may* go to the meeting, Mr. Marrion? All right, it's only my joke—I don't say I shall come back with a solution of our problem; but I'll certainly come back knowing a little more about sludge disposal. Surely that must be for the benefit of the district! And the same applies to all the other matters with which the council has to deal. Why, if it wasn't for these meetings, where one can rub shoulders with one's fellows and exchange ideas, there'd be very little progress at all. Do you realise that before many years councils 'll be called upon invariably to pay the expenses of their officers in attending these meetings? Well, it is so; and—by the way, do you think that the council would be disposed to pay yesterday's expenses for me? They—— What, going, Mr. Marrion? Well, good-bye, if you can't stop, but I'd like to have had your opinion on the point.

* * * *

Poor old Marrion, he's not a bad sort. Wish he'd stopped and discussed the matter, though. I might have got something definite out of him. Mr. Bankes? Show him in, Miss Bruce. What, are you on the warpath too, Mr. Bankes? I've just had the chairman in about it. You don't get paid for days off? And you don't see why I should? No, neither do I, Mr. Bankes, and I'm willing to forego my pay on any day that I'm off duty on the condition that I receive pay for all the overtime I'm on duty. I reckon it 'd pan out to a considerable sum at the end of the year. Give and take, Mr. Bankes, and I'm with you; but to have it all one side—no, that won't do at all. You're a labour man, aren't you, and surely you should be among the first on the council to see that the employees have their due. Look at my salary? Yes, and look at the work I have to do, and the training I have had to undergo to fit me for it. I don't want to be personal, Mr. Bankes, but you're a carpenter, aren't you? And you receive something like £3 a week, on the average, when you're in full work. You've the one trade at your fingers' ends, and that sums up your capacity for money earning. Now, I have about a score of lines, all run into one under the comprehensive term "municipal engineer," and I receive something less than three times what you do. I have a position of a sort to maintain, too. *I* can't live in a ten-shilling-a-week flat, and I can't send my kids out for free education or travel "workman" or anything of that sort. You'll allow all this, won't you? What am I driving at?

* * * *

What am I driving at? Why, that the reason you don't give me and my staff proper support is that you're jealous of us. You feel that you're the master, as being a councillor, and we're the men, and you ask yourself: Why should they get more than I do? This question of my pitiful day off's only a pretext, Mr. Bankes, to have a fresh attack on our salaries. But you'll never get them down, Mr. Bankes, if you hold the floor through a dozen meetings. What I regret to have to call the decent members, as contrasted with the labour members, are too strong for you. There 'll be another election soon? Yes, and I don't think there 'll be much increase in labour representation. To use one of your own expressions, the ratepayers are about fed up. The paltry attacks on

officials and the endeavours to defer increases in salary may endear you to a certain section, but that section's not the strongest by any means. No, I don't want to quarrel, Mr. Bankes. Far from it; but it does me good to get it straight off the chest at times. I can't help it, in fact, and there you are.

* * * *

You meant no offence about yesterday? No, and I meant none in what I have just said. We've both spoken our minds, and there's an end of it. If you care to bring the matter up at the council meeting, you—— Oh, you've no idea of doing that? Glad to hear it, I'm sure; although—— Always respected me? Been a friend to me as far as you could? Hum! Well, I'll take your word for it, Mr. Bankes. And now's your chance to be still further a friend. I went yesterday to attend a meeting—a meeting of my professional institution. As I've explained to Mr. Marrion, in attending this sort of thing I am really acting in the interests of the council and the ratepayers. There's been a lot of talk lately about surveyors being paid the expenses of attending meetings, conferences, and so forth, and I'm thinking of applying to the council for yesterday's expenses. You see—— Must be going? Another engagement? Sorry you can't stay; but you won't forget, will you? A couple of sovereigns 'll cover them, and——

LONDON'S MAIN DRAINAGE.

NEW PUMPING STATION AT STRATFORD.

Last week the new engine-house at Abbey Mills pumping station, Stratford, E., was formally opened by the chairman of the London County Council, Mr. Cyril S. Cobb. The building is 180 ft. long by 42 ft. wide, and contains seven centrifugal pumps, with suction and delivery pipes of 38-in. diameter, capable of dealing with a total of 700 tons per minute. Each pump is direct-coupled to a vertical gas-engine.

Gas has been chosen as the motive power in preference to the installation of steam plant, which would have called for a constant head of steam, and on account of the intermittent demand for working the engines it was decided not to manufacture producer gas at the station.

The admission of water from the low-level sewers is controlled by four hydraulically worked penstocks, two being 7 ft. 6 in. in diameter, and the other two measuring 6 ft. by 5 ft. 6 in. The combined total capacity of the pumps at Abbey Mills, both steam and gas driven, is now 1,300 tons per minute.

The engine-house was designed and commenced as part of the extension of the main drainage system, under the direction of the late chief engineer of the council, Sir Maurice Fitzmaurice, and has been completed recently by the present engineer, Mr. G. W. Humphreys. The construction of the building and the sewer work generally has been supervised by Mr. J. E. Worth, assistant engineer (for main drainage on the north side of the Thames), and Mr. H. M. Rownthwaite, the council's mechanical engineer, has been responsible for the machinery. The buildings and sewers have been erected by Messrs. Perry & Co., Limited, of Bow; the gas engines have been supplied by the Premier Gas Engine Company, of Sandiacre, Nottingham; the pumps by Mr. John Cochrane, of Barrhead, Glasgow; the air compressors by the General Engine and Boiler Company, of New Cross; and the penstocks by Messrs. J. Blakeborough & Sons, of Brighouse.

Town Planning Conference.—The Greater London conference of local authorities to consider practical town planning administration was held last week at the Westminster Palace Hotel, Alderman W. Thompson in the chair. In the course of the proceedings a comprehensive report compiled by the secretary, Mr. Henry R. Aldridge, containing a record of the complete procedure in the Quinton, Harborne, and Edgbaston town planning scheme of the Birmingham City Council was considered.

NEW PARK AT BECKENHAM.

MR. JOHN BURNS AND OPEN SPACES.

Acquired last year by the urban district council, at a cost of £5,000, Kelsey Park, Beckenham, comprising 24 acres of beautifully wooded gardens and ornamental water, was on Saturday opened to the public by Mr. John Burns, president of the Local Government Board. This is the fourth open space to come into the possession of the local authority, all these pleasure grounds being well distributed over the parish. The newly acquired park has been laid out under the superintendence of Mr. J. A. Angell, Assoc.M.Inst.C.E., the surveyor, whose plan would seem to have the unstinted approval of Mr. Burns, judging by the complimentary remarks he made on what he referred to as the "letting alone" of the ground with which Mr. Angell was called upon to deal.

Holding as he did the view that expenditure upon parks was justified, Mr. Burns said that had a larger loan for a larger area been applied for by the district council he would have sanctioned it. Although Beckenham had now some 62 acres of public park and recreation grounds, that would not be sufficient in 50 or 100 years' time, and therefore now that land was cheaper than it would be ten, twenty or forty years hence, the local authority would be well advised to purchase what open spaces it could. London, for its size, had been a model and exemplar in the matter of open spaces, gardens and parks for the rest of the world. Eleven per cent of the total acreage of London was parks, gardens and open spaces, and Berlin, Paris and other large cities were far behind that. Open spaces reduced the death-rate, and Is. spent upon a park in 1913 was better than £100 spent upon a hospital or a sanatorium twenty years hence. He was Minister for health, and had come there to lay the foundation of something better than a hospital, as good as a sanatorium, and a very effective substitute for a private garden.

The Lake, Kelsey Park, Beckenham.

Public Health Law (By Sydney G. Turner. St. Bride's Press, Limited, 24 Bride-lane, Fleet-street, E.C. Price 10s. 6d. nett).—A manual for municipal and county engineers and surveyors, town clerks, clerks to district councils, and other officers, and to members of local authorities. The book is designed to be specially useful to officials in the preparation of reports and in the administration of the law, and to members of local authorities in the discharge of their public duties. It is also of value to students preparing for examinations as municipal engineers and in public health law. The subjects treated of from a legal point of view include the meaning of "sewer" and "drain," sewage disposal, sanitary fittings, river pollution, infectious diseases and hospitals, new streets and buildings, private streets, highways, open spaces, markets, slaughter-houses, housing, &c. This is, we believe, the first time these matters have been dealt with each in a separate chapter, which makes the book easy for reference. There are no reprints of Acts *in extenso*, but under each topic are given the Acts and clauses which refer to it. . . . We should say the work ought to occupy a place in every sanitary authority's office.—*Local Government Journal.*

Law Notes.

Edited by J. B. REIGNIER CONDER, 11 Old Jewry Chambers, E.C., Solicitor of the Supreme Court.

The Editor will be pleased to answer any questions affecting the practice of engineers and surveyors to local authorities. Queries (which should be written legibly on foolscap paper, one side only) should be addressed to "The Law Editor," at the office of The Surveyor, *accompanied by the writer's name and address, but correspondents who do not wish their names to be published should also furnish a "nom de plume." Where necessary, copies of local Acts or documents referred to should be enclosed.* **All explanatory diagrams must be drawn and lettered in BLACK ink only, and in such style as to be fit for direct reproduction—i.e., without re-drawing or amendment.** *Unless these conditions are complied with we cannot undertake to reply to queries.*

Sewage Disposal: Flooding: Liability of Local Authority.—The decision of the House of Lords in the case of *Hanley* v. *Edinburgh Corporation* is of considerable interest. This was an appeal by the pursuer from the decision of the Court of Session, reversing the judgment of the Lord Ordinary in the appellant's favour. It appears that part of the sewage of the City of Edinburgh flows into a burn, which, for a portion of its course, forms the southern boundary of the Craigentinny estate. The district in which the pursuer's market garden is situate was annexed to the City of Edinburgh by the Edinburgh Corporation Act, 1900. By sec. 23 of that Act it was provided that the corporation should not have power to diminish the supply of sewage water flowing through the burn, and used for irrigating the estate, or to deepen or otherwise interfere with the burn so far as passing through the estate. On two occasions, in 1909, after heavy rainfalls, the burn overflowed, and flooded the pursuer's market garden. Since 1900 there had been no increase in the quantity of sewage or surface water discharged into the burn, but a greater portion of the drainage area had become impervious, consequent on building and paving operations, with the result that the surface water found its way into the burn with greater rapidity. The amount immediately involved in the case was small, but the question of liability for future damage was also dependent on the decision, inasmuch as, unless preventive measures were taken, further flooding must inevitably take place. The House allowed the appeal with costs, and restored the decision of the Lord Ordinary, awarding the pursuer £150 damages. Lord Shaw, in the course of his judgment, said that the pursuer maintained that on the dates mentioned the burn in spate rose until the culvert, as constructed, could not carry its waters away. These accordingly gathered until they flooded the Lochend meadows to a considerable height. The water thus dammed back burst over the road and flowed down across the pursuer's land. As the road and drainage authority it was the duty of the corporation to see that proper provision was made to prevent the flooding of this land. They were negligent in not providing a proper culvert to carry off the storm water, and so prevent damage to the pursuer's and any one else's property which happened to be at a lower level, and which, in the circumstances, whenever there was a heavy fall of rain, was liable to be flooded. In his Lordship's opinion the corporation were liable. The Lord Chancellor and Lords Kinnear and Mersey concurred.

QUERIES AND REPLIES.

In order to avoid confusion querists are requested to use distinctive words as **noms de plume**. *The letter* **X**, *combinations such as* **X.Y.Z.**, *and words such as "*engineer*" and "*surveyor,*" should never be used.*

Electric Lighting.—"Sparks" writes: About seven or eight years ago a shopkeeper in this borough put down a small installation for supplying electric light to his shop and premises, and has since extended the wires from the rear of his premises (not crossing any street or place of public resort) so as to supply electric light to seven or eight other shops and houses. There is no public electric supply undertaking in the town, and I shall be glad to know, in the event of the corporation carrying out an electric supply scheme, if the shopkeeper has, by virtue of what he has done, monopolised the supply of electric current, or has he in any way to be considered by the corporation?

No. Sec. 1 of the Electric Lighting Act, 1888, provides that the grant of authority to any undertakers to supply electricity within any area, whether granted by licence or by provisional order, shall not in any way hinder or restrict the granting of a licence or provisional order to the local authority, or to any other company or person, within the same area.

Personal Injury: Liability.—"Wilkie" writes: The work of flushing sewers in this district (rural) is done by carting contractors who are engaged by the council (through their surveyor) and paid at team-labour rate. A few weeks ago, while one of the cartmen was engaged in this work, a young woman rushed in between the cart and the pantry wall and was injured. A claim has been made for compensation. Is the contractor, who sent one of his men to do this work, or the council liable—that is, of course, if it can be proved that there has been negligence on his part?

As a general rule where an independent contractor is employed the person or body employing him is not liable for the negligence of the contractor or his servants, unless such employer has the power of controlling such servants and of regulating the manner in which they do their work. To this rule, however, there are certain exceptions, of which the two following are material in the present case—viz., (*a*) where the contractor is employed to execute certain work which the employer is under a positive statutory obligation to execute, and (*b*) where the contractor is employed to do work in a place where the public are in the habit of passing, which work will, unless precautions are taken, cause danger to the public. Whether the present case is within exception (*b*) may be doubtful, but in my opinion it is clearly within exception (*a*), as the council have a statutory duty to cleanse their sewers. I think, therefore, that the council would be liable if negligence could be proved. See *Hardaker* v. *Idle District Council*, 1896, 1 Q.B., 335.

Building Line.—"Urban" writes: I should esteem it a favour to have your opinion, also if you would inform me of any test case on the following matter: In an urban district there is a vacant piece of land at the corner of a main and side road. (1) In case of the erection of a shop with frontage to the main road, can the local authority insist on the return side of building keeping back to the proposed building line of a side road, or can the building be brought right up to the back edge of the footpath in the side road? In other words, can a corner building be compelled to comply with the building line in two roads? (2) [*a*] Does it affect the question whether there are buildings in the side road or not, [*b*] main roads or not, [*c*] shops or dwelling-houses at corner plot?

(1) A building may be in two roads for the purposes of sec. 3 of the Public Health (Buildings in Streets) Act, 1888. Whether it is in both roads or not is a question of fact for the magistrates to decide (*Warren* v. *Mustard*, 56 J.P., 502). This section prohibits the erection of a building beyond the front main wall of the building on either side thereof in the same street. (2) [*a*] Yes. If there is no building in road B, or no building sufficiently near to be on one side of the proposed building for the purpose of the Act, the section will not apply, and the building need not be set back. See per Lord Justice Fry in *Ravensthorpe Local Board* v. *Hinchcliffe* (24 Q.B.D., 168); *Regina* v. *Chiswick Urban District Council* (72 J.P., 165). In the last case a building 800 ft. distant was held not to be sufficiently near. [*b*] No. The question whether there is any building in the main road or not does not affect the question as to the application of the Act with respect to the other road. [*c*] No.

Extraordinary Traffic.—"T. I. B." writes: During the past three years a water company have constructed waterworks which are now complete. An arrangement was made for the payment of the costs of the damage done to the roads by the traffic during the construction of the works, and this has been duly carried out, quite satisfactorily, by the contractors. The works being completed, the company are now hauling coal over 2 miles of highway by motor wagon, and doing considerable damage. Will you kindly inform me if this coal haulage comes under the definition of extraordinary traffic? My impression is that it is extraordinary for a period. What is that period? Can you quote any cases bearing hereon?

The question whether traffic is extraordinary has to be determined by reference to the ordinary traffic on the particular roads, and to the character of the roads. If the traffic in question is out of the common order of the traffic on these roads, and substantially increases the burden imposed by the ordinary traffic, it would probably be held to be extraordinary traffic. Under the Locomotives Act, 1898, sec. 12, sub-sec. (*b*), proceedings must be commenced within twelve months of the time at which the damage was done, or where the damage is in consequence of any particular building contract, or work extending over a long period, not later than six months after the completion of the contract or work. See *Mayor of Wolverhampton* v. *Salop County Council* (64 L.J.M.C., 179); *Norfolk County Council* v. *Green* (68 J.P., 223); *Geirionydd Rural District Council* v. *Green* (72 J.P., 321).

Assistants' and Students' Section.

CONDUCTED BY SYDNEY G. TURNER, ASSOC.M.INST.C.E.

All communications in regard to this page must be addressed to The Editor, St. Bride's House, 24 Bride-lane, Fleet-street, E.C. *Envelopes must be marked "Assistants' Section" in the top left-hand corner. Correspondents are invited to submit questions for consideration and answers to the questions which appear. For the contributions considered to be the most meritorious, one or more premiums in books will be awarded monthly. Diagrams must be drawn to scale on separate sheets, ready for reproduction.*

THE MONTHLY PREMIUM.

The contributions during the past month have not, in the opinion of the adjudicators, been such as to justify the award of the full premium. They have, however, decided to award a half premium to

Mr. A. V. COLE,
Town Hall,
Nelson,

whose reply to Question 320 was the best received during the month.

QUESTIONS.

This week answers are invited to the following questions:—

324. Oil Engines.—Assuming two engines of equal horse-power (4-h.p.), one an oil engine and the other a petrol, what would be the approximate cost for running each engine for fuel and repairs? How would the costs compare with each other, including first outlay and oil, repairs, &c.? In regard to efficiency, which engine would be the more efficient from an economic standpoint? ("Griffo.")

325. Air Compressors.—How is the size of an air receiver calculated in connection with an air compressor? Of what thickness of metal would it be made if (1) of cast iron, (2) wrought iron, assuming it had to withstand a pressure of from 15 lb. to 40 lb.? Give any further particulars regarding same. ("Griffo.")

327. Flow of Sewers.—State the advantages of egg-shaped and circular sewers, and give conditions under which such advantages would occur. Give proofs of velocities and discharge. (D. G. B., *Darlington.*)

328. Concrete Paving.—Give details of the construction of wooden moulds for concrete pavement slabs, and explain the method of using them. ("Beginner.")

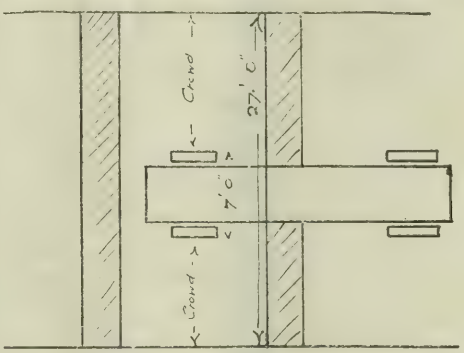
329. Sewerage.—Using the generally accepted most accurate formula, at what gradients must 9-in., 12-in. and 15-in. pipe sewers be laid to give a uniform velocity of 4 ft. per second when flowing two-thirds full? ("M. C. E.")

330. Sewage Disposal.—Design a small sewage disposal system for a gentleman's residence, capable of dealing with 500 gallons per day. The sewage is fairly strong on account of the drainage from a small cowshed. The available fall can be neglected, and the earth is of a sandy-clay nature. State approximate cost. The effluent should discharge into a soakaway. ("Inky.")

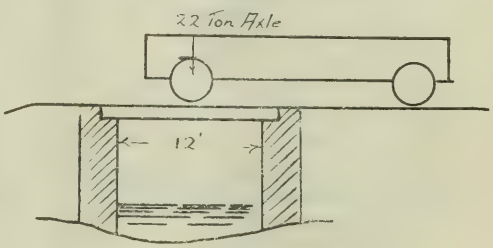
[The Editor is at all times glad to hear from readers who desire to submit questions regarding matters of general interest, points of daily practice, &c., for insertion in the "Assistants' and Students' Section." Questions which are published are taken into consideration, as well as other matter, in awarding the Monthly Premium.]

REPLIES TO QUESTIONS.

326. Reinforced-Concrete Bridge Design.—Show a suitable design in reinforced concrete, either in a single slab or slab and beams, for a decking to carry a roadway over a bridge; span 12 ft., width



Plan.



Section.

27 ft., cover 9 in. macadam; brickwork abutments. Show the calculations by which the section, steelwork, &c., is arrived at. The maximum live load that can come on the bridge is a 22-ton axle, and the remainder of the bridge covered with a crowd. (G. B. S., *Hove.*)

A bridge of the slab and beam type will more economically meet the needs of a 12-ft. clear span, proposed to be subjected to a 22-ton axle load, rather than one of the single slab type. The design offered is simple, and should offer no great extra expense for centering.

The crowd, referred to in query, need not be considered, as each of the four beams is calculated for a super. load of 11 tons, and this abundantly covers any load that a crowd would cause over any portion of bridge.

Calculations for Floor Slab.—In calculating the

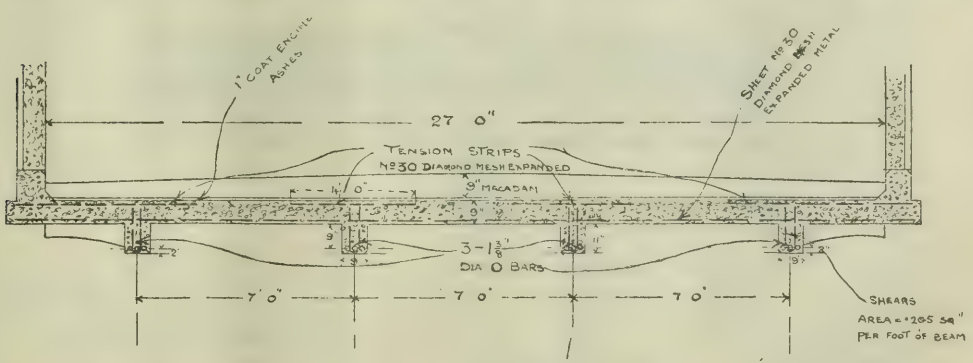


FIG. 1.—CROSS-SECTION.

thickness and reinforcement of floor slab, a strip 3 ft. wide is taken into consideration—it being

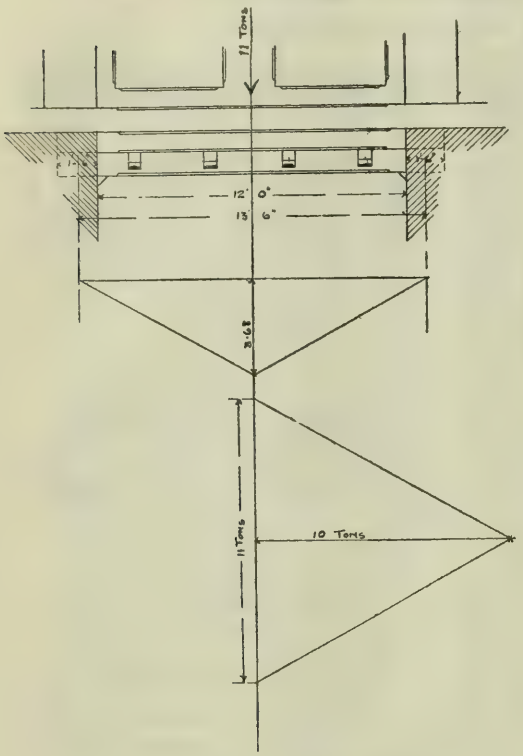


Fig. 2.—Elevation and Stress Diagram.

assumed that each wheel load (11 tons) is supported by a strip 3 ft. to 4 ft. wide.

M = Bending moment
b = width of beam
b_r = width of rib of T beam
b_s = effective width of slab
l = length of span of beam
d = depth of beam from centre of steel to compression face
T = total tension on steel
p = spacing of shears in beam
A_v = area of shear reinforcement

Dead weight of slab $\frac{36\times9}{144}\times156$ lb. = 351lb. per ft. run.

,, ,, macadam $\frac{36\times9}{144}\times100$ lb. = 225 ,,

Superimposed load $\frac{11\text{ tons (wheel load)}}{7\text{ (span)}}$ = 3520

4096

$$M=\frac{W\,l^2}{12}=\frac{4096\times7\times7\times12}{12}=200{,}704\text{ in. lb.}$$

$$n=\frac{At}{b}\left(\sqrt{\frac{30\ b}{At}+15^2}-15\right)$$

$$=\frac{1{\cdot}6875^*}{36}\left(\sqrt{\frac{30\times8\frac{1}{2}\times36}{1{\cdot}6875}}+225-15\right)=2{\cdot}82\text{ in.}$$

$$a=d-\frac{n}{3}=8\tfrac{1}{2}-\frac{2{\cdot}82}{3}=7{\cdot}56\text{ in.}$$

$$C=\frac{2\,M}{abn}=\frac{2\times200704}{7{\cdot}56\times36\times2{\cdot}82}=523\text{ lb. per square inch.}$$

$$T=\frac{M}{a\,A\,t}=\frac{2\ 0704}{7{\cdot}56\times1{\cdot}6875}=15{,}732\text{ lb. per square inch.}$$

Calculations for T *beams* (Fig. 3).—Since the beams are placed 7 ft. centres (see Fig. 1), and the maximum superload is given as 22 tons on a 7 ft. axle, the maximum load that would come over each beam will be 11 tons (wheel load).

Assuming the 11 ton wheel load to be placed centrally over span (see Fig. 2), the maximum M will be 36·8 ft tons, graphically, or analytically :— $\frac{Wl}{8}=\frac{13{\cdot}5\times11}{8}=36{\cdot}8$ ft. tons.

The equivalent distributed load that would produce the same M is: $\frac{36{\cdot}8\times8}{13{\cdot}5}=22$ tons.

Dead weight of floor slab

$=\frac{9}{12}\times7\times1\times156$ lb. = 819 lb. per ft. run.

Dead weight of beam

$=\frac{11}{12}\times\frac{9}{12}\times1\times156$ lb. = 107 ,, ,,

Dead weight of macadam

$=\frac{9}{12}\times7\times1\times100$ lb. = 525 ,, ,,

Superimposed (distributed) load per ft.

$=\frac{22\times2240}{13{\cdot}5}$ = 3650 ,, ,,

5101 ,, ,,

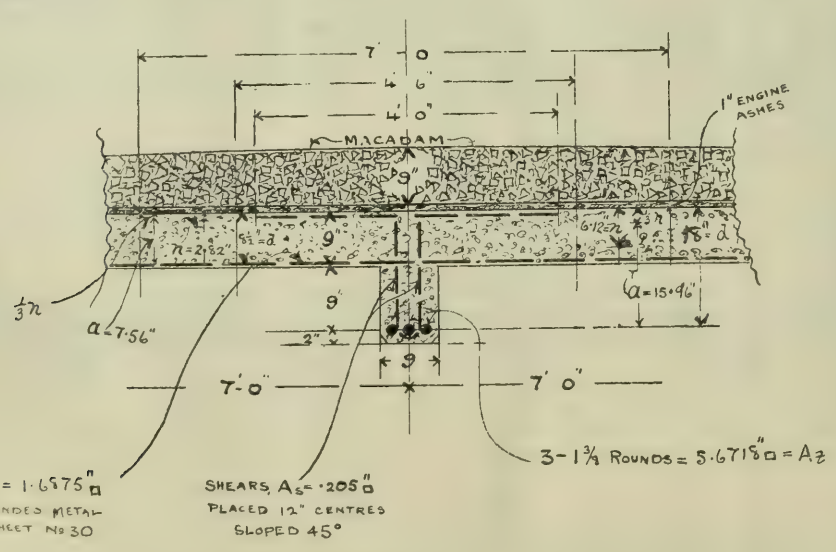


Fig. 3.

$m=\frac{\text{modulus of elasticity of steel}}{\text{modulus of elasticity of concrete}}=15$

S = total shearing force across a section
n = depth of neutral axis from compression face
c = maximum compressive stress in concrete
t = maximum stress in steel
a = radius arm
A_t = total area of steel

$$M=\frac{Wl^2}{8}=\frac{5101\times13{\cdot}5\times13{\cdot}5\times12}{8}=1{,}394{,}485\text{ in. lb.}$$

(Note: The effective width of T beam should be limited to three-fourths the distance between beams centre to centre, or one-third of span, or 15 times the thickness of

* 1·6875 = area of steel in 3 ft. strip of floor slab when using 3 in Diamond Mesh Expand Metal Sheet No. 30.

The Surveyor
And Municipal and County Engineer.

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slab, whichever is least. Therefore one-third of span is allowed as effective width of T beam.)

$$N = \frac{At}{bs}\left(\sqrt{\frac{30\,db_s}{At} + 15^2} - 15\right)$$

$$= \frac{5{\cdot}6718^*}{54}\left(\sqrt{\frac{30 \times 18 \times 54}{5{\cdot}6718}} + 225 - 15\right) = 6{\cdot}12 \text{ in.}$$

$$A = d - \frac{n}{3} = 18 - \frac{6{\cdot}12}{3} = 15{\cdot}96 \text{ in.}$$

$$C = \frac{2M}{ab_s n} = \frac{2 \times 1394485}{15\,96 \times 54 \times 6{\cdot}12} = 539 \text{ lb. per square inch.}$$

$$T = \frac{M}{a\,At} = \frac{1{\cdot}394485}{15\,96 \times 5{\cdot}6718} = 15405 \quad ,, \quad ,,$$

Calculations for steel required in rib of beam per ft. to resis shear:

$$S = \frac{Wl}{2} = \frac{5101 \times 13{\cdot}5}{2} = 6{\cdot}8863$$

Area of steel required per ft. shears sloped to an angle of 45°.

$$A_s = \frac{{\cdot}07\,(S - 40\,dbr)\,p}{a\,t} = \frac{{\cdot}07\,(68863 - 40 \times 18 \times 9)\,12}{15{\cdot}96 \times 16000}$$

$$= {\cdot}205 \text{ square inches per ft.}$$

(F. N., *Dornoch.*)

An International Fire Library.—The British Fire-Prevention Committee, having established, with a nucleus of over 2,000 books dealing specifically with matters of fire prevention, fire service and fire loss, a technical library that will be known as the International Fire Library, is now desirous of calling the attention of authors, public authorities, publishers and collectors to the fact that a new catalogue is in preparation, and that any books, pamphlets or reports which they are able to spare for this collection should be addressed, as soon as possible, to the Hon. Chief Librarian, The International Fire Library, 8 Waterloo Place, Pall Mall, S.W. The library, which is the first of its kind anywhere in Europe, promises to be a very complete specialist technical library, and will be made easily available to all primarily concerned in the subject of fire protection.

* 5·6718 = area of steel in 3 – 1¾" diameter rounds.

INSTITUTION OF MUNICIPAL AND COUNTY ENGINEERS.

SOUTH-WESTERN DISTRICT MEETING AT TRURO.

A meeting of the South-Western District of the Institution of Municipal and County Engineers was held at the County Hall, Truro, on Friday last, those present being Mr. H. T. Chapman (chairman), and the following members—viz.: Messrs. J. S. Walton, Falmouth; John Ennor, Newquay; H. A. Garrett, Torquay; James Paton, Plymouth; W. A. Collins, Bridgwater; W. J. Merrett, Redruth; G. Palmer, Redruth; A. E. Brookes, Truro; and T. Moulding, Exeter. The visitors included Messrs. A. J. Blight, St. Austell Rural District Council; J. H. Rowe, St. Austell Rural District Council; R. Olver, Launceston Rural District Council; H. A Hosking, St. Germans Rural District Council; H. Monson, Redruth Rural District Council; W. Leather, Camborne Urban District Council; E. H. Crispin, Cornwall County Council; C. A. Fothergill, Exeter; R. S. Murt, Cornwall County Council; and F. A. Barnes, Truro City Council.

Apologies for non-attendance were read from the president (Mr. R. J. Thomas), and from Messrs. F. Parr, W. P. Robinson, C. O. Baines, and R. A. Rogers.

The chairman thanked the members for re-electing him chairman for the ensuing year. He also welcomed the visitors to the meeting.

The chairman also stated that he had promised the Association of Somerset Surveyors to support the following resolution:—

"That this association, having regard to the fact that surveyors are now compelled to use mechanically-propelled vehicles in order adequately to inspect the roads under their supervision, are of opinion that the same facilities in the matter of taxation on vehicles and rebate on petrol consumed that are at present allowed the medical profession should be granted to them."

He explained that a copy of the resolution had been sent to the Chancellor of the Exchequer and the secretary of the institution. After some discussion, it was proposed by Mr. Brookes, and seconded by Mr. Garrett, that the resolution be supported by the South-Western District members. This was passed *nem. con.*, and the secretary was instructed to forward the resolution to the secretary of the institution.

Mr. A. E. Brookes, the county surveyor of Cornwall, then read a few notes on "Points in connection with Road Maintenance, with particular reference to Bituminous Roads." A discussion followed, this being taken part in by Mr. J. Ennor, the surveyor of Newquay, who proposed a vote of thanks to Mr. Brookes for the paper; others taking part were Messrs. Garrett, Paton, Walton, Barnes, Hoskins, and the chairman. The last named took the opportunity of complimenting Mr. Brookes on the quality of the roads between Torpoint and Liskeard, and from St. Austell to Truro, over which he had motored that day.

Mr. Brookes having replied, it was unanimously resolved that he should be asked to supplement the notes, and submit them in the form of a paper, to be read either at a district meeting or the forthcoming annual meeting. This Mr. Brookes promised to do.

The members and visitors were afterwards entertained to supper by Mr. Brookes at the County Hall.

On Saturday the party paid a visit to the Bath and West Show in the morning, and were the guests of the West of England Stone Company and the St. Keverne Stone Company in a trip down the river Fal in the afternoon. On arriving at Falmouth the party were met by the deputy mayor and the borough surveyor of Falmouth, Mr. J. S. Walton, and were driven round the Castle Drive, after which the party were permitted to inspect the semi-tropical gardens owned by Mr. Howard Fox. Tea, provided by the Mayor of Falmouth, followed.

After a vote of thanks to the Mayor of Falmouth, which was replied to by the deputy mayor in the absence of the mayor, the party broke up, having spent a very enjoyable day.

Refuse Destructor for Stockport.—A proposal has been adopted to erect a destructor on the site of the Heaton-lane Gasworks, Stockport.

INSTITUTION OF MUNICIPAL ENGINEERS.

NORTH-WESTERN DISTRICT MEETING AT SALFORD.

At the meeting of the North-Western District of the institution, which was held at the Town Hall, Salford (by permission of the Town Hall and Markets Committee of the corporation) on Saturday last, the following were among those present: Messrs. Frank Latham, president; John T. Pegge, vice-president; Arthur Bowes, vice-president; A. R. Bleazard, chairman of the district; J. Robinson (Darlington), G. W. Battye (South Crossland), W. Briggs (Stockport), G. F. Daniel (Salford), A. Darlington (Billinge), J. T. Davies (Little Hulton), A. Evans (Salford), Jas. Firth (Shelley), T. Fogg (Heywood), A. Foster (Salford), B. J. Garrett (Waterfoot), A. Herring-Shaw (Manchester), B. Hinchcliffe (Gomersal), G. H. Hopkinson (Chorley), J. Howard (Worsley), W. E. Hughes (Connahs Quay), R. Laycock (Farsley), J. Liddell (Furness Vale), F. W. Platt (Salford), J. T. Shield (Blackburn), J. W. Sunderland (Norden), E. Walker (Stretford), H. S. Whitehead (Salford), J. W. Wiles (Manchester), G. Willis (Urmston), B. Higginson (Irlam), H. J. Jenkinson (Salford), C. H. Blakeway (Heaton Norris), A. Dempsey (Eccles), J. H. Marsh (Worsley), W. J. Thorp (Harrogate), F. A. Williams (Altrincham), members; and D. Barton (Cheadle), student. The friends and visitors included Dr. Grossmann (Manchester), Dr. S. E. Melling (Salford), Councillors E. Mather (Salford), W. S. Roberts (Salford), C. A. Mather (Billinge), J. H. Platt (Huddersfield), and Messrs. J. Corbett (Salford), H. E. Brown (Altrincham), W. H. Duckworth (Salford), A. Elder (Oldham), S. G. Hay (Huddersfield), G. P. Holt (Worsley), R. J. McKenn (Heywood), H. H. Parker (Salford), J. Cleverley (Greenfield), L. Duguid (Manchester), A. Degiardé (Manchester), G. Heys (Manchester), A. V. Mernes (Manchester), J. V. Nicholls (New Mills), O. O'Gorman (Salford), and H. Shiele (Warsaw); Messrs. J. W. Gleave, the honorary secretary of the district, and B. Wyand, secretary of the institution, also were present.

Before commencing the business meeting Mr. Bleazard (who occupied the chair) welcomed the president on behalf of the members of the district.

The Deputy Mayor of Salford gave the institution a very hearty welcome to the Royal and County Borough of Salford, and regretted that other duties prevented him from remaining with them for the whole of the meeting.

The president returned thanks to the deputy mayor for his kind remarks, and the district chairman (Mr. Bleazard) seconded, the deputy mayor suitably responding.

The business meeting was then taken, and it was resolved that the minutes of the meeting held on April 16th at the Victoria Hotel be confirmed.

It was decided that a postal vote should be taken on the following matters: (*a*) Whether papers should be read on Saturdays instead of Wednesdays; (*b*) whether the local headquarters should be transferred from the Victoria Hotel to the Mitre Hotel, Manchester; and (*c*) where the July annual meeting should be held.

The president's letter of last December was also mentioned, and the president announced that some of the many matters therein referred to had been dealt with by the council at recent meetings.

Dr. J. Grossmann, M.A., F.I.C., then gave a lecture, "The Sewage Sludge Problem and its Solution," and in the discussion—an account of which, together with an abstract of the lecture, will appear next week—Dr. Melling, borough analyst, Wigan; Councillor Mather, chairman of the Rivers Conservancy Committee, Salford; and Messrs. A. Bowes, vice-president of the institution; J. T. Pegge, past-president of the institution; J. Corbett, engineer and surveyor, Salford; A. Herring-Shaw, assistant professor of municipal engineering, Manchester School of Technology; Jas. Howard, surveyor, Worsley; F. W. Platt, building surveyor, Salford; and R. J. McKenn, sewage works manager, Heywood, took part.

During the discussion the members of the council retired to hold a council meeting in another part of the town hall, and Mr. F. W. Platt took the chair.

At the conclusion of the meeting those present inspected the extensions and alterations to the town hall buildings, and were subsequently entertained to tea by the River Irwell Conservancy Committee.

After tea the president proposed a vote of thanks to the Town Hall and Markets Committee for kindly placing the town hall at the disposal of the institution for the meeting they had just held, and to the Rivers Conservancy Committee for the excellent high tea. He also expressed the indebtedness of the institution to Dr. Grossmann for his very able, interesting, and excellent lecture, and concluded by referring to Mr. Platt's many activities on behalf of the institution.

Mr. John Robinson (Darlington) seconded the votes of thanks, which were carried with acclamation.

Councillor Mather replied on behalf of the Salford Corporation, and pointed out that, though Salford had taken a lead on certain questions, they had been indebted to other authorities for information and exchanges of ideas. The officials of other authorities were therefore extremely welcome, and they would be pleased to allow them to use the town hall should they desire it on any future occasion.

Dr. Grossmann, in his reply, gave the gathering a very cordial invitation to visit the Oldham sewage works and inspect his plant in operation. He concluded by proposing a dual vote of thanks to the president for coming all the way from Penzance to the meeting, and to the district chairman for presiding.

These gentlemen responded, and a few others were called upon briefly to address the gathering, the chief among them being Mr. Corbett, to whom a vote of thanks had been passed for the very interesting display of drawings of the Salford sewage works.

SOCIAL EVENING.

On the evening preceding the day of the above meeting the president met the members at a social evening at the Mitre Hotel, Manchester, when there were present Mr. A. R. Bleazard (chairman North-Western District), Dr. Grossmann, and Messrs. F. W. Platt, F. D. Barton, W. Briggs, A. Dempsey, J. T. Davies, G. F. Daniel, T. Fogg, A. Foster, H. Grimshaw, A. Herring-Shaw, J. Howard, G. H. Hopkinson, J. H. Marsh, R. J. McKenn, J. T. Shield, J. W. Wiles, B. Wyand and J. W. Gleave.

High tea was the first item, and this having been concluded, a lengthy musical programme was gone through. In addition to the artistes who gave their services, Messrs. H. H. Holroyd (humorist), O. Salt (baritone) and E. Walker (pianist), the following members contributed to the convivialities of the evening: Messrs. T. Fogg (tenor), A. Foster and J. H. Marsh (raconteurs), and J. T. Davies (elocutionist). Messrs. Fogg and Salt also sang several duets.

After tea Mr. F. W. Platt made an announcement for the following day, and was thanked by Mr. Latham for the great trouble he had taken with the arrangements. Later Dr. Grossmann made a short speech thanking the president for giving him the opportunity of meeting the members, and spoke in praise of the Institution of Municipal Engineers. Mr. Latham suitably replied, explaining the points which had led to the institution's foundation, and added some personal reminiscences of other professional bodies. At a later stage Mr. Wyand proposed a vote of thanks to Mr. J. W. Gleave (hon. district secretary) for his labours, and to the president for his hospitality. These were carried with acclamation and suitably acknowledged. The artistes were also cordially thanked for their services.

COUNCIL MEETING.

At a meeting of the council held at the Town Hall, Salford, on Saturday last, the following applicants were recommended for admission:—

To Membership: Messrs. A. Elder, Inland Revenue Valuation Department, Oldham; F. W. Poynter, highway surveyor, Watford Urban District Council; A. Harford-Stevens, engineer, Blaby Rural District Council; A. N. Sawhney, palace engineer, Jumma, India; J. Fothergill, deputy surveyor, Padiham Urban District Council, and R. J. McKenn, manager and chemist, sewage and destructor works, Heywood.

To Associate-Membership: Messrs. A. Barton, building inspector, Buxton Urban District Council, and B. Boothman, borough surveyor's office, Clitheroe.

(Under the new by-laws these elections will be ratified at the next council meeting if no written objections are lodged within fourteen days.)

New Members, &c.—From the applicants recommended for admission at the last meeting three members and one associate-member were elected, and one transfer was made to the membership class.

Examinations.—At the examination held on May 16th and 17th Mr. V. G. Norris, of the district sur-

veyor's office, Bramley, satisfied the examiners in his knowledge of general practice and theoretical principles, and was awarded a certificate for his special knowledge of highway construction. The name of Mr. Irving-Graham, of the county surveyor's office, Carlisle, was also registered as satisfying the examiners in general practice and theoretical principles.

NEXT COUNCIL MEETING.—It was resolved that, owing to the date of the International Road Congress, the next meeting of the council should be held on June 25th instead of June 28th, the date previously announced.

B. WYAND,
Secretary.

39 Victoria-street, S.W.
June 3, 1913.

CORRESPONDENCE.

For every ill beneath the sun
There is some remedy or none;
If there be one, resolve to find it:
If not, submit, and never mind it.
— ANON., *circa* 1843.

NEWCASTLE-ON-TYNE TRAM RAILS.

To the Editor of THE SURVEYOR.

SIR,—In the paper read at the recent meeting of the Institution of Municipal and County Engineers at Newcastle Mr. McKellar stated (*vide* THE SURVEYOR of May 16th last) that "the type of rail adopted for the Newcastle tramways very closely resembles the No. 4 section, which was standardised several years afterwards by the Engineering Standards Committee."

I have now (for the first time) closely studied the design and dimensions of the rail section employed at Newcastle, and must say I am greatly surprised at Mr. McKellar's claim. I venture to assert that not only is there no ground for claiming an approximate identity between the profiles of the B.S. No. 4 and the Newcastle rail, but that they are not even comparable in their major characteristic features.

Anyone who claims that there is "very close resemblance" between these two sections certainly betrays a lack of appreciation of the factors that make for practical and economical efficiency in tram-rail design.

Passing to a different matter—viz., the strength of the web of B.S. section No. 4—it may be remembered that Mr. W. J. Hadfield, in the discussion on Mr. Wakelam's paper on "Corrugation," stated that, as he had found some of his rails split, he thought it must be due to insufficient strength in the web. This view I controverted (*vide* THE SURVEYOR, January 3rd, 1913), and maintained that splitting of the web was due to causes other than that assumed by Mr. Hadfield. No similar complaint has been received during the ten years that the B.S. tram rails, to the extent of several hundred thousand, have been in use all over the world.

Mr. McKellar inferentially testifies that the web of the B.S. rail is of ample strength, as it is considerably stronger than the Newcastle section, and of the latter he cites the fact that over a period of some twelve years not a single fracture had been found.—Yours, &c.,

W. J. HOWARD-SMITH,
Chairman (1901-13) B.S. Tram Rails Committee.

104 Regency-street,
Westminster, S.W.
May 30, 1913.

SURVEYORS' INSTITUTION EXAMINATIONS.

To the Editor of THE SURVEYOR.

SIR,—It has been my unfortunate lot to have failed to satisfy the examiners in the typical subject of the intermediate examination of the above institution, so it becomes necessary for me to wait until March next before I shall again have the opportunity of presenting myself, and by that time the new regulations of the institution making it compulsory to pass the final in addition to the intermediate will be in force. Now what I think is a hardship is that in instances where the failure is in the typical subject only the candidate has proved, by obtaining pass marks in the aggregate (and, in many cases, an aggregate number of marks considerably higher than another who has passed), that he is a competent surveyor, and it seems hard that for the lack of a few marks in one subject only he should be compelled to take the final in addition to the intermediate.

What I now wish to suggest is that other candidates who have obtained pass marks in the aggregate should take the matter up with the council, who may, perhaps, be induced to hold another examination in time to allow the relegated candidates to pass, and so apply for election before the time the new rules come into operation, or otherwise suspend the rule, so far as it applies to these candidates, for one year, making it possible to obtain the P.A.S.I. diploma by passing in the typical subject next March.

I want it to be understood that I do not make any complaint, and I make no charge of injustice. What I am anxious to obtain is a favour from the council. Will others similarly situated help in the matter?—Yours, &c.,

TYPICUS.

DUST LAYING.

To the Editor of THE SURVEYOR.

SIR,—I notice my name has been coupled with the use of "Akonia" in your article on the subject in your issue of May 16th inst.

I have employed this material for six successive years, and I prefer it to tar for dust-laying purposes; it has, too, the added advantage of being less expensive, less difficult to handle, and is never slippery.

Tar gives a protective coating to the carriageway for about four months in the year, but it is very slippery, and must, in towns at any rate, be watered at least twice daily if the dust is to be prevented from rising. That dust is of an offensive character, discolouring if not actually killing the flowers in the roadside gardens. Tar is but a palliative which has scarcely justified the vapourings spent upon it.

I have driven, in the height of summer, over some tarred roads which have been positively dangerous to equestrians, and we have, in consequence, had to dismount and lead the horses. . . .

The problem set road surveyors is simply one of weighting the particles of dust beyond the lifting power engendered by the velocity of a travelling car or high wind. "Akonia" solves this effectually, and at a cost on each season's use of just a fraction above that of ordinary watering.—Yours, &c.,

FRED. C. UREN.

Municipal Buildings,
Aldershot.
May 29, 1913.

OIL-MIXED CONCRETE.

To the Editor of THE SURVEYOR.

SIR,—Your publication of the tests upon which Mr. Logan Waller Page has been engaged for three years will convince all who have studied the results that oil mixed with concrete to reduce porosity is extremely harmful to the cement.

The initial and final setting with a 5 per cent mixture of oil are delayed to the extent of 50 per cent and 47 per cent respectively; but the most serious defects were obtained in the crushing strength, for 10 per cent of oil is shown to reduce the strength of concrete by 25 per cent at twenty-eight days.

The bond tests show the inadvisability of using a plain bar reinforcement with an oil-concrete mixture.

The publication of Mr. Page's tests will evoke serious doubt in the minds of engineers in practice as to the advisability of using oil-mixed concrete for waterproof work.

This question of waterproofing was seriously before me some twelve months ago in the construction of high-level sewage tanks in reinforced concrete. For this work I used a "Pudloed" cement rendering at an extra cost of 6¾d. per super. yard with very good results, and have even obtained a dry tool store under a 6-in. floor.—Yours, &c.,

W. G. H. BROWNE.

Council Offices,
Bolsover,
Chesterfield.
May 29, 1913.

Lichfield Refuse Destructor.—At the formal opening of the Lichfield refuse destructor recently, the city surveyor, Mr. W. B. Chancellor, stated that the total cost of the installation was £2,000. The contractors were Messrs. Heenan & Froude, and the screening plant was by Messrs. W. Richards & Son, Leicester.

LOCAL GOVERNMENT BOARD INQUIRIES.

The Editor invites the co-operation of Surveyor readers with a view to making the information given under this head as complete and accurate as possible.

INQUIRIES HELD.

Cambridge T.C. (May 27th. Major J. Stewart).—£695 for works of paving in Bene't-street, and £6,103 for works of sewage disposal in the parish of Milton.—Evidence with respect to both schemes was given by the clerk, Mr. J. E. L. Whitehead, and the borough surveyor, Mr. J. Julian.

Chesham U.D.C. (May 16th. Mr. C. H. Eyles).—£2,042 for the erection of working-class dwellings at Newton.—The clerk, Mr. W. J. Standring, stated that since 1907 forty-one cottages which the medical officer, Dr. T. F. Long, deemed least desirable had been pulled down, and in lieu of those nineteen had been built, making a nett loss of twenty-two. The council could not build cottages and make them self-supporting if they were to be let at 2s. to 2s. 6d. per week. The medical officer said that if houses could not be built except at a cost which would compel the council to let them at 6s. per week to make them self-supporting, he did not think it was much good dealing with the matter, because he did not really think the people whom the council wished to cater for could afford to pay a rent like that. What were really wanted in the district were houses let at 3s. 6d. to 5s. per week.

Croydon T.C. (May 20th. Mr. A. G. Malet).—£4,350 for improving the South Norwood public baths.—The borough engineer, Mr. G. F. Carter, stated that it was proposed to roof in the open-air bath, lengthen it from 70 ft. to 75 ft., form a gallery, provide collapsible dressing boxes, increased lavatory accommodation, new first-class slipper baths, and enlarge the laundry. This would enable the larger bath to be used through the whole of the year instead of during a few of the hottest months. At present at swimming galas people had to sit on top of the dressing boxes, which was very undesirable.

Ealing T.C. (May 20th. Major J. Stewart).—£4,000 for the extension of the town hall.—The town clerk, Mr. G. E. Brydges, stated that the council were hoping that the repayment of the proposed loan would be spread over a period of at least sixty years. The borough surveyor, Mr. C. Jones, said that, with the extension, they would have no more room than they required, but it would doubtless be made to suit their needs for some years to come. Some questions were put to the borough surveyor as to the increases of staff since 1907, and, at the inspector's suggestion, the surveyor summed it all up by saying that whereas two men had occupied a room in 1907, it was now occupied by four or five.

Hartshorne and Seals R.D.C. (May 16th. Major C. E. Norton).—£2,200 for a water supply for Ticknall.—The surveyor, Mr. N. F. Spence, stated that the proposal was to pump water from the springs in the parish by means of windmill power to a reservoir at such an elevation as to supply the villages by gravitation.

Swanage U.D.C. (May 20th. Mr. R. H. Bicknell).—£1,050 for the purchase of property for the purposes of a depot, and also money for private street works. It is proposed to purchase Gilbert Works for the depot, and the particulars with respect to this scheme and the private street works were supplied by the clerk, Mr. C. E. West, and the surveyor, Mr. W. H. Pearce.

Wiltshire C.C. (May 23rd. Mr. A. G. Drury).—£13,500 for the extension of the county council offices at Trowbridge.—The clerk, Mr. W. L. Bown (with whom was the county surveyor, Mr. J. G. Powell), stated that for some time past it had been quite clear to the council that the accommodation at present provided for carrying on their increasing business was not sufficient for the purpose. The existing offices were built in 1899, and the original intention was to carry the building up a storey higher than it was, but difficulties with regard to light and air prevented this from being done. The room in which the inquiry was held was also never intended as a council chamber, but for offices. Owing, however, to the abandonment of the upper storey and other reasons, it had to be converted, and the office accommodation was not so extensive as was first intended. Before that time the meetings of the council were held in the Trowbridge Town Hall. It was proposed to house the whole of the council's staff in the present buildings and in the proposed extension.

APPLICATIONS FOR LOANS.

Bolton T.C.—£11,098 for works of widening and improvement.

Cheltenham T.C.—£2,000 for electricity mains extensions.

Epsom U.D.C.—£450 for electricity services.

Hawarden R.D.C.—£1,000 for drainage works.

Leicester T.C.—£52,350 for electricity extensions.

Lexden and Winstree R.D.C.—£2,000 for a water tower, machinery, and mains.

Maidenhead T.C.—£1,450 for repaving works.

Pontypool U.D.C.—£5,600 for paving works.

Sidmouth U.D.C.—£11,300 for the erection of fifty-one cottages.

Stoke-on-Trent T.C.—£4,405 for paving with granite setts.

Sunderland R.D.C.—£2,246 for works of sewerage, and £1,673 for paving works.

Todmorden T.C.—£1,705 for road widening.

Wellington (Salop) R.D.C.—£1,900 for a water supply scheme.

Worthing T.C.—£6,750 for the extension of the electricity generating plant and buildings.

LOANS SANCTIONED.

Aberavon T.C.—£932 for street lighting.

Bispham U.D.C.—£8,155 for electricity extensions.

East Ham T.C.—£2,051 for public conveniences, and £668 for fencing a recreation ground.

Grimsby T.C.—£8,760 for additional electricity plant, £400 for the extension of cooling towers and oil separators, £6,000 for mains, and £2,000 for sewerage works.

Halifax T.C.—£23,180 for electricity plant and mains.

Hendon U.D.C.—£6,592 for a fire station.

Hexham U.D.C.—£232 for the purposes of the Abbey and Seal recreation ground.

Marylebone B.C.—£42,500 for electricity extensions.

Middlesbrough T.C.—£33,000 for a drainage scheme and pumping station.

Twickenham U.D.C.—£675 for the construction of an inclined embankment along the Thames portion of Radnor Island.

FORTHCOMING INQUIRIES.

JUNE.	£
9.—**West Bromwich.** For paving purposes and the provision of a tip (Mr. R. H. Bicknell)	3,400
10.—**Birmingham.** For the purpose of sewage disposal (Mr. R. H. Bicknell)	37,672
10.—**Boston.** For works of piling (Mr. P. M. Crosthwaite)	1,000
10—**Colchester.** For electricity and street works (Mr. T. C. Ekin)	11,135
10.—**Edmonton.** For road improvement purposes (Mr. M. K. North)	1,525
10.—**Horsham.** For works of sewerage (Major C. E. Norton)	1,000
10.—**Rotherham.** For street improvement purposes (Mr. Edgar Dudley)	9,421
11.—**Halstead.** For the provision of public baths (Mr. P. M. Crosthwaite)	800
11.—**Southend.** For the purchase of electrical machinery and depot purposes (Mr. T. C. Ekin)...	12,900
11.—**Widnes.** For road widening purposes (Mr. Edgar Dudley)	4,400
12.—**Kettering.** For baths and electricity purposes (Mr. M. K. North)	7,200
12.—**Salford.** For the provision of playing fields (Mr. Edgar Dudley)	10,000
12.—**Walthamstow.** For paving and electricity purposes (Mr. T. C. Ekin) ...	35,161
13.—**Allonby.** For works of sea defence (Mr. H. Shelford Bidwell)	8,300
13.—**Hampton.** For the purchase of property for street widening works (Mr. Edgar Dudley)	430
13.—**Wellingborough.** For the provision of a steam disinfector (Mr. M. K. North)	250

Municipal Work in Progress and Projected.

The Editor invites the co-operation of SURVEYOR *readers with a view to making information given under this head as complete and accurate as possible.*

The following are among the more important projected works of which particulars appear below: Buildings — Birmingham £31,057, Barrow £12,000, Sydney (Australia) £2,750,000; housing and town planning—Cardiff £5,495, Sidmouth £11,300; roads and materials—Camberwell £3,084, Godstone £30,314, Lewisham £18,641, Worcestershire £94,609; sewerage and sewage disposal—Eastbourne £3,000, North Dublin £3,000, Whitby £5,000; water, gas and electricity—Bewdley £3,000, Clown £41,500, Wellington £1,900.—Particulars of other works projected will be found on our "Local Government Board Inquiries" page.

BUILDINGS.

Barrow T.C.—It has been agreed to prepare a site in Ramsden-square, at a cost of £2,580, on which to erect the new Carnegie Free Library, which will cost £12,000, apart from the price of the land.

Birmingham T.C.—The proposal has been confirmed for the enlargement of the Yardley-road, Salterley-grange and West Heath sanatoria, at an estimated cost of £31,057.

Cardiff T.C.—The Property and Markets Committee are considering plans for a new weights and measures department in the Roath Market.

Deal T.C.—It is proposed to erect a pavilion on the sea front.

Godstone R.D.C.—The following schemes are under consideration, and the engineer and surveyor, Mr. G. E. Crowter, has received instructions to prepare drawings and estimates for a ferro-concrete bridge over the river Eden at Haxted, a ferro-concrete bridge at Water Tide, Lingfield, and a ferro-concrete bridge at Woohurst-lane, Oxted.

Llanrwst R.D.C.—The surveyor, Mr. Morris Roberts, has received instructions to prepare a plan of a proposed new bridge at Llangernyw, at an estimated cost of £200, a moiety of which, it is hoped, will be paid by the county council.

Sydney (Australia) T.C.—The Public Works Committee have recommended the construction of a cantilever bridge, costing £2,750,000, over the harbour to connect Sydney with North Sydney.

Weymouth T.C.—The Works Sub-Committee of the county council have inspected sketch plans and further details of the corporation's scheme for improving the Backwater by constructing an embankment road in lieu of the existing bridge. The committee have reported to the county council that they were favourably impressed with the provisional proposals of the corporation, and it was decided that they should further elaborate their scheme with a view to the submission of full plans, estimates and financial proposals at the meeting of the County Committee to be held on July 9th.

HOUSING AND TOWN PLANNING.

Cardiff T.C.—The proposal to build thirty workmen's houses on a site at Kitchener-road has been approved by the Health Committee. The city treasurer estimated that the cost of building the houses would be £5,495. Sinking fund and interest on a sixty years' loan rates, ground rent, &c., amounted to £501 14s., and the annual income from the rent (6s. 6d. per week for each house) was £507, leaving £5 6s. for contingencies. The treasurer added that from the situation of the proposed property, and by comparison with other properties in the same district, he was of opinion that the corporation would have no difficulty in securing a good class of tenant at 6s. 6d. weekly.

Dover T.C.—A letter has been received from the Local Government Board declining to approve the scheme submitted for the rehousing of the working classes to be displaced by the pier viaduct and improvement of the district. The board intimate the desirability of pulling down and widening Limekiln-street and Bulwark-street as part of the rehousing scheme, and suggest that under those circumstances consent might be obtained. A plan on these lines has been submitted, and it is stated that 450 people will thus be rehoused. This plan has been approved, and is to be forwarded to the Local Government Board.

Hay (Brecknock) R.D.C.—A committee has been appointed to inquire into the housing conditions in the town.

Lynton U.D.C.—A letter from the Local Government Board adverting to the lack of housing accommodation in the district has been referred to the Works Committee.

Neath T.C.—The borough surveyor, Mr. D. M. Jenkins, has invited tenders for the erection of workmen's dwellings.

Sidmouth U.D.C.—Land is to be purchased at £300 an acre for the erection of workmen's dwellings, and plans for fifty-one cottages have been approved. The estimated cost of the scheme is £11,300.

Truro R.D.C.—A special meeting has been called to consider a letter from the Local Government Board calling attention to the inadequate housing conditions in the district.

PARKS AND OPEN SPACES.

Colne T.C.—The corporation have purchased about 20 acres of land from Lord Derby for £4,000, for the purpose of a public park.

Lambeth B.C.—The General Purposes Committee recommend the council to contribute the sum of £250 towards the cost of the purchase of a piece of land fronting Knight's-hill for the purpose of an open space, such contribution to be subject to the London County Council undertaking to maintain the land as an open space. The total cost of the acquisition of the land, which is slightly over 4 acres in extent, is £1,250.

ROADS AND MATERIALS.

Camberwell B.C.—The borough engineer, Mr. W. Oxtoby, has submitted a return of the cost of the Red Post-hill improvement, at £3,084, and the Works Committee recommend that the Road Board be again approached to make a contribution of £568 towards the cost of the work.

Cardiganshire C.C.—A committee has been appointed to consider the plans and specifications prepared by Mr. Howard Humphreys, engineer of the proposed new road from New Quay to Llanarth.

East Barnet U.D.C.—Complaint has been received from a ratepayer of the "speed" of the council road roller, and of a leak the engine had caused in the water pipe leading to his house. Councillor Porter asked if there was any speed limit? The surveyor, Mr. H. York, said that there were two speeds, one 2 miles and the other 3½ miles an hour. Councillor Porter said that he thought the engine went quicker. The surveyor said that he wished it did sometimes. The council decided to deny liability.

Godstone R.D.C.—Cottage-lane and Water-lane are being made up at a cost of £1,100. Another road is under consideration, to be made up at a cost of £2,600. A scheme is being prepared for the reconstruction of the main road at Whyteleafe, and three new roads at Tatsfield are about to be made up at a cost of £900. Various widenings are also under consideration. The estimated cost of maintenance of highways for the year ending March 31, 1914, amounts to £17,664, making a total projected expenditure of £30,314, including road construction and bridge building.

Holborn B.C.—Part of the roadway on the north side of New Oxford-street (between Bainbridge-street and Tottenham Court-road) is to be repaved with fine granite setts, at an estimated cost of £350.

Lambeth B.C.—The General Purposes Committee recommend the council to contribute the sum of £300 towards the cost of widening Westminster Bridge-road on its southern side between Felix-street and Lambeth Palace-road, in connection with proposed rebuilding operations at this part. The total cost of the widening is estimated at £1,550.

Lewisham B.C.—The borough surveyor, Mr. E. van Putten, reporting on the resurfacing of the roads

along the motor-omnibus routes, states that Brownhill-road, between St. Fillan's-road and Lalehamroad, has been laid with slag tar-macadam, an area of 2,960 yds.; St. Mildred's-road, between Manorlane and the foot of Brownhill-road, has been laid with Guernsey granite bound with Plascom, an area of 2,316 yds.; and Woolwich-road, from Montpelier-row to Long Pond-road, has been laid with "Suremac" tar-carpeting, an area of 1,564 yds.; that the work of resurfacing is proceeding in Lee-road with tarred slag-macadam; Sydenham-road with tarred granite-macadam; and on Perry-hill, towards Catford, with broken granite grouted in with "Plascom." The Highways Committee have authorised the borough surveyor to obtain and use experimentally small quantities (5 to 10 tons) of Messrs. Dussek's bituminous binder, and Messrs. Morden & Co.'s "Mexphalte," which is also a bituminous binder. In connection with the resurfacing of the steep and narrow part of Perry-hill leading towards Bell-green, the committee have authorised the borough surveyor to put down "Rocmac," at the price of 7s. per ton of granite laid, quoted by Rocmac, Limited.—The committee recommend that the tenders of the Acme Flooring and Paving Company (1904), Limited, for Lewis-grove, High-street, Lewisham, and Lewisham-road, and Messrs. John Mowlem & Co., Limited, for Bromley-road, be accepted. The approximate cost of these works at the prices quoted will be £2,393 for Lewis-grove, High-street, Lewisham, and Lewisham-road, and £16,248 for Bromley-road.

Nottingham T.C.—Certain property in Barker-gate, at its junction with Carter-gate and Sneinton-street, containing an area of 321 yds., is to be purchased for £925, for the purpose of the Barker-gate improvement. —A scheme for lowering the hilly top of Carlton-road, Sneinton-hill, is to be carried out forthwith.

Ryde T.C.—The north side of St. John's-road is to be paved with cement slabs.

Worcestershire C.C.—At this week's meeting of the council the annual estimates of the Highways and Bridges Committee were submitted and approved. The estimated total expenditure is £94,609, which includes an expenditure on Road Board work of £26,702, as compared with a total expenditure of £72,626 last year.—The Road Board have approved of the first portion of a scheme estimated to cost £127,000, and have given a grant towards the first section, which is estimated to cost £22,256. The work has been commenced, and arrangements have been made for six extra gangs to be employed upon this special work. The estimates also cover an expenditure for tar-painting about 60 miles of main roads.

SEWERAGE AND SEWAGE DISPOSAL.

Clones (Co. Monaghan) U.D.C.—A scheme of sewerage has been proposed for part of the town, and an engineer has been instructed to draw up a report on the subject.

East Barnet U.D.C.—The engineer and surveyor, Mr. H. York, has prepared plans and sections of the proposed extension of the Station-road sewer, at an estimated cost of £460.

Eastbourne R.D.C.—The excess of the estimated cost of the Pevensey sewerage scheme is £3,000, and the Local Government Board is to be asked to sanction a loan for that amount.

Kingston (Surrey) T.C.—The tender of Messrs. Goddard, Massey & Warner has been accepted for six press plates for the sewage works at £3 12s. 6d. each; and that of the Sheepbridge Coal and Iron Company for six branch pipes for £12.

North Dublin R.D.C.—It is proposed to carry out sewer extensions at an estimated cost of £3,000, and also to extend the water main at a cost of £250.

Raunds U.D.C.—With a view to the prevention of floods, it has been decided that the bed of the brook from Smithfield Bridge to the mouth of the main culvert be altered to give a clearing fall, and that the invert of the main culvert should also be similarly altered in level.

Scarborough T.C.—It was reported at the recent meeting that during the last twelve months 326 privies had been converted into water-closets.

Whitby R.D.C.—A scheme is being prepared for the sewerage of Sleights, at an estimated cost of £5,000.

WATER, GAS, AND ELECTRICITY.

Bewdley T.C.—The corporation have resolved to expend £3,000 on the extension of the waterworks, and have instructed their engineers, Messrs. Berrington, Son & Watney, of Wolverhampton and Westminster, to prepare the necessary plans and estimates for submission to the Local Government Board.

Bishops Stortford U.D.C.—The surveyor, Mr. R. S. Scott, has submitted, and the council have agreed to, the following quotations from the National Gas Company for the supply of plant at the sewage works: New suction-gas plant complete, £99; new parts to replace the faulty parts of the gas engine, £49; fitting, men's actual time and expenses (which the surveyor estimated), at £12 12s.

Broadstairs U.D.C.—The inauguration took place on Saturday last of a new water-softening plant at the Rumfields waterworks.

Clown R.D.C.—Mr. S. E. Hodson, engineer, has presented a report on the district water scheme, which is nearing completion. The estimated cost, he said, was £41,500, and the daily estimated requirements of water 300,000 gallons. The cost of the water when 300,000 gallons of water were being used would be £4,826 per annum.

Doncaster T.C.—The proposal that a supply of water should be obtained from Leeds is to be the subject of official negotiation between the two corporations.

Dundee T.C.—The price of gas has been fixed at 2s. 2d. per 1,000 ft.

Exeter T.C.—The electricity undertaking shows a nett surplus for the past year of £1,373.

Kelso T.C.—A new water supply from the Heatherhope Burn, in the Cheviots, about 16 miles from the town, was inaugurated recently.

Loughborough T.C.—The nett profit on last year's working of the gas undertaking was £2,447.

Shrewsbury T.C.—The Water Committee report that the value of the fuel consumed at the waterworks during the year was only £408. The new engine had therefore been the means of reducing the cost of fuel for the year by well over £200, although 9s. 4d. per ton, as against 7s. 10d. per ton on the previous year, was paid for fuel.—It has been agreed to renew the water mains in Preston-street, St. Julian's Friars, and The Priory, at the estimated cost of £127.

Walsall T.C.—In a report to the council Mr. E. M. Lacey states that the only way to make the electricity undertaking a commercial success would be to erect a power station of some 3,000 kilowatts capacity. An estimate of the cost fixes the total expenditure which would be involved at about £38,000, but it is pointed out that, in addition, the corporation would have to "scrap" the existing direct current plant, which would represent writing off capital to the amount of over £34,000.

Wellington R.D.C.—The scheme for supplying water to the Rock and other parts of the rural district, at a cost of £1,900, has been adopted.

Westbourne R.D.C.—The Pitter Universal Rotary Machine Syndicate, Limited, London, have prepared a scheme for a water supply for the district.

West Hartlepool T.C.—A new scheme is to be put in operation for producing electricity by means of waste heat. The new generating station will possess twice the capacity of the old, and its two turbo-generators, each of 1,500 kilowatts, will be driven by exhaust steam from the furnace blowing engines of the Seaton Carew Iron Company, adjacent to whose works the station is built. In return for their exhaust steam, which has hitherto been blowing to waste in the air, the Seaton Carew Iron Company will receive free from the corporation's new generating station the supply of electric current that they need at their works. When the new station is in operation the corporation will be able to produce electricity at a relatively cheap rate, for the expenditure on coal, which is the chief cost in generating current by the ordinary system, will practically be eliminated.

MISCELLANEOUS.

Basingstoke T.C.—The new cemetery in Salisbury-road was formally opened last week. It consists of 28½ acres, and was purchased for £2,300. Eleven acres have been laid out from plans prepared by

the borough surveyor, Mr. F. R. Phipps, ASSOC.M. INST.C.E.

Belfast T.C.—The motor fire engine supplied by Messrs. John Morris & Sons, Limited, at £1,000, has been tested and found satisfactory, and the purchase has been confirmed by the council.

Bournemouth T.C.—Since the construction of the sea wall the sand level on the east shore has in places been lowered by the action of the sea. The borough surveyor, Mr. F. W. Lacey, has received instructions to report on the matter, and also as to the advisability of erecting groynes.

Eastbourne T.C.—Reports of two municipal undertakings have been submitted. The electricity department, after meeting all capital charges, showed a nett profit of £2,495, and the motor omnibuses returned a profit, despite the wet summer last year, of £711.

Glasgow T.C.—The financial year of the tramway department closed on Saturday night with a total revenue of £1,007,573. For the first time in the history of the undertaking the receipts have exceeded the round figure of £1,000,000, the total at the corresponding date last year being £987,280.

Newport (I.W.) T.C.—It has been decided to purchase over an acre of land for £600 as a site for a market.

Orrell (Lancs) U.D.C.—The tender of Messrs. Bolton has been accepted for cast-iron pipes, and that of Messrs. Laithwaite for earthenware pipes.

Stockton T.C.—The nett profit on the gas undertaking during last year was £6,668, and that on the electricity undertaking £545.

Swansea T.C.—The proposals of the Parliamentary Committee that official sanction should be sought for several tramway extensions, including the Townhill route, have been confirmed by the council.

Warrington T.C.—Last year the profits from the gas department were £14,448, from the electricity department £2,944, from water £2,155, and from tramways £3,320.

Wellington (Salop) R.D.C.—The surveyor, Mr. J. Breeze, has received instructions to pay the best roadmen 18s. a week and the others 15s.

PERSONAL.

Mr. Ninian Wilson, burgh surveyor of Langholm, died, we regret to state, last week.

Mr. H. D. Woodcock, surveyor to the Guisborough Rural District Council, has been granted an increase of salary.

Mr. Norman Douglas Morton, of Kenilworth, has been appointed assistant surveyor to the Stourbridge Urban District Council.

Mr. A. Saxon Snell, F.R.I.B.A., has been appointed consulting architect for the erection of the Liverpool Corporation pierhead baths.

Mr. P. K. Wright, a member of the burgh surveyor's staff, has been appointed burgh engineer to the Grangemouth Corporation.

Mr. J. Burford, assistant surveyor to the Ashbourne Urban District Council, has been appointed assistant surveyor to the Newmarket Urban District Council.

The Country Roads Board of Victoria—of which Mr. W. Calder is the chairman—are arranging for membership of the forthcoming International Road Congress.

Mr. A. J. McDonald, architectural draughtsman to the Acton Urban District Council, has been placed in charge of the drawing office, at a salary of £180 per annum.

Mr. C. D. Aspray, chief engineering assistant to the Acton Urban District Council, has been appointed assistant surveyor for a period of one year on probation, at a salary of £225.

Mr. E. Vaughan Edmunds, surveyor to the Llanslin (Denbigh) Rural District Council, died suddenly, we regret to state, on Tuesday morning. He had been in indifferent health for some time.

Mr. Herbert Edwin Blain, for nearly ten years manager of the West Ham Corporation tramways, is resigning. Mr. Blain is this year's president of the Municipal Tramways Association.

Mr. Harold F. Coales, M.INST.C.E., engineer and surveyor to the Sunbury-on-Thames Urban District Council, has been unanimously granted £75 for his work as engineer of the new sewage scheme.

Mr. Harold Bradley, junior surveying assistant in the department of the county surveyor of Worcestershire, Mr. C. F. Gettings, has been appointed to a similar position under the Devonshire County Council.

Mr. W. Oxtoby, M.INST.C.E., borough engineer of Camberwell, will represent his council at the International Road Congress, and the Works Committee recommend the council to subscribe £4 towards the expenses of the congress.

Mr. P. Dodd, M.INST.C.E., borough engineer and surveyor of Wandsworth, has been appointed as the Roads Improvement Association's second delegate on the Engineering Standards Committee (Sectional Committee on Road Material) in place of Mr. Howard Humphreys, resigned. The association's other delegate on this committee is Mr. H. Percy Boulnois, M.INST.C.E.

Mr. Charles Clemesha Smith, M.INST.C.E., waterworks engineer to the Corporation of Wakefield, who was formally installed yesterday as president of the Institution of Water Engineers, and of whom an inset portrait is given with the present issue, served his articles with Messrs. Filliter & Rofe, MM.INST.C.E., Leeds and Westminster, and was engaged on the construction of large impounding reservoirs and other works for the Leeds Corporation, Burnley Corporation, Wakefield Corporation, and the Leeds and Liverpool Canal Company. On the completion of his articles he was employed as assistant resident engineer under Mr. Henry Rofe, Westminster, on the construction of the Ardsley reservoir (capacity 340,000,000 gallons) for the Wakefield Corporation, the Cant Clough reservoir (capacity 290,000,000 gallons) for the Burnley Corporation, and the Winterburn reservoir (capacity 280,000,000 gallons) for the Leeds and Liverpool Canal Company, also on Parliamentary surveys and other work. In 1892 he was appointed resident engineer on the construction of the Green Withens reservoir (capacity 240,000,000 gallons), including tunnels, several miles of catchwaters, and other works for the Wakefield Corporation at Rishworth Moors. In 1897 he was appointed waterworks engineer to the Wakefield Corporation, and has since carried out all constructural work for the corporation, including a filtration scheme for the whole supply, service reservoirs, and so forth. The population now supplied by the works of the corporation is approximately 160,000, the area covered being about 60 square miles. Mr. Clemesha Smith was elected an associate member of the Institution of Civil Engineers in 1894, and was transferred to full membership in 1905.

German Electrical Plant for South Wales.—Mr. John Moxon moved, at the Newport (Mon.) Town Council meeting on Tuesday, that the tender of the A.E.G. Electric Company, Limited, Berlin, should be accepted for a 3,000-kilowatt turbo-generator and 3,000-kilowatt condenser at £7,120, and the tender of the Lancashire Dynamo Company, Limited, for a 600-kilowatt direct-current generator at £925. He anticipated, he said, that they would be criticised for accepting a German tender, but it should be pointed out that the lowest English tender was £1,326 higher than the German firm's. The German firm gave a guarantee of delivery within thirty weeks, and of the thirty-six tenders received no other firm had come near that. Only two votes were recorded against the acceptance of the tender.

Brighton and Trolley 'Buses.—The Brighton Town Council yesterday had before them a report on the question of the introduction of trolley 'buses. The Tramways Committee have visited and inspected systems at Stockport, Leeds and Keighley. They recommend the adoption of the double-deck 'bus, and that tenders be invited for the supply of overhead wire posts and all other apparatus and materials for the route from Preston-road, near the northern boundary of the town, and New-road. Compared with petrol and petrol-electric 'buses the report shows a nett saving of 2d. per mile by the use of trolley 'buses. The total working cost per car mile is put as follows: Working expenses, 6·50d.; capital charges, 1·32d.; total, 7·82d. The total capital cost of the scheme is: Equipment, £3,200; 'buses, £2,250; shelters and miscellaneous, £150; total, £5,600. The report contains expressions of regret that the corporations of Brighton and Hove had been unable to promote a joint scheme.

SOME RECENT PUBLICATIONS.*

Letchworth (Garden City) and Hitchin with their surroundings are admirably covered in the latest of the well-known series of Homeland Handbooks, the purpose of which is to provide adequate guides to localities and districts in Great Britain. In an introduction to the work Mr. Ebenezer Howard, whose book "Garden Cities of To-morrow" did so much to popularise the movement, points out that the garden city idea is still unrealised, in a sense, he says, and in a very real sense, there is not in existence anywhere a garden city. Letchworth is one in the making, but Mr. Howard asks that those who would really see it must not only see it as it is to-day, but must summon imagination to their aid, and picture it as it will be in days to come. The price of the handbook is 1s. nett.

An index to "Depreciation and Wasting Assets" (By P. D. Leake, F.C.A. London: Henry Good & Son. Price 10s. 6d.) has just been published, and should add considerably to the usefulness of that volume as a book of reference. The index has been personally prepared by Mr. Leake, and is specially drawn with the object of assisting students of this subject. Although, as we stated in reviewing it on March 29, 1912, the book is one which makes its primary appeal to the professional accountant, it will be found of considerable value to those responsible for the management and control of municipal trading enterprises. The price of the index is 6d.

We have also received the following:—

Reprints from "Arbeiten aus dem Kaiserlichen Gesundheitsamte," Vol. XLIV., 1913. Report upon the pollution of the river Röder by the wastes from a cellulose factory. Report upon the disposal of the sewage of the town of Offenbach am Main. Published by Julius Springer, Berlin.

FOR OTHER ADVERTISEMENTS
See End of Paper.

TO CONTRACTORS AND OTHERS.

The Council of the Metropolitan Borough of Wandsworth is prepared to receive Tenders for executing necessary works of repair upon that part of Moyser-road, Streatham, which lies between Gracedale-road and Furzedown-drive.

The Specification and Drawings may be seen, and Forms of Tender obtained of the Borough Engineer, Mr. P. Dodd, M.INST.C.E., at the office of the New Streets Department, No. 56 East-hill, Wandsworth, S.W., between the hours of 10 and 4 (Saturdays 10 and 12), upon payment of a deposit of Five Guineas. Tenders, enclosed in sealed envelopes, and endorsed "Tender for Repairing Moyser-road," must be delivered at the Council House, East-hill, Wandsworth, S.W., and may be placed by the person tendering in the box provided for the purpose not later than Four o'clock in the afternoon of Monday, the 23rd June next.

Persons tendering must, in the case of all workmen employed by them in and about the execution of the Contract, pay wages at not less and observe hours of labour not greater than the rates and hours recognised by the Associations of Employers and Employees and in practice obtained in the District where the work is to be executed. No Tender will be received unless it be made upon one of the forms provided for the purpose.

The Council does not pledge itself to accept the lowest or any Tender. If required, the Contractor must provide two sureties for the due execution of the Contract.

D. A. NICHOLL,
Town Clerk.

Council House,
Wandsworth, S.W.
June 4, 1913. (522)

£30,000. — Exceptional opportunity for joining an old-established firm of Engineers and Contractors. Additional capital required for financing large new contracts, British and foreign, at 10 per cent on cost.—Write Box 3,642, Willings, 125 Strand, W.C. (521)

* Any of the publications reviewed, or referred to as received, will be forwarded by the St. Bride's Press, Limited, on receipt of published price.

COUNTY OF SOUTHAMPTON.

TO BRIDGE CONTRACTORS AND TO DRAINAGE CONTRACTORS.

Persons desirous of tendering for the undermentioned Contracts may obtain Plans, Specifications, and General Conditions, and all other information in connection therewith on application at the Office of Mr. W. J. Taylor, County Surveyor, The Castle, Winchester, on and after Monday, June 16th, 1913, between the hours of 9 a.m. and 4 p.m. (Saturdays 9 a.m. and 12 noon).

Contract No. 1.—The Reconstruction of Great Town Bridge, Whitchurch, on the Winchester, Whitchurch and Newbury Main Road, consisting of four small brick arches, with concrete abutments and piers.

Contract No. 2.—The Construction of Surface-water Drains (about one mile in length), on the Winchester, Portsmouth and Chichester Main Road, between Fareham and Portchester.

Contract No. 3.—The Construction of Short Lengths of Surface-water Drains, on the Bournemouth and Southampton Main Road, between Millbrook and Redbridge.

A deposit of £1 1s. will be required for a copy of the Plan and Specification of *each* Contract. This deposit will be refunded on receipt of a *bonâ-fide* Tender and the return of the documents.

Deposits must be made by cheque, payable to "The Hampshire County Council," and crossed "Bank of England," or particulars will not be sent.

Tenders must be on Forms supplied by the County Surveyor, and endorsed "Great Town Bridge," "Surface Drainage, Fareham," or "Surface Drainage, Millbrook" (as the case may be), and must be delivered to me by or before 10 a.m. on Monday, June 30th, 1913.

The County Council do not bind themselves to accept the lowest or any Tender.

H. BARBER,
Clerk of the County Council.

The Castle, Winchester.
June 4, 1913. (519)

THE URBAN DISTRICT COUNCIL OF STOURBRIDGE.

The above Council invite Tenders for the Erection of a Ferro-concrete Bridge (Mouchel-Hennebique system). Plans and particulars can be obtained from the undersigned, and Tenders to be delivered not later than Monday, the 16th instant.

F. WOODWARD,
Surveyor.

The Town Hall,
Stourbridge.
June 4, 1913. (518)

WILLENHALL URBAN DISTRICT COUNCIL.

SEWAGE OUTFALL WORKS MANAGER.

The above Council invite applications from competent persons for the position of Manager at their Sewage Outfall Works.

Applicants must have a thorough knowledge of electrically-driven elevators, pumping machinery, and power-driven distributors; also a practical experience in the treatment of sewage on bacteriological lines, and the general management and cropping of a sewage farm.

Salary £100 per annum, with house and light.

Age not to exceed 45 years.

Sealed applications, endorsed "Manager," together with copies of three recent testimonials, to be delivered to the undersigned not later than Saturday, June 28th, 1913.

List of duties and general particulars of the appointment may be had from Mr. T. Edgar Fellows, Engineer and Surveyor to the Council.

Canvassing, either directly or indirectly, will disqualify.

ROWLAND TILDESLEY,
Clerk to the Council.

Town Hall,
Willenhall.
June 4, 1913. (520)

INDIAN STUDENT desires practical training with Municipal Surveyor or Engineer.—Particulars to Box 1,255, office of THE SURVEYOR, 24 Bride-lane, Fleet-street, E.C.

MAIN ROAD MAINTENANCE IN SOUTHAMPTON.

COUNTY SURVEYOR'S REPORT.

The year ended March 31, 1913, being the first during which all the main roads of the county of Southampton, other than those in the old urban districts, have been maintained under the direct management of the county council, some observations as to the steps taken and the progress made in bringing the new system into operation are made by the county surveyor, Mr. W. J. Taylor, M.INST.C.E., in his annual report.

The four divisional surveyors took up their appointments a short time only before the commencement of the year; they had, therefore, little opportunity of making themselves acquainted with their divisions, and none whatever to arrange for the supply of local materials, before the year's work actually commenced. They had consequently to take up their duties under circumstances which necessitated working at high pressure for a considerable period, the organisation of the work had to be pushed on with great rapidity, particularly as the season for putting in hand the surface tarring had arrived, and the delay in appointment handicapped them almost throughout the year.

The main roads were divided into lengths averaging nearly 5 miles, and a lengthman allotted to each. Some of these roadmen were transferred from the employment of the district councils, but others were engaged as rapidly as they could be found elsewhere, and all were at work on their respective sections of road early in the year.

During the year the number of lengthmen was increased to 130, and the average length per man is now 4¼ miles. Many of these men thoroughly understand their work, but others are not so satisfactory, and Mr. Taylor thinks there can be little doubt that it will be much to the advantage of the roads to devote great care to the training of intelligent men for this work. "On the difficult task of carrying out minor repairs, and in the repair of small holes and depressions," he observes, "much of the success of road work depends, particularly as under modern traffic these defects occur with great rapidity."

The county surveyor mentions that a commencement has been made in the selection of suitable men for the organisation of permanent rolling gangs, which will be, as far as possible, constantly employed in consolidating material, and thereby become more expert and work to greater effect than if employed for most of the year on other and less important duties.

An important part of the organisation for direct control was the appointment of one foreman and two sub-foremen or gangers to each of the four divisions. The duties of these foremen are—under the direction of the divisional surveyor—to take charge of sub-divisions containing an average of about 45 miles of roads, to see that the men keep time, to travel about, and to work with and instruct the rolling and tarring gangs and the lengthmen, and to assist in checking the materials used and work done.

The whole organisation is now getting into smooth working order, but Mr. Taylor admits that much remains to be done to perfect it, particularly in the selection and training of the spreaders and lengthmen. The more constant attention given to the roads during the past year by the larger number of lengthmen permanently employed upon them has resulted in an improvement of the surface drainage; outlets and grips have been more frequently opened, drains and gullies have been kept in a more efficient state, while considerable progress has been made in clearing overgrown wastes, and the alignment and widening of the roads; there is, nevertheless, much work of this kind yet to be done, and some time must necessarily elapse before all the work under these heads is well in hand.

SURFACE TARRING.

Good progress was made with tarring until the wet weather set in, and as this was more or less continuous, the work was not quite completed until later in the year.

There were many complaints from people living by the side of the roads of delay in applying tar immediately the fine weather set in; it was thought that directly the dust began to blow was the time to do the work, but as the tarring has not been carried out as a dust palliative, the work was not commenced until the road surfaces were dry to a sufficient depth to ensure penetration, and therefore protect the road. "Unless this precaution be taken," the county surveyor observes, "surface tarring from a road maintenance point of view would not justify its cost, especially with the increasing prices of the material used."

No tar was applied to roads in the neighbourhood of fish streams unless steps could be taken to intercept or filter the storm water flowing from the surfaces so treated. The numerous soakage bays and rough filters which were constructed in such places appeared to be thoroughly effective; they were nearly all constructed with the co-operation and assistance of the adjoining landowners and tenants, and no complaints whatever were received of injury to fisheries or cress beds. There was, on the other hand, much complaint from the inhabitants adjoining some portions of the roads which could not be tarred owing to its being found impracticable to take the precautions just referred to.

The tar was applied to the roads principally by brush machines, of the Weeks and Waithman type; one spraying machine was also used; 548,685 sq. yds. were dealt with by the council's own machines, and the remainder of the work, 589,274 sq. yds., was done by contract, the county council supplying the tar, and the roadmen in their employ doing the sweeping.

The effects of the tar have again been most encouraging, and the extent to which the road surfaces have been preserved by it is stated to be very marked, although, owing to the continued wet weather, the beneficial effects in the summer were not so conspicuous. The waterproofing effect was sufficient to minimise the saturation of the road crust during the prolonged period of wet which followed.

The cost of treating the 1,137,959 sq. yds.—equivalent to 12¼ miles of road 16 ft. in width—is given in the report as £5,671, or 1·20d. per yard. The area covered per 10 gallons of tar was 47·55 super. yds.

MATERIAL.

Owing to transport difficulties caused by the great rise in freights and unusual scarcity of shipping and railway trucks, the material for the roads for many weeks arrived in quite inadequately small quantities; in October the position was so serious that it was necessary to relieve one contractor of orders placed with them, to the extent of about 12,600 tons, and to distribute it among other contractors. Even this did not result in a prompt supply, and by the end of December 56 per cent only of the material authorised for use on the roads had been received.

The material arrived in increasing quantities toward the end of the year, and its consolidation was accelerated by the open weather—there was no serious hindrance by frost—so that, notwithstanding the difficulties of supply, by the end of the year all the estimated imported material had been received, and about 96 per cent of it spread and consolidated on the roads, twenty-six rollers being employed on the work.

Sixteen miles of main roads were improved during the year by surfacing with granite in place of gravel and flint; 19,646 tons of basalt and granite were used in this work of extension. It was anticipated when the estimates for the past year were prepared that more imported material would be used for extending the improved coats, but, owing to the unusual wear and tear previously referred to, it was necessary to divert some of it from its original purpose for repairing "pot holes" and resurfacing old granite coats. Even by this transfer of metal it was impossible to do all the repairs to these old surfaces that are desirable, and much of it must be dealt with in the present year.

The mileage of the roads under various kinds of materials is now approximately as follows: Granite, basalt, &c., 236·31; tar-macadam, 2·45; flint, 183·1; gravel, 120·33; total 542·19.

ESTIMATES.

The estimated cost of maintaining and improving the roads during the present year is given by Mr. Taylor as £75,220, as compared with £65,250, the approved estimate (including a supplementary one for tarring of £1,150) for the work during the past year, an increase of £9,970. The estimates provide 13,310 tons for the surfacing with granite in place of gravel and flint on 10 miles of road.

Mr. Taylor says it becomes of increasing import-

ance to cover up the flint and gravel on all the principal lines of communication, at the earliest possible date, as with growing traffic it is quite impossible to maintain a satisfactory surface with the local materials, which are so rapidly pulverised and lost. Referring to the subject of tarred material, he remarks that while it cannot be said that tarred material is more economical under all conditions, there can be no doubt it is so on the more heavily trafficked portions of the main roads, and in consequence it is desirable in those places gradually to make the change.

THE PRICE OF TAR.

The county surveyor suggests that the continued rise in the price of refined tar makes it necessary to consider whether its exclusive use cannot with safety be departed from in some cases. Experiments with dehydrated tar have already been sanctioned, and some has been ordered. Mr. Taylor considers there is no reason why water-freed tar should not be tried on roads where there is no risk of pollution of streams or ponds; such a tar, he thinks, with limited percentage of free carbon, should give satisfactory results, and be worth using if it can be obtained at a substantially reduced cost, as compared with refined tar. He adds that the matter will be carefully investigated and later on reported upon.

Mr. Taylor says it is desirable also to experiment with liquid asphalts as a surface material, as although higher in first cost, these may prove so much more durable as to warrant the additional cost, while it will obviously be much to the advantage of road improvement if the road authority can by these means reduce the quantity of refined tar required.

ANALYSIS AND DISTRIBUTION.

In order to avoid the delays occasioned by waiting for analyses of and sometime replacing condemned tar, after it has been delivered at the various stations throughout the county, an entirely fresh system of analysis and distribution has now been adopted. Containers of about 30,000 gallons at the contractor's works are filled with distilled tar, which is placed under seal by county officials, and the contents are analysed by the county medical officer. If the tar is found by him to be in accordance with the specification it is at once distributed to the various points on the main roads as required. The barrels are filled from the sealed containers under the supervision of an inspector employed by the county council for that purpose, who affixes to each barrel a certifying label that it is filled from the sealed tank, so that none but approved tar reaches the road. By this means not only is the time occupied by analysing a large number of samples saved, but, in addition, waste of time on the road by men and horses is also avoided.

A Road Foreman as Magistrate.—At the Lincoln City Council on Tuesday, upon the Highways Committee's minutes, Mr. Milner said he noticed that Mr. S. Bell, their road foreman, who a short time ago was appointed a magistrate, sat on the magisterial bench last Friday for about five hours. The public wanted to know who paid him for that time—whether it came out of the fines imposed on defendants or the pockets of the ratepayers. Alderman Cottingham said he looked upon the appointment as a distinct honour to the working men connected with the corporation. There was a tacit understanding that Mr. Bell should devote certain time once a week to his magisterial work.

Town-Planning Schemes.—Replying to a question in the House of Commons on Tuesday, Mr. John Burns stated that the Birmingham (Quinton, &c.) town-planning scheme had been finally approved. Three other schemes (East Birmingham, Rochdale, and Ruislip-Northwood) had been made by the local authorities, and submitted to the Local Government Board for approval. Many other schemes which the board had authorised to be prepared were now in course of preparation by the local authorities concerned.—The Harrow Council have given notice of their intention to apply to the Local Government Board for sanction to prepare a scheme of town-planning for their district, and in parts of the adjoining parishes in the Uxbridge rural and Hendon rural areas.

TREES IN PUBLIC STREETS.

EXPERT'S REPORT TO CAMBERWELL BOROUGH COUNCIL.

Various representations have lately been made by ratepayers and others to the Camberwell Borough Council with respect to the beauty and utility on one hand, and the danger to passers-by on the other, of the trees in many of the public streets of the borough. Recently a fatality occurred at Dulwich through a falling branch, and a lady passenger on the top deck of a motor 'bus had her finger smashed as the result of the collision of the vehicle with an overhanging branch in the Old Kent-road. In the circumstances, the borough engineer, Mr. William Oxtoby, M.INST.C.E., has caused a survey to be made of all the trees in Camberwell New-road and Old Kent-road, and in view of the number requiring to be removed he has submitted a report on the subject to the borough council. In addition, the Works and General Purposes Committee have presented a report in which they state that the trees have been examined by a well-known expert from Kew Gardens, together with Mr. J. Sinton Christie, the council's parks and gardens superintendent. In his report Mr. Christie says that, in considering the obstruction from the traffic point of view, particular attention was given to the difficulties in the matter of motor omnibuses drawing into the kerb. He proceeds to point out that in every case in the two roads mentioned the obstruction is caused by the stems of the trees and not by protruding or overhanging branches. "It is a known fact," he remarks, "that the angle at which a tree may be growing will vary owing to the extra vigorous growth of the roots on one side or the other forcing the stem over. This action may be intermittent, and occurs in the case of old trees as well as with young ones. The fact that a tree leans over may not always be due to any lessened support by the roots, but to a partial increase in growth of the root system. In the case of trees growing in streets there is usually a tendency for them to lean slightly towards the roadway, due to the growth of the roots under the footway and forecourts being greater than under the road, where the depth of drainage is against free root action near the surface. This variation may only be a matter of a few inches, but when considered in relation to the traffic problem it is an important point. Owing to their size and the conditions under which they are growing (which are quite different from those of a tree growing in a park), it is impossible to pull the stems over without cutting away a number of the roots, which would not only lessen the stability of the trees, but possibly kill them, and further, they would require to have permanent stay ropes attached to them to prevent their being blown over during a wind."

After carefully considering the whole of the facts Mr. Christie is convinced that there are only two practical ways out of the difficulty—(1) to widen the footways sufficient to give a clear passage for vehicular traffic, or (2) have those trees removed which are a source of danger to the public.

The expert, in his report, says that he is very decidedly of opinion that the trees are dangerous, that if allowed to remain they will become more so, and that if he had to deal with the problem he would remove all the trees in question, and either replace them with young trees set further from the kerb, or, if this were not practicable, give up the idea of trees in such places; further, that the safety of the public should not be sacrificed or risked for mere appearances, and that trees in streets or roads are not effective unless they have sufficient space for their proper display. He further states that on inspection he is convinced that, as the trees are too old to be removed, and too stiff in the stem to be drawn back, it will be necessary either to remove them altogether or to reset the kerb further out to protect them from vehicular traffic. He also suggests that in future planting of trees in streets where the trees are likely to interfere with road traffic it would be better to plant them on the inside instead of the outside of the footpath. The expert further states that he has seen a number of the trees in reference to which complaints were made as to their mutilation a few years ago, and that it is satisfactory to see that the trees have quite recovered, and are now shapely and good examples of their kind.

The committee have been informed by the borough engineer that it may be possible, through the rectification of the pavements in the Old Kent-road, to save the whole of the trees in that thoroughfare, and they

consider that the question of the trees in the road should be adjourned accordingly.

At the meeting of the council on Wednesday it was decided that all dangerous trees in the two thoroughfares should be removed, and to plant young trees at a further distance from the kerb.

A LIVERPOOL STREET SUBSIDENCE.

THE CORPORATION'S RESPONSIBILITY.

An important point with respect to the responsibility of the local authority for the condition of the roads arose in a case heard at the Liverpool County Court on Monday, when the Liverpool Corporation were sued by a dock labourer and professional boxer named William Cook in respect of injuries he had received in Dunnett-street on November 29, 1912. Mr. A. Hyslop Maxwell (instructed by Mr. G. J. Lynskey) appeared for the plaintiff, and the corporation were represented by Mr. Woolf (instructed by Mr. E. R. Pickmere, town clerk of Liverpool).

Mr. Maxwell explained (the *Liverpool Post* report states) that his client is a professional boxer, who also does dock labouring work. On the date named, about 5 p.m., having finished his work, and while proceeding along Dunnett-street, he felt the roadway give way, and he was precipitated into a hole. He was thrown to the ground unconscious, and was removed in the ambulance to the hospital, where he remained for a week. Two witnesses who examined the hole would state that it was of a sloping character, about 22 in. from east to west, 20 in. from north to south, and at the shallowest part it was 8 in. deep, and 11 in. in depth at the deepest part. Counsel proceeded to explain that if merely by reason of non-repair of the highways anyone was injured they had no remedy at law, because that was what was called nonfeasance; but if a road had been so constructed as to make it such a nuisance that it would give way in the manner which had happened in Dunnett-street, and if the jury were of opinion that bad construction could be made out, and that the road under notice could not have given way unless it had been badly constructed, that was what the law described as misfeasance, and the plaintiff would be entitled to receive damages at the hands of the jury. Counsel submitted that the present case was one of misfeasance. The corporation maintained that they were not liable because there had been no misfeasance, that they had constructed the road properly, and that the accident had been caused by ordinary wear and tear.

In addition to losing his work at the docks, plaintiff had been prevented from fulfilling certain boxing engagements, while he had also lost fees which would otherwise have accrued to him for giving tuition in boxing. He claimed altogether £85.

Evidence was called bearing out counsel's opening statement, and at the close of the plaintiff's case

Mr. Woolf submitted that there was no case to go to the jury, because misfeasance on the part of the corporation had not been established by the plaintiff.

His Honour held that there was no case to go to the jury, and non-suited the plaintiff.

Nibbling at Town Planning.—Opening the proceedings of the Greater London Town-planning Conference last week, Alderman Thompson said there were 150 municipalities nibbling at town-planning, and a great number of them had got to the position of preparing their schemes. In thirty-three cases authority had been given by the Local Government Board for preparing town-planning schemes. There were now 70,000 acres of land included in schemes which had got to that stage.

ROYAL SANITARY INSTITUTE.

ANNUAL CONGRESS AND EXHIBITION, EXETER.

The annual congress of the Royal Sanitary Institute will be held at Exeter from July 7th—12th next, under the presidency of Earl Fortescue, K.C.B., Lord-Lieutenant of Devonshire. The order of proceedings will be found set out in our issue of May 23rd.

E. WHITE WALLIS,
Secretary.

INSTITUTION OF MUNICIPAL AND COUNTY ENGINEERS.

President—Mr. R. J. THOMAS, M.INST.C.E., County Surveyor, Buckinghamshire.

ROCHDALE MEETING.

A meeting of the institution is to be held in the North-Western District at the Town Hall, Rochdale, on Saturday, June 14th.

PROGRAMME.

11 a.m. Reception in the council chamber (main entrance of town hall) by his Worship the Mayor, Alderman W. Cunliffe, J.P.

Paper by Mr. S. S. Platt, M.INST.C.E., borough surveyor, "On Some of the More Recent Municipal Works of Rochdale," which will be taken as read.

Drawings and progress photographs will be exhibited in adjoining rooms, showing the works described and intended to be inspected.

Inspect the town hall (described fully in Vol. xxiii. of "Proceedings" of institution).

Inspect tramway centre, formed by covering the river in ferro-concrete.

12.30 p.m.—Luncheon (tickets 3s. each).

1.30 p.m.—Proceed in brakes (1s. 6d. each) to inspect the following works—viz., Falinge Park, branch police station, tramway depot and offices, ferro-concrete bridges, Mellor-street, sewage disposal works extension at Roch Mills (including new screening and raking arrangements, electrical pumping plant, percolating filters, &c.).

4 p.m. (about).—Afternoon tea at Roch Mills House, kindly provided by the Paving and Sewering Committee.

Arrangements will be made for a brake, if required, to leave Roch Mills for the Rochdale Station about 4.30 p.m.

NOTICE.

In order that the necessary arrangements may be made, members must give notice of their intention to be present not later than Monday next, when copy of the papers will be sent in due course.

A. W. BRADLEY, M.INST.C.E.,
Hon. District Secretary.
Borough Surveyor,
St. Helens, Lancs.

ANNUAL GENERAL MEETING AND TOWN PLANNING CONFERENCE, GREAT YARMOUTH.

(July 16th—19th.)

Wednesday, July 16th.—Morning: General business of the institution; presidential address and presentation of premiums; adjournment for lunch. Afternoon: Conference on Housing and Town Planning Act.

Thursday, July 17th.—Morning: (*a*) Papers on road matters; (*b*) conference (continued); adjournment for lunch, given by mayor and corporation to members of the institution and delegates to the conference. Afternoon: (*a*) Papers on road matters (continued); (*b*) conference continued and concluded. Evening: Annual Dinner.

Friday, July 18th.—Morning: Papers on road matters and subjects of general interest. Afternoon: Trip to waterworks at Ormesby Broad.

Saturday, July 19th.—Morning and afternoon: Trip by rail and steam launches over some of the rivers and broads of Norfolk.

The following is a preliminary list of the papers to be read and discussed at the Town Planning Conference:—

"Town Design in Practice," by J. E. Wilkes, town planning engineer, Dunfermline.

"Legal Aspects of Town Planning," by J. L. Jack, town clerk, Dunfermline.

"Description of Birmingham Schemes," by H. E. Stilgoe, city engineer, Birmingham.

"Early Examples of Town Planning in the City of Edinburgh," by A. H. Campbell, city engineer, Edinburgh.

"Cities Beautiful by the Sea," by J. S. Brodie borough engineer, Blackpool.

"The Small Dwellings Acquisition Act, 1899," by J. L. Redfern, borough engineer, Gillingham.

"The Housing Question and its Solution," by Reg. Brown, surveyor to the urban district council, Southall.

"Factors Causing Bad Housing," by G. B. Hartree, surveyor to the urban district council, Alton.

"Description of Town Planning Schemes and Housing in Sheffield," by C. F. Wike, city surveyor, Sheffield.

"A Description of the Ruislip-Northwood Town Planning Scheme," by W. Louis Carr, surveyor to the urban district council, Ruislip-Northwood.

The delegates to the conference will be welcomed by the mayor and corporation of Great Yarmouth, and entertained to luncheon by kind invitation of the mayor and corporation.

An important exhibition of plans of town planning schemes, kindly lent by authorities in various parts of the kingdom, will be available during the meeting.

In the course of a circular letter, from which we have extracted the above particulars, Mr. Thos. Cole, the secretary of the institution, remarks that the two previous conferences proved so successful, and the papers and discussions of such value in the elucidation of the problem of housing and town planning, that it is hoped full advantage will be taken by authorities of the sanction granted by the Local Government Board for the payment of expenses of delegates. The board have had under consideration the question of sanctioning expenditure by local authorities in respect of the attendance of delegates at conferences on this subject during the present year, and in connection with certain conferences proposed to be convened at various centres during the year by the National Housing and Town Planning Council, to consider details in the administration of the Housing, Town Planning, &c., Act, 1909, the board have intimated that they will entertain applications from local authorities under the Act, whose accounts are subject to audit by the district auditors, for sanction to the payment of the reasonable expenses of the attendance at one of these conferences of not more than two representatives, including the surveyor or other officer concerned with the working of the Act. The board have intimated, however, that they would not feel justified in sanctioning expenditure in connection with the representation of a local authority at more than one conference of the kind this year, and that it must be understood that the conference selected in each case should be that at the centre most conveniently reached from the district of the particular local authority. The board are of opinion that they could not properly sanction expenditure by local authorities generally in sending delegates to the conference at Great Yarmouth. If, however, any local authority, under the Act of 1909, to whom the Local Authorities (Expenses) Act, 1887, applies, should prefer to send one or two delegates to this conference, the board would be prepared, as in the case of a conference convened by the National Housing and Town Planning Council, and subject to the conditions above indicated, to consider applications for sanction to the payment of reasonable expenses in the matter.

LEEK MEETING: ALTERATION OF DATE.

A meeting of the institution in the West-Midland District will be held at Leek on July 5th (Saturday).

THOMAS COLE,
92 Victoria-street, S.W. *Secretary.*

INSTITUTION OF MUNICIPAL ENGINEERS.

President—Mr. FRANK LATHAM, M.INST.C.E.I., F.S.E., Borough Engineer and Surveyor, Penzance.

A meeting of the North-Western District of the institution will be held at Wellington (Salop) on Saturday, June 21st.

PROGRAMME.

1.30 p.m.—Meet at Council Chamber, Walker-street, Wellington.

2 p.m.—Inspect fire station, public baths, library, market, gasworks, water pumping station, Cottage Hospital and recreation ground.

3 p.m.—Drive to sewage disposal works, impounding reservoir and water filtration works at the famous Wrekin. Brake tickets, 2s. 6d. per head.

6 p.m.—Members and friends will be entertained to tea by John Bayley, Esq., C.C., principal of Wellington College, at the college.

Members residing in the southern portions of this district are earnestly requested to make every effort to attend, together with their friends (ladies or gentlemen). All who intend to be present are asked to notify Mr. Riley, Surveyor's Office, Walker-street, Wellington, as early as possible (and not later than the 14th June) to enable him to make arrangements for conveyances, &c.

J. W. GLEAVE,
"Brantwood," *Hon. District Secretary.*
Coomassie-street,
Heywood.
May 27, 1913.

COUNCIL MEETINGS.

The following council meetings have been arranged: June 25th, London; July 30th, London.

B. WYAND,
Secretary.
39 Victoria-street, S.W.
May 1, 1913.

APPOINTMENTS VACANT.

Official and similar advertisements received up to 4.30 p.m. on Thursdays will be inserted in the following day's issue, *but those responsible for their despatch are recommended to arrange that they shall reach* THE SURVEYOR *office by noon on* **Wednesdays** *to ensure their inclusion in the weekly list of summaries. Such advertisements may, in cases of emergency only, be telephoned (No. 1339 Holborn), subject to later confirmation by letter.*

CORRESPONDENCE CLERK.—June 7th.—Wood Green Urban District Council. £65 per annum.—Mr. W. C. Harding, clerk.

TEMPORARY ENGINEERING ASSISTANT.—June 7th.—Wood Green Urban District Council. £2 2s. per week.—Mr. W. C. Harding, clerk.

GENERAL SURVEYING AND ENGINEERING ASSISTANT.—June 9th.—Corporation of Lancaster. £120 per annum.—Mr. Arthur G. Bradshaw, borough surveyor and water engineer.

JUNIOR SURVEYING ASSISTANT.—June 10th.—Worcestershire County Council. £75 per annum.—Mr. S. Thornely, clerk, Shire Hall, Worcester.

SURVEYOR'S ACCOUNT CLERK.—June 11th.—East Suffolk County Council. £90—£120.—Mr. W. Jervis, county road surveyor, County Hall, Ipswich.

BUILDING INSPECTOR.—June 14th.—Corporation of Stafford. 45s. a week.—Mr. W. Plant, borough engineer.

CLERK OF WORKS.—June 23rd.—Carnarvonshire Joint Standing Committee. £2 10s. per week.—Mr. A. Bodvel-Roberts, clerk of the peace, Carnarvon.

ASSISTANT VALUER AND SURVEYOR.—June 30th.—Calcutta Improvement Trust. 600—800 rupees per month.—Mr. C. H. Bompas, chairman, 5 Clive-street, Calcutta.

CITY SURVEYOR'S DEPUTY (ENGINEERING DEPARTMENT).—June 30th.—Corporation of Manchester. £750 per annum.—City Surveyor, Town Hall.

CITY SURVEYOR'S DEPUTY (SURVEYING DEPARTMENT).—June 30th.—Corporation of Manchester. £750 per annum.—City Surveyor, Town Hall.

TECHNICAL (SANITARY) INSPECTOR.—October 1st.—Municipality of Alexandria.—The Director-General of the Municipality.

ASSISTANT SECRETARY.—For the Road Board. £500 a year.—The Road Board, 28 Broadway, Westminster.

MUNICIPAL COMPETITIONS OPEN.

Official and similar advertisements received up to 4.30 p.m. on Thursdays will be inserted in the following day's issue, *but those responsible for their despatch are recommended to arrange that they shall reach* THE SURVEYOR *office by noon on* **Wednesdays** *to ensure their inclusion in the weekly list of summaries. Such advertisements may, in cases of emergency only, be telephoned (No. 1359 Holborn), subject to later confirmation by letter.*

NEWCASTLE-UPON-TYNE.—June 19th.—Designs for laying out a portion of the Walker estate, for the corporation. Premiums, £50, £30 and £20.—The Town Clerk.

LIVERPOOL.—July 24th.—Designs for a sanatorium of 250 beds. Premiums, 150, 100 and 50 guineas.—Mr. Edward R. Pickmere, town clerk.

CHEPPING WYCOMBE.—September 1st.—Designs for town-planning the borough and an area immediately adjoining. Premiums, £25, £10 and £5.—Mr. T. J. Rushbrooke, borough surveyor, High Wycombe.

MUNICIPAL CONTRACTS OPEN.

Official and similar advertisements received up to 4.30 p.m. on Thursdays will be inserted in the following day's issue, *but those responsible for their despatch are recommended to arrange that they shall reach* The Surveyor *office by noon on* **Wednesdays** *to ensure their inclusion in the weekly list of summaries. Such advertisements may, in cases of emergency only, be telephoned (No. 1359 Holborn), subject to later confirmation by letter.*

Buildings.

TRURO.—June 9th.—For the construction of a reservoir, for the rural district council.—Mr. Coulter Hancock, clerk.

STOCKPORT.—June 9th.—For the erection of a wooden store and painting shop, for the Tramways Committee.—Mr. J. Atkinson, borough surveyor.

KENT.—June 9th.—For the supply of standard portable shelters for open-air treatment, for the county council.—County Medical Officer of Health, Mill-street Chambers, Maidstone.

WELLINGBOROUGH.—June 9th.—For the construction of a reinforced concrete bandstand, for the urban district council.—Mr. E. Young Harrison, engineer and surveyor.

ABERDEEN.—June 9th.—For the extension of the fish market, for the corporation.—Mr. W. Dyack, burgh surveyor.

GLAMORGAN.—June 9th.—For alterations and additions to police stations, for the Standing Joint Committee.—County Council Offices, Cardiff.

MANCHESTER.—June 9th.—For the erection of a steam roller shed and stand, for the corporation.—City Architect.

GLASGOW.—June 9th.—For alterations to Dixon Hall, and erection of a boiler-house, for the corporation.—Mr. J. Lindsay, town clerk.

BARNES.—June 10th.—For the erection of twenty-eight cottages, for the urban district council.—Mr. G. Bruce Tomes, surveyor, Council House, High-street, Mortlake, S.W.

GOOLE.—June 11th.—For the erection of a combined convenience and shelter and workshops, for the urban district council.—The Surveyor.

WINCHESTER. — June 11th. — For repairs to schools, for the corporation.—City Surveyor.

CARSHALTON.—June 11th.—For the construction of brick walls (piers and panels), wrought-iron fencing and iron gates, and oak and Jarrah park pale fencing, for the urban district council.—Mr. W. Willis Gale, surveyor.

WINCHCOMB.—June 13th.—For the construction of a concrete reservoir, and laying mains, sluice valves, and other works, for the rural district council.—Messrs. Phillott & George, engineers, 31 Promenade, Cheltenham.

NEWTON ABBOT.—June 14th.—For the reconstruction of Penn Inn Bridge, for the urban district council.—Mr. Coleridge D. White, surveyor.

WALLASEY.—June 14th.—For the erection of a pavilion, for the corporation.—Mr. W. H. Travers, borough engineer and surveyor.

WEDNESBURY.—June 14th.—For works and renovations at town hall, for the corporation.—Mr. E. M. Scott, borough surveyor.

MILFORD (Co. Donegal).—June 14th.—For the erection of forty-nine labourers' cottages, for the rural district council.—Mr. S. Watters, clerk.

DOVER.—June 16th.—For the erection of a public convenience, for the corporation.—Mr. W. C. Hawke, borough engineer.

WEST RIDING.—June 16th.—For erecting new constabulary headquarters, for the Standing Committee.—Mr. Percy O. Platts, acting West Riding architect, County Hall, Wakefield.

MANCHESTER.—June 18th.—For the extension of the School of Art, for the corporation.—Accountant, Education Offices, Deansgate.

WILTS.—June 18th.—For repairs to a school, for the county council.—County Surveyor, Trowbridge.

HEBDEN BRIDGE.—June 19th.—For the erection of new stables, for the urban district council.—Mr. T. Waddingham, engineer and surveyor.

LANCASHIRE.—June 20th.—For the erection of school, for the Education Committee.—Mr. H. Littler architect, 16 Ribblesdale-place, Preston.

RHONDDA.—June 20th.—For the erection of a school, for the urban district council.—Mr. J. Rees, architect, Hillside Cottage, Pentre.

NORTHUMBERLAND.—June 20th.—For alterations to a council school, for the Education Committee.—Mr. C. Williams, secretary, The Moothall, Newcastle-on-Tyne.

HARROW-ON-THE-HILL.—June 21st.—For the erection of two cottages, stables, and stores, and additions to hospital, for the urban district council.—Mr. J. P. Bennetts, engineer and surveyor.

WEST RIDING.—June 23rd.—For the widening (in masonry) of Cottingley Bridge, for the Highways Committee.—Mr. F. G. Carpenter, West Riding surveyor, County Hall, Wakefield.

TOTTENHAM.—June 23rd.—For redecoration of schools, for the Education Committee.—Mr. W. H. Prescott, surveyor.

SOUTHAMPTON.—June 23rd.—For reconstructing a warehouse, for the Harbour Board.—Mr. J. E. Pailthorpe, clerk, Town Quay.

CARDIGAN.—June 23rd.—For the construction and extension of waterworks, consisting of mains, valves, hydrants, and supplemental reservoir, for the corporation.—Mr. D. Morgan Jones, town clerk.

WEST SUSSEX.—June 23rd.—For the erection of an infants' school, for the Joint Education Committee.—Mr. H. P. Roberts, county education architect, Thurlow House, High-street, Worthing.

FARNHAM.—June 24th.—For the erection of five cottages, for the urban district council.—The Surveyor.

HERTS.—June 27th.—For the construction of a bridge, for the county council.—Mr. Urban A. Smith, Hatfield.

HERTFORDSHIRE.—June 27th.—For the construction of a new bridge over the Stort Navigation at Bishops Stortford, for the county council. — Mr. Urban A. Smith, county surveyor, Hatfield.

HERTFORDSHIRE.—June 27th.—For the construction of a new bridge over the Stort Navigation at Sawbridgeworth, for the county council.—Mr. Urban A. Smith, county surveyor, Hatfield.

Iron and Steel.

TENBY.—June 11th.—For the supply and delivery of 1,500 ft. of cast-iron pipes of 48-in. diameter, and 922 ft. of 9-in. diameter, also certain special castings, for the corporation.—Mr. G. Lort Stokes, town clerk.

ASHTON-UNDER-LYNE.—June 11th. — For the supply of cast-iron pipes, special castings, bolts, nuts, and washers, for the Waterworks Joint Committee.—Mr. F. J. Dixon, water engineer.

TENBY.—June 11th.—For the supply of cast-iron pipes, for the corporation.—Mr. T. J. Moss-Flower, civil engineer, 28 Victoria-street, Westminster.

MERTHYR.—June 14th.—For laying and jointing water mains, for the corporation.—Mr. T. A. Rees, town clerk.

TEDDINGTON.—June 16th.—For the supply and erection of pumping machinery, auxiliary plant, and pipework, at the sewage disposal works, for the urban district council.—Mr. Marshall Hainsworth, surveyor.

WALTON-LE-DALE.—June 16th.—For sinking well head and borehole, and supplying borehole pump and shafting, for the urban district council.—Mr. G. J. Gibbs, 7 Lune-street, Preston.

SUTTON (Surrey).—June 18th.—For the supply of a new double vertical fire engine, for the urban district council.—Mr. Hedley Grieves, surveyor, Municipal Offices.

Roads.

WANDSWORTH.—June 9th.—For making up and paving part of Wimbledon Park-road, for the borough council.—Mr. Edward J. Ellis, deputy town clerk.

CREWE.—June 9th.—For making up several back passages, for the corporation.—Mr. G. Eaton Shore, borough surveyor.

WALLSEND.—June 9th.—For kerbing, flagging, and tar-macadamising, for the corporation.—Mr. G. Hollings, borough surveyor.

BARNES.—June 10th.—For paving the carriageway of Sheen-lane from High-street to Upper Richmond-road with creosoted deal blocks laid on a concrete foundation, for the urban district council.—Mr. G. Bruce Tomes, surveyor, Council House, High-street, Mortlake, S.W.

TOTTENHAM.—June 10th.—For repairing tar and asphalt paving, for the urban district council.—Mr. W. H. Prescott, engineer.

BILLINGE.—June 10th.—For the supply of granite-macadam, kerbs, and setts, for the urban district council.—The Surveyor.

CAERPHILLY.—June 10th.—For paving, channelling, kerbing, sewering, and forming, for the urban district council.—Mr. A. O. Harpur, surveyor.

ENFIELD.—June 11th.—For the supply of 4,000 tons of 1½-in. hand-broken Clee Hill, Dhu, or best blue Guernsey granite, for the urban district council.—Mr. T. W. Scott, clerk.

ENFIELD.—June 11th.—For making up two streets and part of a third street, for the urban district council.—Mr. T. W. Scott, clerk.

CHEADLE.—June 11th.—For draining, levelling, metalling, and asphalting, for the urban district council.—Mr. E. Sykes, surveyor.

SMALLTHORNE.—June 11th.—For works in Cross-street, for the urban district council.—The Surveyor.

ATHERTON.—June 11th.—Tenders invited for the purchase of tar.—Mr. W. Garnett, clerk.

OLDHAM.—June 12th.—For paving and sewering several streets, for the corporation.—Mr. J. H. Hallsworth, town clerk.

MACCLESFIELD.—June 14th.—Tenders invited for the purchase of tar.—Mr. F. R. Oldfield, town clerk.

STAINES.—June 14th.—For making up, paving, and surface draining, for the urban district council.—Mr. E. J. Barrett, engineer and surveyor.

CROYDON.—June 14th.—For tar paving and tar dressing playgrounds, for the Education Committee.—Mr. James Smyth, clerk, Education Offices, Katherine-street.

WILLITON.—June 14th.—For the hire of steam roller, for the rural district council.—Mr. F. Risdon, clerk.

HARROW-ON-THE-HILL.—June 14th.—For the supply of broken granite, granite chippings, and limestone tar-paving, for the urban district council.—Mr. J. P. Bennetts, surveyor.

WAKEFIELD.—June 14th.—For the supply of broken granite, broken whinstone, broken furnace slag, and team labour, for the rural district council.—Mr. Frank Massie, Tetley House, 47 Kirkgate, Wakefield.

HASTINGS.—June 14th.—For work of road rolling, for the rural district council.—Mr. A. R. Inskipp, clerk.

HEBDEN BRIDGE.—June 16th.—For the reconstruction of footpaths, for the urban district council.—Mr. T. Waddingham, engineer and surveyor.

REIGATE.—June 16th.—For the construction of new streets and walks and surface-water culvert with other works, for the corporation.—Borough Surveyor.

SHEFFIELD.—June 16th.—For asphalting at schools, for the Education Committee.—City Architect.

TEDDINGTON.—June 16th.—For road works in several streets, for the urban district council.—Mr. M. Hepworth, surveyor.

ILKLEY.—June 17th.—For making up two streets, for the urban district council.—The Surveyor.

LEWES.—June 20th.—For scarifying and steam rolling, for the corporation.—Mr. Montague S. Blaker, town clerk.

[illegible]INGHAM.—June 25th.—For fixing Norwegian kerb and channel, concrete slab paving and paved [illegible], for the corporation.—Mr. C. W. Marks, borough surveyor and engineer.

HERTS.—For the construction of Tarmac or tarred slag roads, for the county council.—County Surveyor, Hatfield.

Sanitary.

WINDSOR.—June 9th.—For works of drainage, for the rural district council.—Mr. J. B. Gale, clerk.

SEGHILL.—June 9th.—For the removal of ashes, for the urban district council.—Mr. T. Spencer, clerk.

MIDDLESBROUGH.—July 9th.—For the construction of about 1,100 lin. yds. of 7-ft. and 6-ft. diameter brick culvert, with manholes, junctions and other chambers, also the erection of pumping station and engine house, for the corporation.—Mr. S. E. Burgess, borough engineer.

BIRMINGHAM.—June 10th.—For the construction of about 1½ acres of bacteria beds with upwards of 14,000 cub. yds. of medium, and other appurtenant works, for the District Drainage Board.—Mr. John D. Watson, engineer, Tyburn, Birmingham.

BLAYDON.—June 10th.—For the removal of refuse, for the urban district council.—Mr. R. Biggins, sanitary inspector, Blaydon-on-Tyne.

RIPLEY.—June 10th.—For the construction of sewage disposal works, for the urban district council.—Mr. G. W. Bird, surveyor.

ULVERSTON.—June 11th.—For the construction of sewers and manholes, for the rural district council.—The Engineer, Town Hall.

CHORLEY WOOD.—June 11th.—For work of scavenging, for the urban district council.—Mr. J. Robinson, inspector, 9 Market-street, Watford.

DURHAM.—June 11th.—For laying pipe sewers and constructing manholes and sewage tanks, for the rural district council.—Mr. G. Gregson, surveyor, 38 Saddler-street, Durham.

LAMBETH.—June 12th.—For the erection of an underground convenience, for the borough council.—Mr. H. Edwards, borough engineer.

LISTOWEL (co. Kerry).—June 19th.—For constructing main sewer, for the rural district council.—Mr. M. O'Connell, clerk, Union Offices.

SOUTH SHIELDS.—June 19th.—For the erection of a public convenience and shelter, for the corporation.—Mr. Leslie Roseveare, borough engineer and surveyor.

WHITTINGTON AND NEWBOLD.—June 30th.—For the construction of 1,600 yds. of 12-in., 15-in. and 18-in. earthenware pipe sewers, with manholes, tanks, filters, engine and pump house, machinery, and other works, for the urban district council.—Mr. Bathgate Comb, surveyor, St. John's-road, Whittington Moor, Chesterfield.

NORTH BROMSGROVE.—June 30th.—For the construction of 1,000 yds. of 6-in., 7-in. and 9-in. diameter stoneware pipe sewers, manholes, overflow chamber, ventilating columns, and other works, for the urban district council.—Mr. Francis T. Leven, clerk.

HOUGHTON-LE-SPRING.—July 1st.—For scavenging work, for the rural district council.—Mr. R. B. Marley, clerk.

MADRAS.—September 9th.—For the supply and delivery of English stoneware pipes and specials, varying from 4 in. to 21 in. internal diameter, and aggregating a total length of about 143 miles, for the corporation.—Messrs. James Mansergh & Sons, agents, 5 Victoria-street, Westminster, S.W.

HEMSWORTH.—No date.—For improvements at the sewage disposal works, including the construction of a filter, for the rural district council.—Mr. John Scholefield, clerk.

Stores.

ASHTON-IN-MAKERFIELD.—June 7th.—For the supply of road and sanitary materials, gas meters and galvanised steam tubes and fittings, for the urban district council.—Mr. Albert Sykes, clerk.

HEYWOOD.—June 9th.—For stores, for the Electricity Committee.—Chairman of the Committee.

CLACTON.—June 11th.—For the supply of oils, cotton waste, gas meters, bitumen, electrical fittings, gas mantles, cement and ballast, for the urban district council.—Mr. G. T. Lewis, clerk.

KEIGHLEY.—June 30th.—For the supply of ironmongery, iron castings, pitch, oil, broken limestone, granite, earthenware pipes, and cement, for the corporation.—Borough Engineer.

Miscellaneous.

EDINBURGH.—June 11th.—For the supply of 6,000 tons of clean Arran sand for filters, for the Water Trustees.—Mr. W. Boyd, clerk, 12 St. Giles-street, Edinburgh.

CHEPPING WYCOMBE.—July 8th.—For a supply of best anthracite coal, for the corporation.—Mr. T. J. Rushbrooke, water engineer.

TENDERS FOR MUNICIPAL WORKS OR SUPPLIES.

The Editor invites the co-operation of SURVEYOR *readers with a view to making the information given under this head as complete and accurate as possible.*

* Accepted. † Recommended for acceptance.

GUILDFORD.—Accepted for the supply of granite, for the rural district council.—Mr. J. Anstee, surveyor:—

	Per ton. s. d.
British Macadams, Limited, Cannon-street, E.C. (for Penmaenmawr granite)	16 4
London Granite Company, Limited, Water-lane, Great Tower-street, E.C. (for Quenast granite)	14 9
Clee Hill Dhu Stone Company, Limited, Ludlow, near Salop	14 9
Ellis & Everard, Markfield and Bardon Hill Granite Quarries, near Leicester	14 3
Mountsorrel Granite Company, Limited, Mountsorrel, near Loughborough	13 9
Enderby and Stoney Stanton Granite Company, Limited, Narborough, near Leicester	13 9
Groby Granite Company, Limited, Groby, near Leicester	13 8
Whitwick Granite Company, Limited, Whitwick, near Leicester	13 6

LONDON. Accepted for the supply of jarrah wood and creosoted deal paving blocks, for the London County Council:—

Millars' Timber and Trading Company, Limited, Pinners' Hall, E.C., per 1,000 Jarrah Wood-paving Blocks.—37,000, size 3 in. by 6 in. by 3½ in., £6 12s. 6d.; 8,000, ditto, £6 12s. 6d.; 15,000, ditto, £6 12s. 6d.; 12,000, size 3 in. by 9 in. by 4 in., £10 17s.; 32,000, ditto, £10 17s.; 159,000, size 3 in. by 9 in. by 4¼ in., £12 6s. 9d.

W. Griffiths & Co., Limited, Bishopsgate, E.C., per 1,000 Jarrah Wood-paving Blocks.—8,000, size 3 in. by 6 in. by 3½ in., £6 18s.; 10,000, ditto, £6 17s.; 4,000, ditto, £6 16s. 6d.; 62,000, size 3 in. by 9 in. by 4½ in., £12 12s.; 50,000, ditto, £12 13s.; 50,000, ditto, £12 7s.

Burt, Boulton & Haywood, Limited, Cannon-stret, E.C., per 1,000 Creosoted Deal-paving Blocks.—60,000, size 3 in. by 9 in. by 4½ in., £7 13s. 1d.

W. W. Howard, Brothers & Co., Trinity-square, E.C., per 1,000 Creosoted Deal-paving Blocks.—50,000, size 3 in. by 9 in. by 4 in., £6 10s. 5d.; 7,000, ditto, £6 10s. 5d.; 3,000, ditto, £6 12s. 4d.; 138,000, size 3 in. by 9 in. by 4½ in., £7 6s. 3d.; 26,000, ditto, £7 6s. 3d.; 12,000, ditto, £7 8s. 5d.; 30,000, ditto, £7 6s. 8d.; 30,000, £7 7s. 11d.; 72,000, size 3 in. by 9 in. by 5 in., £8 2s.; 80,000, ditto, £8 2s.

LONDON.—For the supply of steel rails and other requirements, for the London County Council:—

SLOT RAILS AND CONDUCTOR TEES.

W. Scott, Limited, Leeds	£16,566
J. Batt & Co., Limited, London	15,711
Frodingham Iron and Steel Company, Scunthorpe †	12,812

TRACK RAILS AND FASTENINGS.

	Carbon Steel.	High-silicon steel (Sandberg process).
A. W. Nye, New Broad-street, for Société Anonyme d'Ougrée-Marihaye, Belgium (no fish bolts quoted for tender)	£19,930	No tender
Bolckow, Vaughan & Co., Limited, Middlesbrough	24,321	£25,071†
J. Batt & Co. (London), Limited, Old Broad-street, E.C., for rails manufactured in England and/or Germany and/or Belgium	18,504	19,197
W. Scott, Limited, Leeds	24,512	26,012
A. Brown & Co., of Cannon-street, E.C., for Société Anonyme des Acieres d'Angleur, Belgium	26,391	27,339
Barrow Hæmatite Steel Company, Limited, Barrow-in-Furness	26,526	No tender
Cammell, Laird & Co., Limited, Sheffield	(Fishplates only quoted for)	

The chief engineer's estimates are £27,875 for rails of carbon steel and £29,375 for rails of high silicon steel.

SPECIAL TRACK RAILS, RENEWABLE GUARDS AND FASTENINGS.

Bolckow, Vaughan & Co., Limited, Middlesbrough	£17,014	£17,476†
Barrow Hæmatite Steel Company, Limited, Barrow-in-Furness. (No bolts quoted for in tender)	17,441	No tender
J. Batt & Co. (London), Limited, Old Broad-street, E.C., for rails manufactured in England, and/or Germany and/or Belgium	18,504	19,197
W. Scott, Limited, Leeds	19,481	20,406

The estimates of the chief engineer are £22,794 for rails of carbon steel, and £23,256 for rails of high silicon steel.

LONDON.—For the supply of Guernsey granite setts, for the London County Council:—

County Wharf (1,000 tons, 3-in. by 6-in. setts).—Fry Brothers, Greenwich, 31s. 6d.; A. & F. Manuelle, Gracechurch-street, E.C., 31s. 6d.; J. Mowlem & Co., Limited, Westminster, 32s.; Brookes, Limited, Westminster, 32s.; W. Griffiths & Co., Limited, Bishopsgate, E.C., 32s. 3d.; H. Woodham & Sons, Catford, 32s. 6d.; Enderby and Stoney Stanton Granite Company, Limited, Narborough, 32s. 3d.

Deptford Wharf (450 tons, 3-in. by 6-in. setts).—Fry Brothers, Greenwich, 31s. 6d.; A. & F. Manuelle, Gracechurch-street, E.C., 32s.; J. Mowlem & Co., Limited, Westminster, 32s. 3d.; Brookes, Limited, Westminster, 32s.; W. Griffiths & Co., Limited, Bishopsgate, E.C., 32s. 6d.; H. Woodham & Sons, Catford, 32s. 6d.; Enderby and Stoney Stanton Granite Company, Limited, Narborough, 33s. 3d.

Battersea Wharf (250 tons, 3-in. by 6-in. setts).—Fry Brothers, Greenwich, 31s. 6d.; A. & F. Manuelle, Gracechurch-street, E.C., 31s. 9d.; J. Mowlem & Co., Limited, Westminster, 32s.; Brookes, Limited, Westminster, 32s. 3d.; W. Griffiths & Co., Limited, Bishopsgate, E.C., 32s. 6d.; H. Woodham & Sons, Catford, 32s. 6d.; Enderby and Stoney Stanton Granite Company, Limited, Narborough, 32s. 3d.

Leven-road Wharf (500 tons, 4-in. by 6-in. setts).—Fry Brothers, Greenwich, 27s. 6d.; A. & F. Manuelle, Gracechurch-street, E.C., 27s. 9d.; J. Mowlem & Co., Limited, Westminster, 28s.; Brookes, Limited, Westminster, 28s. 3d.; W. Griffiths & Co., Limited, Bishopsgate, E.C., 29s.; H. Woodham & Sons, Catford, 29s. 6d.; Enderby and Stoney Stanton Granite Company, Limited, Narborough, 31s. 3d.

Deptford Wharf (250 tons, 4-in. by 6-in. setts).—Fry Brothers, Greenwich, 27s. 6d.; A. & F. Manuelle, Gracechurch-street, E.C., 28s.; J. Mowlem & Co., Limited, Westminster, 28s. 3d.; Brookes, Limited, Westminster, 28s.; W. Griffiths & Co., Limited, Bishopsgate, E.C., 28s. 6d.; H. Woodham & Sons, Catford, 29s. 6d.; Enderby and Stoney Stanton Granite Company, Limited, Narborough, 32s. 3d.

The Highways Committee have accepted the tender of Fry Brothers, who were the lowest tenderers, for four of the five items and one of the two lowest tenderers for the other item.

NUNEATON. For the construction of earthenware pipe sewers, for the corporation.—Mr. F. C. Cook, borough engineer and surveyor:—

J. Brown, Nuneaton	£958
W. H. Crawley, Doncaster	933
H. C. Pullar, Northwich	901
Jukes & Co., Tipton	882
C. P. Trentham, Limited, Birmingham	880
Emery & Co., Aston, Birmingham*	774

POPLAR.—For the supply and erection of an overhead travelling crane, for the London County Council:—

East Ferry-road Engineering Works, Limited, Millwall	£107
T. Smith & Sons, Rodley	90
Higginbottom & Mannock, Limited, Manchester	84
I. Spencer & Co., Limited, Manchester †	72

RUSHDEN.—Accepted for the supply of granite and slag, for the urban district council.—Mr. W. B. Madin, engineer and surveyor:—

GRANITE MACADAM.

	Tons.
Enderby and Stoney Stanton Granite Company, Enderby	750
Groby Granite Company, Groby	100
Jees Hartshill Granite Company, Nuneaton	100
Hodson & Son, Nottingham	100
Cliffe Hill Granite Company, Markfield	100
Forest Rock Granite Company, Whitwick	100
Croft Granite Company, Croft	100
	1,950

SLAG.

	Tons.
Kettering Iron Company, Kettering	350
Wellingborough Iron Company, Wellingborough	350
T. Butlin & Co., Wellingborough	350
	1,050

Widening Washbrook-road Bridge. W. G. Wilmott, Rushden, £74 10s.

ST. DOGMELLS. For the supply of pail closets, for the rural district council.—Mr. I. E. E. George, Troedyrhiw, Cardigan:—

	Each. £ s. d.
W. J. Jenkins, Cnwcsciencyn, Rhoshill	2 10 0
J. Morris, Cwm, St. Dogmells*	2 4 6
— Griffiths, Bayvil, Cardigan*	2 2 0
S. George & Son, Cilgerran, Pem.*	2 2 0

Three tenders were accepted—viz., the first, second, and third, and the inspector was given a free hand to get the closets from either of the three when any were required.

WEST HAM.—For the extension of the technical institute, construction of underground conveniences, and private street works, for the corporation.—Mr. J. G. Morley, borough engineer:—

TECHNICAL INSTITUTE EXTENSION.

H. J. Carter, Limited, Grays and Forest Gate	£3,748
F. & G. Foster, Norwood Junction	3,593
A. E. Symes, Stratford	3,557
W. S. Sharpin, Bow	3,545
J. W. Jerram, Plaistow	3,489
H. C. Horswill, Forest Gate*	3,279

UNDERGROUND CONVENIENCE, QUEEN'S-SQUARE.

H. J. Carter, Limited, Grays and Forest Gate	£1,750
E. Proctor & Sons, Plumstead	1,677
J. W. Jerram, Plaistow	1,649
A. E. Symes, Stratford	1,649
F. & G. Foster, Norwood Junction	1,645
H. C. Horswill, Forest Gate*	1,554

PRIVATE STREET WORKS, SUGAR HOUSE-LANE AND DARTMOUTH-ROAD.

	Sugar House-lane.	Dartmouth-road.
G. P. Trentham, Limited, Walthamstow	£5,089	£266
J. Mowlem & Co., Limited, Westminster	5,039	336
D. T. Jackson, Barking	4,921	272
W. Griffiths & Co., Limited, Bishopsgate, E.C.	4,786	329
H. Farrow, Brixton	4,946	
G. J. Anderson, Poplar*	4,466	265

MEETINGS.

Secretaries and others will oblige by sending early notice of dates of forthcoming meetings.

JUNE.

6-7.—Institution of Water Engineers: Summer General Meeting at Wakefield.

6-7.—Institution of Municipal and County Engineers: Meeting at Dundee.

14.—Institution of Municipal and County Engineers: Meeting at Rochdale.

23-28.—International Road Congress in London.

JULY.

5.—Institution of Municipal and County Engineers: Meeting at Leek.

7-12.—Royal Sanitary Institute: Annual Congress and Exhibition at Exeter.

16-19.—Institution of Municipal and County Engineers: Annual Meeting at Great Yarmouth.

APPOINTMENTS OPEN.

Official and similar advertisements received up to 4.30 p.m. on Thursdays will be inserted in the following day's issue, *but those responsible for their despatch are recommended to arrange that they shall reach* THE SURVEYOR *office by noon on* **Wednesdays** *to ensure their inclusion in the weekly list of summaries. Such advertisements may, in cases of emergency only, be telephoned (No. 1339 Holborn), subject to later confirmation by letter.*

WORCESTERSHIRE COUNTY COUNCIL.
Applications are invited for the appointment of Junior Surveying Assistant in the County Road Surveyor's Office. Commencing salary, £75 per annum. All information relating to the appointment and forms of application can be obtained from the undersigned, to whom applications must be delivered by the 10th June, 1913. Canvassing in any form will disqualify. S. Thornely, Clerk of the County Council, Shirehall, Worcester, 24th May, 1913. [T 239] (490)

EAST SUFFOLK COUNTY COUNCIL.
Wanted, in the Office of the County Road Surveyor, a surveyor's Account Clerk. Salary, £90 per annum, rising, for approved service, to £120 per annum.

Applicants must have a good knowledge of book-keeping, and be quick and accurate at figures.

Applications, stating age and experience, and accompanied by copies of not more than three recent testimonials, to reach me here on or before the 11th June, 1913.

W. JERVIS,
County Road Surveyor.

County Hall,
Ipswich.
May 27, 1913. (497)

MUNICIPALITÉ D'ALEXANDRIE.
AVIS.

La Municipalité d'Alexandrie a l'honneur d'informer le Public qu'elle met au concours un poste de Surveillant Technique attaché au Service Sanitaire de la Classe de L.E. 16-20 avec un traitement initial de la classe.

Les candidats devront accompagner leur demande des pièces suivantes: –

(1°) Certificats d'aptitude technique justifiant les connaissances suivantes—

(*a*) Mathématiques élémentaires et préparation de plans et croquis.

(*b*) Connaissance générale des questions de drainage et d'assainissement.

(2°) Extrait de naissance. Le candidat doit avoir moins de 35 ans et jouir d'une bonne santé.

(3°) Certificat de bonne vie et mœurs.

(4°) Connaissance de la langue française ou anglaise.

Le candidat ne connaissant pas l'arabe, devra dans un délai d'un an de sa nomination, avoir un usage pratique de cette langue et subira alors un examen du quel dépendra son maintien définitif.

Les demandes d'admission au Concours seront adressées à Mr. le Directeur Général de la Municipalité d'Alexandrie jusqu'au 1er Octobre prochain.

Alexandrie, le 29 Avril, 1913.

LE DIRECTEUR GENERAL.
(515) (Signé) A. Granville.

[TRANSLATION.]

MUNICIPALITY OF ALEXANDRIA.
NOTICE.

The Municipality of Alexandria has the honour to inform the Public that it offers for competition a Technical Inspectorship attached to the Sanitary Department in the class [rated at] L.E. 16-20 with the commencing salary of that class.

Candidates must send in with their application the following documents:—

(1) Certificates of technical proficiency showing the following attainments—

(*a*) Elementary mathematics and the preparation of plans and sketches.

(*b*) General knowledge of drainage and sanitation questions.

(2) Certificate of birth. The candidate must be under 35 years of age and in the enjoyment of good health.

(3) Certificate of good character and conduct.

(4) Knowledge of French or English language.

A candidate not knowing Arabic must, within a period of one year from his nomination, possess a practical command of that language, and will then have to pass an examination on which his definitive appointment will depend.

Applications for admission to the Competition are to be addressed to the Director-General of the Municipality of Alexandria up to the 1st of October next.

Alexandria the 29th of April, 1913.

THE DIRECTOR-GENERAL.
(515) (Signed) A. Granville.

ROAD-BINDER. Wanted, representatives to push well-known Proprietary Non-bituminous Binder. Generous commission basis.—Address "Z. H. 152," c/o Deacon's, Leadenhall-street, E.C. (464)

CITY OF MANCHESTER.
The Corporation of Manchester invite applications for the position of Deputy of the City Surveyor in the Surveying Department. Salary, £750 per annum.

Candidates must be Fellows of the Surveyors' Institution.

The Candidate appointed will be required to devote the whole of his time to the duties of the Office, to become a contributor to the Manchester Corporation Officers' Thrift Fund, and to execute their Deed of Service.

Printed forms of application, to be obtained from the City Surveyor, Town Hall, Manchester, stating particulars as to age, health, articles, appointments, qualifications, &c., and accompanied by copies of four testimonials, and, in addition, the names of three referees, must be delivered to me, the undersigned, endorsed "Deputy of the City Surveyor in the Surveying Department," on or before June 30th, 1913.

No application which is not on the printed form above referred to will be considered.

Canvassing, directly or indirectly, is prohibited.

THOMAS HUDSON,
Town Clerk.

Town Hall, Manchester.
May 23, 1913. (494)

CITY OF MANCHESTER.
The Corporation of Manchester invite applications for the position of Deputy of the City Surveyor in the Engineering Department. Salary, £750 per annum.

Candidates must be Corporate Members of the Institution of Civil Engineers.

The Candidate appointed will be required to devote the whole of his time to the duties of the Office, to become a contributor to the Manchester Corporation Officers' Thrift Fund, and to execute their Deed of Service.

Printed forms of application, to be obtained from the City Surveyor, Town Hall, Manchester, stating particulars as to age, health, articles, appointments, qualifications, &c., and accompanied by copies of four testimonials, and, in addition, the names of three referees, must be delivered to me, the undersigned, endorsed "Deputy of the City Surveyor in the Engineering Department," on or before June 30th, 1913.

No application which is not on the printed form above referred to will be considered.

Canvassing, directly or indirectly, is prohibited.

THOMAS HUDSON,
Town Clerk.

Town Hall, Manchester.
May 23, 1913. (495)

TENDERS WANTED.

BOROUGH OF REIGATE.
TO ROAD CONTRACTORS.

The Town Council of Reigate invites Tenders for the construction of new streets and walks, and also of a surface-water culvert with other subsidiary works, on the Reigate Lodge Estate, situate within the said Borough, in accordance with plans, sections, and specifications prepared by Mr. Fred. T. Clayton, C.E., the Borough Surveyor.

Bills of Quantities and Forms of Tender may be obtained on application to the Borough Surveyor, at his Office at the Municipal Buildings, Reigate, where the said plans and specifications may also be inspected.

The Contractor whose Tender may be accepted will be required to enter into a contract in writing, the form whereof may be seen at my Office, and himself and his Sureties will be required to enter into a Bond for the due fulfilment of the contract.

Sealed Tenders, addressed to me, endorsed "Tender for Streets, &c., Reigate Lodge Estate," are to be delivered at my Office at the Municipal Buildings aforesaid, not later than Noon of Monday, the 16th day of June next.

Dated this 26th day of May, 1913.

(By order)
ALFRED SMITH,
(496) Town Clerk.

The Surveyor

And Municipal and County Engineer.

Vol. XLIII. JUNE 13, 1913. No. 1,117.

Minutes of Proceedings.

Trade Wastes: A New Text-book.

In view of the problem, daily becoming more acute, not only in this country, but in Germany, America and elsewhere, of dealing satisfactorily and economically with the various liquid wastes which result from manufacturing processes, it is very necessary to have at disposal all the information that can be secured with regard to the means which have proved successful in purifying these liquids. There is no doubt that the authors of the volume just published are particularly qualified for the compilation of such a work. The experience gained by Drs. Maclean Wilson and H. T. Calvert during many years' working of the Rivers Pollution Prevention Acts has great value, and is now available in this volume for all who are interested in the matter. It should certainly be studied by all manufacturers, who will find that in many cases the cost of a purification process may be to a great extent counterbalanced, and in some instances even made profitable, by the value of by-products recovered. Fibre in paper mills, glycerine, grease, dyes, potash, soda, sulphur and yeast are some of the by-products of considerable value which may be recovered during the processes of purification of various trade wastes.

Apart from the fully detailed descriptions of various methods of purification which have been adopted for different kinds of trade waste, the actual manufacturing processes are briefly but clearly described, and are extremely interesting. Separate chapters are devoted to a description of the numerous apparatus and appliances used in purification works, to the vexed question of the discharge of trade waste waters into public sewers, and to methods of analysis and limits of impurity. An excellent feature of the book is the addition, at the end of each of the thirteen chapters, of a very useful bibliography upon each separate subject. On the other hand, we are rather surprised to learn that, in the author's opinion, the treatment of brewery refuse in contact beds is not successful because of rapid acid fermentation. They consider that percolating filters are more suitable, and reference is made to one such installation where the bed of the stream into which the effluent is discharged was formerly covered with fungus, and had a very offensive smell of brewery waste, while now "neither the smell nor the fungus has quite disappeared, but both are little noticeable." We are acquainted with at least two cases where brewery wastes are satisfactorily treated in contact beds, and the effluent is discharged into very small streams without causing the growth of fungus or any smell whatsoever. As we have stated on other occasions, we believe that most failures of contact beds are due to improper design and lack of knowledge in management. Again, in describing the construction of percolating filters the authors state that it is not absolutely necessary to provide a false floor if the bottom layer of material is of large pieces so as to permit of the escape of finely divided solids with the effluent. Very few engineers will agree with this or with the later statement that the filtering medium must be graded with great care in five separate layers of different grades. Apart from the great difficulty of getting contractors to carry out such a specification, it is, we believe, now generally recognised that, with the exception of the bottom layer of somewhat larger pieces about 6 in. in depth, which comes immediately over the false floor, the whole of the remainder right up to the surface should be as nearly as possible of one grade throughout. Indeed, the greater efficiency of this method of arranging the medium was well established by the Philadelphia experiments (The Surveyor, April 21, 1911, p. 561). An indication of the troubles which arise when fine material is used on the surface is given by the authors themselves when they recommend that the surface layer of fine material ($\frac{1}{8}$ in. to $\frac{1}{4}$ in.) "should be banked round the sides of the filter to a height of 3 in. or so above the general level, so as to *prevent any liquid overflowing.*" These are, however, matters of engineering, and do not detract from the value of a text-book written jointly by a medical man and a chemist whose knowledge and experience in their own particular branches of the subject are of inestimable value to all engineers, surveyors and others who may have to deal with the difficult problem of purifying trade wastes.

* * *

Local Councillors and the Sanitary Laws.

It is a significant commentary upon the difficulties and differences that constantly arise between urban and rural authorities and their officials that these stumbling blocks are generally associated, more or less, with matters of sanitation. The majority who constitute these councils, belonging as they do to the agricultural community, with its remoteness from populous places, prefer to be a law unto themselves in questions affecting their personal interests and environment, and this preference freely expresses the measure of their resentment when the responsible official makes a move, or proposes to make a move, for the abatement of some prehistoric nuisance, with which habit and custom has familiarised the countryside, but which at length must necessarily come up for consideration and abatement. The spirit which dictates the indignation of the local councillor is ostensibly economic in the excusable and partially innocent sense that it has for its object the monetary interests of the ratepayers, but in reality the prejudice of the objector has its origin in a rooted antipathy to the "interference" of the constituted authority with a state of things that has stood the test of time and association without complaint or protest. This is the spirit which has invoked from the Beverley Rural District Council a defiance of a letter from the Local Government Board, in which that authority presses upon the council their responsibility under the Public Health Acts for the sanitary condition

* "Trade Waste Waters: Their Nature and Disposal," by H. Maclean Wilson, M.D., B.SC., chief inspector, West Riding of Yorkshire Rivers Board, and H. T. Calvert, M.SC., PH.D., F.I.C., chief chemical assistant. 340 pp., with 74 illustrations, including 22 plates. London: Charles Griffin & Co., Limited, Exeter-street, Strand. Price 18s. nett.

of Elloughton. The Whitehall authority relies for the action it has taken not merely upon reports by the medical officer of health and the inspector of nuisances, but also upon the fact that the council themselves have recognised the desirability of a sewerage scheme being carried out. When it is stated that the defiant attitude towards the Local Government Board which the council have chosen to assume is justified on the plea that the sanitary condition of the district complained of is satisfactory, we are enabled to measure the degree of consistency by which the members of that body are influenced.

Then there is the additional instance of the Swinton Urban District Council, which recently passed the report of the Sanitary Committee that notices be served upon certain property owners to carry out necessary sanitary works. It was sought by certain councillors to prove that the formal adoption of the report by the council only meant that it had been passed "as a correct record," and that consequently it could be amended, if necessary. The clerk, Mr. F. L. Harrop, with a commendable courage which certain members regarded as official audacity, rebuked the malcontents for their "extraordinary" behaviour, and reminded them that their conduct did not conduce to the dignity of the council. "The condition of things existing," Mr. Harrop continued, "had been condemned by the sanitary inspector, the medical officer, and the council as insanitary," and after the decision of the council the notices must be served. These cases are quoted as examples of the obstacles that are constantly being placed in the path of sanitary reform in urban and rural communities, and they prove, if anything can, that the powers of the local officials could be constantly minimised, if not nullified altogether, if it were not for the salutary existence of the more powerful weapon which the Legislature has placed in the hands of the Local Government Board.

* * *

Croydon Relief Road: The Local Government Board Inquiry.

The excellent service which is performed by inspectors of the Local Government Board was exemplified in a striking manner during the proceedings at the inquiry held at Croydon into the proposed expenditure of some £19,000 on a relief road. We cannot congratulate either the proposers or the opponents of the scheme on having stated the case for or against with reasonable clearness and force, and the inspector, Mr. Malet, had a difficult task in eliminating unsuitable matter and in suppressing impertinent questions and replies which were not evidence. Really important matters of fact, the establishment of which at an early stage in the proceedings would have saved much time, were not fully disclosed until towards the end, and there was an almost continuous attempt, by both sides, to get witnesses to say what they knew other persons thought, and what they thought other persons knew. The inspector had frequently to intimate that the question asked was not to the point, or to remind the questioner that it had already been asked and answered.

That the promoters brought forward no independent road surveyor in support of their scheme is perhaps not remarkable in view of the fact that the designer of the road, Mr. E. F. Morgan, had the support of his colleague, Mr. G. F. Carter, the borough engineer, and in view, too, of the further fact that the Road Board were contributing £30,000 towards the cost. The opposition, on the other hand, wasted a good deal of time in trying to establish by the examination of various witnesses, not road surveyors or engineers, their contention that the proposed road is not a good engineering work. Mr. C. Chart, an architect and surveyor, was, of course, an expert witness on the subject of the development of building land and the work which would have to be done on the road in order to develop such land, but with no witnesses capable of going beyond that, the opposition might as well have left the engineering of the road alone. The promoters produced witnesses to give expert evidence as regards facts relating to heavy motor traffic, among these being Mr. Shrapnell Smith, and other traffic witnesses expressed the opinion that the by-pass road would be much used. On the other hand, the lack of suitable witnesses, from among persons not connected with the borough, was felt when the opposition attacked the promoters on the broad issue that the proposed expenditure would only be a small part of the final expenditure, and that the road as shown in the plans was inadequate even as a road, and apart from building developments. We make no comments on the facts themselves, or on the evidence, since the matter is now in the hands of the Local Government Board, but we wish to point out very strongly that much time would be saved and the issues would be much clearer if both sides in such cases as this would put forward a few good witnesses who would not break down under cross-examination as to their statements or their qualifications for making those statements. Such witnesses need not always be technical men, but they must be intelligent men if they are to be of real use. One of the best witnesses at the Croydon inquiry was a shopkeeper.

* * *

London County Council and Railless Traction.

Prominent among the authorities who had determined upon the adoption of railless trolley cars and who had promoted schemes in the current session of Parliament was the London County Council. The council were seeking Parliamentary powers in respect of four schemes on specially selected routes in districts where for a time the traffic was not likely to be very heavy, and which therefore would not justify the expense of a full tramway installation on the underground conduit or the overhead trolley system. When the Bill in which the proposals of the council were embodied came up for second reading, an "instruction" to the Committee to which it was to be referred was carried to insert a provision imposing upon the council an obligation not to apply the overhead system of traction without the consent of the road authorities. Inasmuch as in the case of the railless trolley system of traction there is no other known means of working the vehicles, this "instruction" was equivalent to placing in the hands of the road authorities an absolute veto on the schemes after statutory powers had been obtained. In the circumstances, the committee of the council in charge of the Bill recommend that it should be withdrawn. In their report to the council they point out that one of the great disadvantages under which the tramways now labour is the absence of connecting lines necessary for carrying passengers upon the tramways right through to their destinations or to better recognised traffic centres than those at present reached by the lines. It was felt that the railless trolley system of traction along thoroughfares where heavy and expensive street widenings would have to be carried out if it were proposed to lay down a tramway would enable the council to connect up the tramways. It was also considered that, apart from the financial interests of the undertaking, the low cost of this system would justify the council in installing it in many instances along suitable routes where at present the public is seriously inconvenienced by the absence of satisfactory means of communication. When the standing orders of Parliament relating to the introduction of railless trolley schemes were under consideration no veto was

given either to the road or local authorities. The above-mentioned "instruction," however, goes beyond the right of veto over introduction, as it involves the additional inconvenience that the veto is given after the council has explained and justified its proposals before Committees of both Houses of Parliament, where all persons or bodies interested therein would have the right to appear in opposition to the proposals.

* * *

Purchase of Water Undertakings.

The controversies which have arisen in regard to the finance of the Metropolitan Water Board, and the suggestion which has been made in some quarters that the present position is due in part at any rate—to the payment of excessive sums by way of compensation to the old companies, lends a special interest at the present time to questions connected with the valuation of waterworks undertakings on transfer to municipal authorities. The very able paper on this subject read at the last meeting of the Institution of Water Engineers by Mr. E. J. Silcock, M.INST.C.E., will therefore doubtless be read with considerable interest, particularly as Parliament is very much inclined to favour municipal ownership and control of public water supplies. Mr. Silcock's paper will be found in another column, but it is impossible in this place to discuss at all adequately the many factors which must enter into the valuation for an undertaking of this kind. The amount to be paid usually turns chiefly upon the fixing of a fair and just number of "years' purchase," to be used as a multiplier in capitalising the nett income. Mr. Silcock points out that many considerations arise in the determination of this number, some of which more directly affect the accountant, while others demand the skill and judgment of the engineering expert. For example, one governing factor must obviously be the degree of security of the ascertained current nett income. This depends upon a variety of engineering considerations, conspicuous among which may be mentioned the quality and quantity of the supply, the age and condition of the works, and their capability of meeting the demands made upon them. Mr. Silcock has treated the whole subject in a very clear way, and we cordially commend his paper to any engineer who may be concerned in a municipal purchase and may be called upon to support the advice given to his authority in the witness chair.

* * *

The Surveyors' Institution Examinations.

In our last issue there appeared a letter from "Typicus," in which the writer called attention to the unfortunate position of those candidates at the recent Professional Associateship examination of the Surveyors' Institution who failed in the "typical subject," but who were otherwise successful. That "Typicus" is not alone is shown by the batch of letters which we have received from other candidates who find themselves similarly placed. It appears that in consequence of the coming into force of the new regulations governing these examinations the privilege which such candidates have hitherto enjoyed of taking the typical subject only at a subsequent examination cannot apply to the present complainants, as the recent examination was the last to be held under the old rules. Of course, this was, or might have been, known to them before they took the examination, and "Typicus" is quite right in carefully stating that he makes no charge of injustice, but is only anxious to obtain a favour from the council having regard to the exceptional circumstances. In the letter from "Beta," which we publish this week, it is suggested that we might be willing to receive the names of candidates affected with a view to the presentation of a petition. We are always anxious to assist our readers — and particularly the younger members of the profession in any way open to us, and we shall therefore be pleased to hear from such candidates, and to pass the letters on to either "Typicus" or "Beta," with a view to the preparation of a memorial. The council might be asked either to hold a special examination in typical subjects only, in time for the October elections; or, in the alternative to say that the success of such candidates in the examination to be held next March should confer upon them the status of professional associate of the institution, without the necessity of their passing the final examination.

* * *

A Hard Case.

The appointment of a successor to Mr. F. Griffith, who recently retired from the position of water engineer and manager to the Leicester Corporation, has been accompanied by some unfortunate circumstances, culminating in the resignation of Mr. Neville B. Davies, ASSOC.M. INST.C.E., the assistant engineer. We are unable, on the information before us, to pronounce judgment upon the action of the corporation, but, *primâ facie*, it appears that Mr. Davies has been very hardly treated. Having been in the service of the corporation for twenty-two years, he naturally felt that he had some claim to promotion, and upon the vacancy occurring he offered his services to the Water Committee. Not only was he unsuccessful in his application, but the appointment was never even advertised so that his claims could be considered in competition with those of other candidates. The difficulty in which Mr. Davies was placed may be gauged from the fact that his new chief was professionally considerably his junior. In the circumstances Mr. Davies took the bold course of resigning his appointment as a protest an action which will command a good deal of sympathy and admiration. It is to be hoped that the great Corporation of Leicester will not allow the matter to rest where it is, but will do something by way of making amends to an officer who has an exceptionally long record of service, and who appears to have a real grievance in having his claims relegated to those of a much younger man.

* * *

A Water Board Case.

That much criticised body the Metropolitan Water Board recently found themselves in the rather unusual position of defendants to a summons for refusing to furnish a supply of water. It appears that since 1908 a butcher, carrying on business next door to the complainant, had obtained his supply of water through the complainant's pipe, and the board had sanctioned that arrangement. In March of this year the board called on the complainant to cut off the connection with his neighbour's house, failing which they would be obliged to withdraw the supply from his premises. The complainant felt that he could not act in that way towards his neighbour, and consequently the board cut off his supply. Correspondence passed between the parties, and eventually the board's officials took the matter into their own hands and provided a separate supply. It is provided by the regulations of the board that every house must have a separate supply, except in the case of a block of buildings having one owner. The learned magistrate therefore dismissed the summons against the board, saying that although they had acted within their legal rights, he considered that the complainant had been rather badly treated. He therefore refused to grant costs.

Water Supply of Jersey.

By ALFRED J. JENKINS, Assoc.M.Inst.C.E.

Jersey is the largest and most southerly of the Channel Islands, and is situated in the Bay of St. Malo, about 15 miles from the coast of Normandy. The island has an extreme length of nearly 12 miles from east to west, and a width varying from 4 to 7 miles. Its north-western, south-western and south-eastern portions consist of coarse-textured syenitic granite; between the two first-named areas and extending to the middle of the island the rock is a stratified archæan shale. The north-eastern part consists of volcanic rocks, chiefly "felsite" in a variety of forms. The north coast varies in altitude from 250 ft. to 480 ft., and the south from sea level to 200 ft.; in a general sense the island may be said to slope to the south in that the six principal streams rise near the north and west coasts and discharge into St. Aubin's Bay, which occupies the middle of the south coast. The population numbers 52,000, at which figure it is constant; of these about 35,000 live in St. Helier, and the villages distributed around the Bay of St. Aubin; the remainder are fairly uniformly distributed over the whole area.

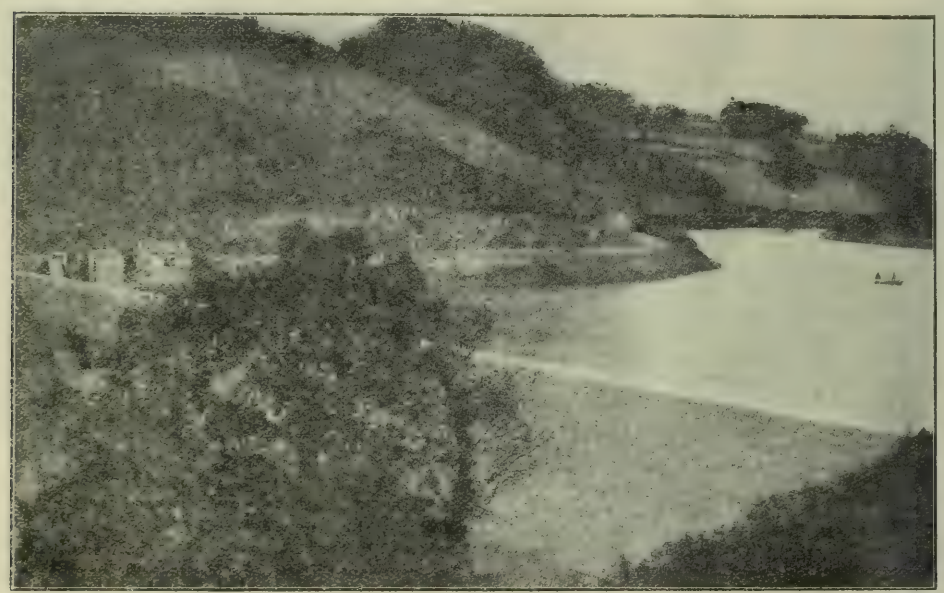


Fig. 1. Jersey Water Supply: View of Dannemarche Reservoir and Dam.

Prior to 1870 there was no public water supply, and the first attempt to introduce one was badly conceived. The insufficiency and inferiority of the service created a prejudice against the supply which it has been difficult to overcome, with the result that even at the present time there exist, even in the populous areas, a large number of shallow wells of doubtful character, to which attention is being given by the sanitary authority as opportunities arise.

The Jersey New Waterworks Company was formed in 1882. It took over the works of the former enterprise, and has steadily, though perhaps not rapidly, developed a sound concern supplying an excellent water in adequate quantity. The area of supply extends along about 6 miles of the south coast, and embraces the populous area before referred to. Its source of supply is the St. Lawrence stream, which drains the central watershed—an area of 1,200 acres. Much of the water is derived from springs issuing from among the volcanic rocks at the head of the watershed, but the bulk of the flow is the drainage of cultivated land which is stored and filtered, and subsequently pumped to a sufficient elevation. The average annual rainfall over a period of thirty-five years is 33·68 in., with a maximum of 47·66 in. (in 1910), and a minimum of 26·54 in. (in 1887). In 1906 the four months of June to September passed without a single day of useful rainfall.

Storage.

Much of the difficulty experienced by the former company was due to insufficiency of storage accommodation, so that at times water had to be taken directly from the stream to the filters. With highly cultivated land forming the greater part of the gathering ground, very careful selection of water is most important, and the reservoirs are now provided with by-pass brookcourses into which flood water is directed.

The total capacity of the reservoirs is equal to fifteen weeks of summer demand, apart from the inflow during that period, so that, allowing for the estimated increase which will result from the condemnation of the shallow wells previously referred to, the author considers that sufficient storage has been provided for at least another fifteen years. The larger storage reservoirs contain 31,000,000 gallons and 13,000,000 gallons respectively, and, when possible, water is admitted to the former and decanted off into the latter, whence it is decanted into the filters. This operation has only been possible since the larger reservoir was brought into use in 1910, since which date the quality of the water, especially in regard to uniformity, has materially improved.

The larger of the two reservoirs, known as the Dannemarche reservoir, was constructed in the years 1908 and 1909 as a consequence of the resources of the company having been severely tried by the drought of 1906. A detailed description of this will be given later in the paper. The outline map of the island (Plate 1) shows the position of the works and reservoirs.

Filtration.

Ample filter area has been provided in the form of 2,180 sq. yds. of open sand filters, with which it is seldom necessary to exceed a filtration speed of 3½ in. per hour, at which rate bacteria are almost entirely eliminated. Each filter is provided with a notch-gauge outlet, and the filtration head is limited to 2 ft. 9 in. The filter sand is a moderately fine shore sand obtained locally; and it is interesting to note that it is seldom necessary to scrape the beds more than three times a year, when about ¼ in. is removed for washing. There was, however, an exception during the summer of 1911 (a very hot and dry period), when one storage reservoir was very full of algæ and

* Paper read at the Summer General Meeting of the Institution of Water Engineers at Wakefield last week.

diatoms; filter cleaning then became an incessant operation. During the following winter the mud which had accumulated in the bed of the reservoir during the previous fifteen years was removed, and there has been no trouble since.

Two other matters of interest in regard to the filtration may be noted—namely, that the character of the vegetable growths on the filter beds differs from year to year; also that in one year the surface of the filters choked within three weeks of cleaning in the early spring. The author tried the experiment of raking over the surface to a depth of 2 in. or 3 in., and allowing the effluent to run to waste for a couple of days, and as a result of this the beds worked well for three or four months afterwards without further interference.

PUMPING.

The works being situated near the lower end of the valley from which the supply is derived, it is necessary to pump to a service reservoir to supply the higher parts of the district. At the present time the whole supply is raised to 150 ft. above high-water level, but the question of zoning the district with the object of reducing the quantity to be pumped is under consideration. The pumps consist of two units, either

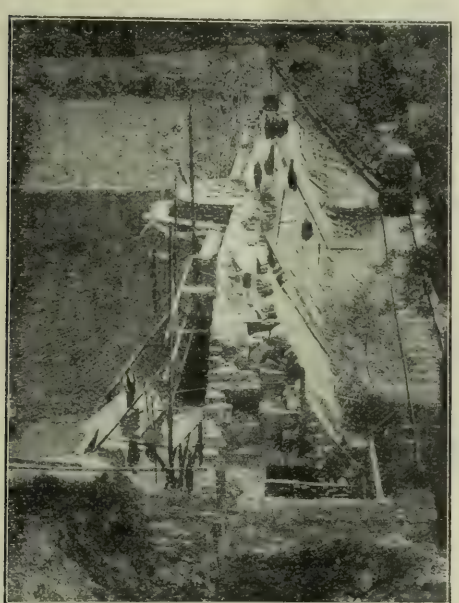


FIG. 2. JERSEY WATER SUPPLY: DANNEMARCHE DAM UNDER CONSTRUCTION.

of which is capable of raising nearly 40,000 gallons per hour—one a compound beam engine, and the other a triple-expansion Worthington pumping engine. The pumps deliver into a covered service reservoir of about one day's capacity, whence there are duplicate trunk mains to St. Helier. The outflow is metered by means of a Palatine recording meter, which has done excellent service.

DANNEMARCHE STORAGE RESERVOIR.

The site selected for the reservoir was to a certain extent determined by the possibility of obtaining land without compulsory powers, but an excellent site was eventually obtained at the rate of £250 an acre—not an unreasonable cost having regard to the highly productive nature of the land. It was situated about 1¼ miles from the southern end of the valley, and about ¾ mile above the Millbrook storage reservoir. Top-water level was fixed at 132 ft. above high-water level. Fig. 1 gives a general view of the completed reservoir.

The middle of the valley is covered with about 10 ft. of alluvial deposit, below which lies the archæan shale. At the eastern end of the trench this shale came to the surface, and was extremely hard and close, but at the western end there was about 20 ft. of loose and shattered ground before tight shale was met with. The whole of this shale is very contorted, and the layers vary in thickness and quality within a distance of a few feet. They lie almost vertically, and nearly parallel to the trench. Owing to numerous twists and folds several fissures were met with, each of which was followed down until the point was reached at which it closed up.

The face of the dam was carried down vertically and for a width of 6 ft. to a watertight foundation, the greatest depth being 36 ft. The remainder of the base rests on two benchings, the toe being generally taken 2 ft. into the rock. The irregularities of the foundation gave very good hold for the dam, and the pressure at the toe is only 4 tons per square foot. Plates 2 and 3 give details of the dam and valve shaft.

Plate 4 shows a diagram of the lines of pressure in the dam, from which it will be observed that the resultant line of pressure with the reservoir full falls within the middle third throughout the section, but that with reservoir empty the resultant falls just outside for a large portion of its length. This results in a maximum tensile stress at the toe of about 310 lb. per square foot, giving a factor of safety of over 100. The object of making this departure from the usual practice was to save masonry, while giving a vertical inner face to the dam. This may be open to adverse criticism, but the author can see no objection to it because the stability of the dam is in no way impaired. It is interesting to note that many dams which have been designed to be free from tension, and are so on horizontal planes, are nevertheless subject to tension on vertical planes near the toe when the reservoir is full, a fact which is frequently overlooked, and which generally occurs when the toe of the dam approximates to the horizontal.

In order to dispose of material from the trench, and to fill up an unsightly hole between the dam and the road embankment south thereof, the excavated ground was dumped at the back of the dam. By this means also two other purposes were served: firstly, the lower part of the down-stream face could be left rough, and, secondly, the filling was used to carry a locomotive crane, the run being eventually lifted (temporarily) about 5 ft. higher than the finished level of the backing to the dam in order that a 31-ft. jib might reach the top of the wall (see Fig. 2). This backing of earth, &c., was not carried high enough to have much effect on the dam, and only resulted in the lines of pressure (reservoir full or empty) being moved a little nearer the centre of the section.

What little spring water was found in the trench was dealt with in the usual way of piping off and stopping back when the concrete was well set.

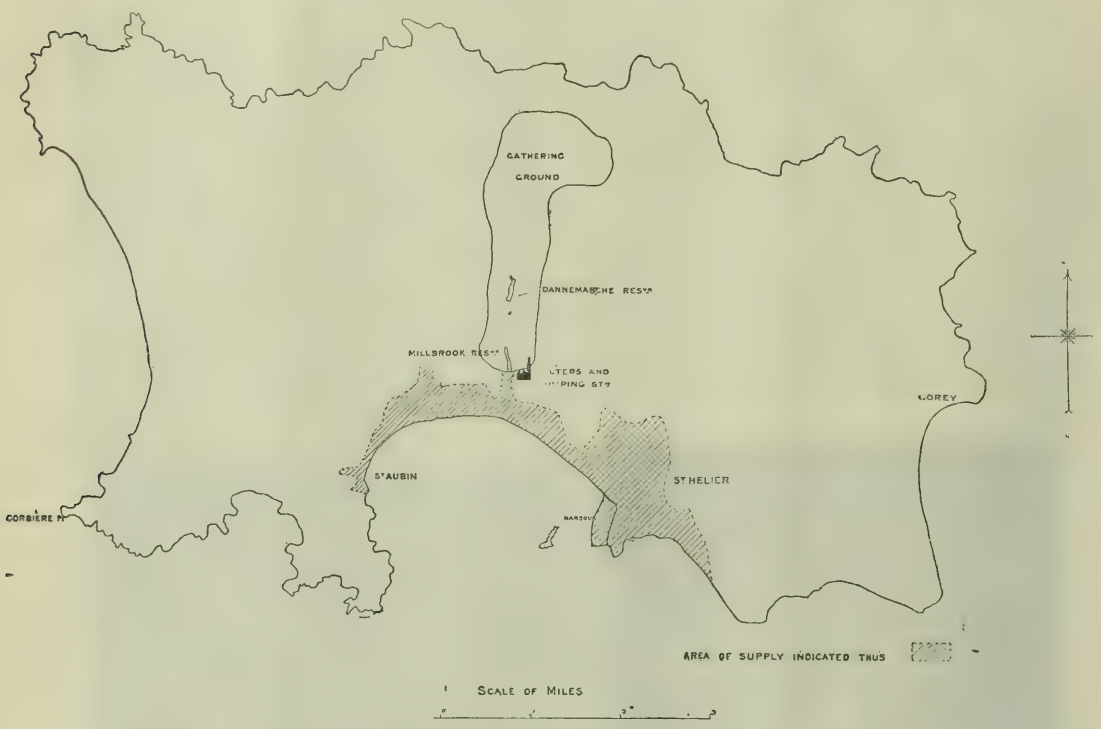
MATERIALS.

The dam was built of Portland cement concrete with irregularly shaped displacers, and the exposed faces were built with coursed and, for the most part, squared granite rubble. The sand used was a mixture of sea sand and finely crushed granite, and all the stone was granite. The proportions of materials used were 1 of cement to 6 parts of granite and sand, except where the dam was less than 6 ft. in thickness, where the proportion was 1 to 5. There was always a considerable margin of mortar to allow for imperfect mixing and for bedding and surrounding the displacers, and the mixture was kept fairly wet. The use of a quantity of finely crushed granite in lieu of part of the sea sand made the mortar easier to work, especially in bedding the displacers; furthermore, it probably added to the watertightness of the work.

The author had hoped to get 30 per cent of displacers into the wall, but owing to the irregular shapes of the stones and the difficulty of handling large stones, not more than 20 per cent were actually used. The displacers were not placed within 6 in. of each other. Many of them were inserted point downwards into the concrete, but stones with a good, even base were set on that base by being well rocked, thumped and twisted into position. In that portion of the wall less than 6 ft. thick no displacers were used.

Where the thickness of the wall permitted, the concrete was laid in three rows of rectangular blocks, each block being a day's work. The sides of the blocks were timbered where the work did not butt against either face-masonry or old concrete, and in the transverse joints large V notches were left to be keyed into by the succeeding blocks. The timbering of each block was arranged so that longitudinally and transversely it broke joint with those immediately beneath and those surrounding it. When the concrete was brought up to the level of an adjoining block, the timbering was either set forward on it or back on the block in course of construction in order to

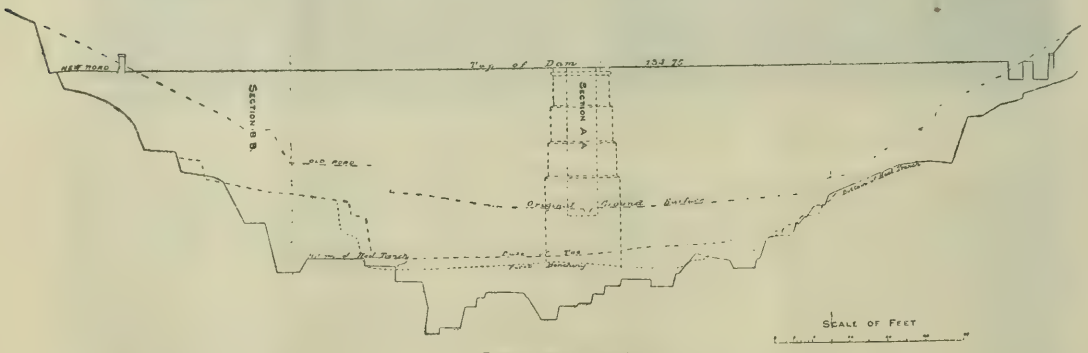
avoid a vertical joint. At the end of each day's work the concrete was finished at a level different to those of surrounding blocks. All concrete was roughed with picks before subsequent work was put on or against face. The same care was taken to break joint, and, in addition, the bed joints were now broken by leaving a key, this being, in the author's opinion, preferable to a longitudinal notch, as it offers greater facilities



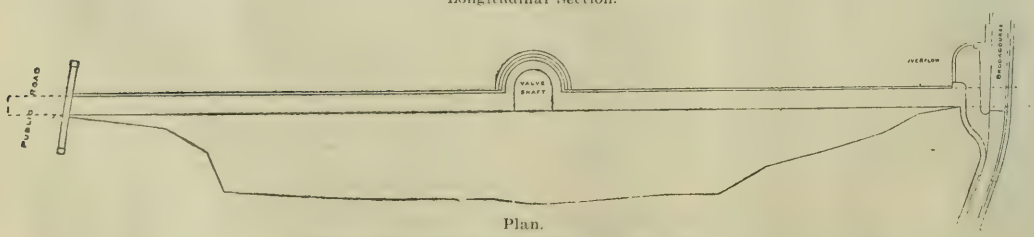
Jersey Water Supply: Sketch Plan of the Island, Showing Works, Gathering Ground and Area of Supply.

(Plate 1.)

it. A horizontal layer of cement mortar was the commencement of each day's work. Masonry facework was carried up in advance of the concrete and allowed at least four days to set, after which the concrete backing was brought up to its level, and the masons for roughing and cleansing. The concrete was hand-mixed. The masonry of the inner face had the joints raked out 2 in. deep before the mortar had set hard, and was afterwards pointed up with mortar comprised of 1 part of cement to 1½ of sand. The outer face had



Longitudinal Section.



Plan.

Jersey Water Supply: Dannemarche Dam.

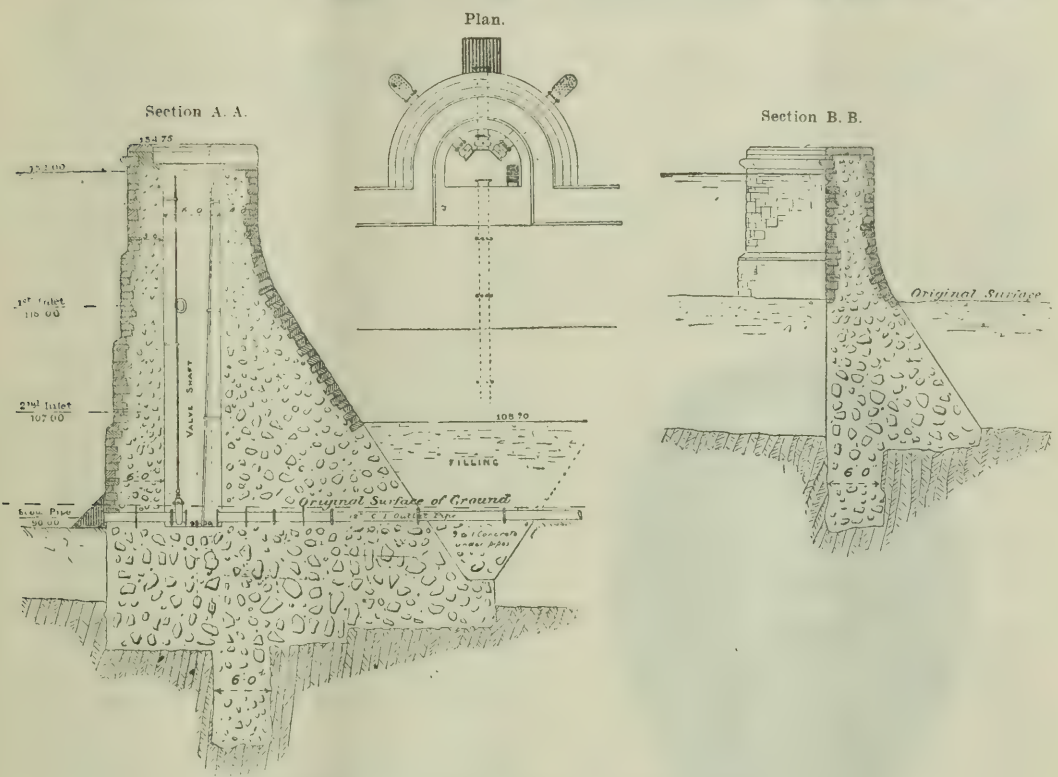
(Plate 2.)

were allowed on it again after four days more. Where the wall became narrow only two rows of blocks were possible, the one being the backing to the masonry on the inner face, and the other of that on the outer the joints struck as the work proceeded. The method of construction is illustrated by the photograph reproduced in Fig. 2.

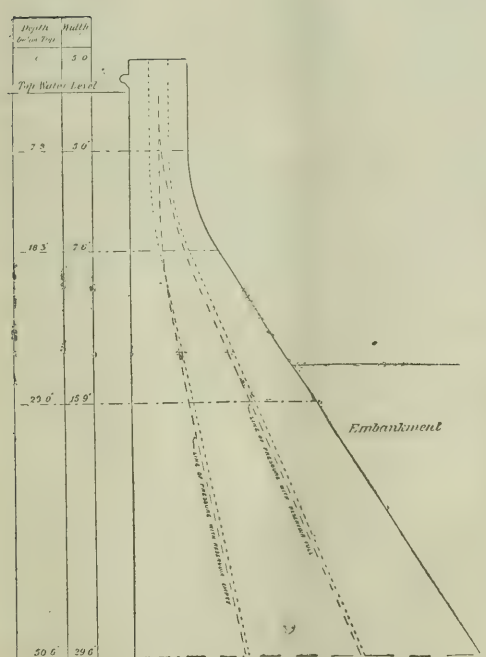
The valve shaft in the centre of the dam was built

as part of the dam: it contains valves which can be used to draw off from three different levels (see Plate 3).

The Portland cement used throughout the work was to B.S. specification, specially slow-setting. Each consignment was carefully tested in regard to fineness, expansion under Le Chatelier test, and tensile strength. If there was a satisfactory growth between the seven and fourteen day samples, and the makers reported a satisfactory twenty-eight-day test, the consignment was used without waiting for that test being made locally, so as to save storage and prevent the cement getting stale. In every case the local twenty-eight-day test proved satisfactory, and briquettes tested subsequently one, two and three years after making, gave excellent results. The cement being exceptionally slow-setting, the age of briquettes was reckoned from the time when it had set hard. If this had not been done, some of the consignments would not have attained sufficient strength to pass the seven-day test, whereas the longer tests have since proved those consignments to have been of excellent quality.



JERSEY WATER SUPPLY: DETAILS OF DANNEMARCHE DAM.
(Plate 3.)



JERSEY WATER SUPPLY: DIAGRAM OF LINES OF PRESSURE, DANNEMARCHE DAM.
(Plate 4.)

COST OF THE WORKS.

Apart from the cost of the land, the construction of this reservoir, which has a capacity of about 31,000,000 gallons, was £11,700. Of this the dam, which contains 4,758 cub. yds., cost £7,030. The concrete cost 22s. per cub. yd.; face work and pointing 12s. 9d. per yard super. extra on above. Other items of cost were:—

Brookcourse diversion, overflow and by-wash	£1,120
Road diversions	1,730
Mains and sluice valves	460
Excavation in reservoir bed	1,200
Fencing and planting trees...	160

Wages paid to labourers, 18s.; to stone cutters, 27s.; and to masons 30s. per week.

The supply of materials was contracted for, and everything was weighed on delivery. The construction was carried out by the author, with Mr. W. Rees Jenkins, ASSOC.M.INST.C.E., as resident engineer.

North Wales Trunk Road Scheme.—A conference, convened by Mr. H. A. Tilby (clerk to the Flint County Council), was held at Rhyl on Monday to settle the route of the new trunk road from Growant to Rhyl along the coast. The conference was attended by representatives of the Rhyl and Prestatyn Urban Councils and the Holywell and St. Asaph Rural Councils, through whose districts the proposed road will pass. The scheme will cost about £17,000, and will shorten the distance to Rhyl by about 2 miles.

Institution of Municipal and County Engineers.

ANNUAL SCOTTISH MEETING AT DUNDEE.

Members from all parts of Scotland and from a number of English towns were present at the meeting of the Institution of Municipal and County Engineers which took place on Friday and Saturday last at Dundee. As is customary at the annual gathering in the Scottish District, the first day was taken up with the consideration of papers and inspections of municipal works, the following day being devoted to an excursion to the beautiful country of Lintrathen—whence a considerable part of the water supply of the city is derived—and to Glamis Castle. The members were received shortly after midday on Friday by Lord Provost Urquhart, who was accompanied by Mrs. Urquhart and the magistrates of Dundee, and they were subsequently entertained to

[*From photo by Lafayette.*]

MR. JAMES THOMSON,
City Engineer of Dundee.

lunch in the Albert Galleries, the company including, in addition to the Lord Provost—who occupied the chair—Messrs. R. J. Thomas (Buckinghamshire), the president of the institution, John Bryce (Partick), vice-president, A. D. Greatorex (West Bromwich), past-president, J. Thomson (city engineer of Dundee), W. H. Blyth Martin (town clerk), John Lindsay (town clerk of Glasgow), A. H. Campbell (Edinburgh), David Ronald (Falkirk), hon. district secretary, F. G. Holmes (Govan), J. S. Brodie (Blackpool), W. C. Easton (Glasgow), Allan Stevenson (Ayr), D. A. Donald (Grangemouth), P. C. Smith (Arbroath), C. Brown (Hawick), J. Watson (Strathaven), Wm. Watson (St. Andrews), James L. Lumsden (Kirkcaldy), J. P. Spencer (North Shields), G. Ross (Clydebank), Robert Spittal (Hamilton), William Nicol (Callander), James B. Roberton (Dundee), R. Dickinson (Berwick-upon-Tweed), T. J. Kenny (Dunfermline), Thomas Smith (Coatbridge), Robert Blackwood (Kilmarnock), A. Forbes (Dunfermline), A. Watt Allison (Crieff), H. Inglis (Airdrie), W. A. Chapman (Airdrie), T. Watt (Airdrie), W. H. Wainwright (Edinburgh), A. H. Goudie (Stirling), James Lee (Paisley), J. Scott (Perth), J. Cameron (Strathaven), W. R. Maxwell (Dunfermline), W. Sym (Stonehouse), G. Donaldson (Kirkcaldy), R. Drummond (Paisley), T. K. Roddan (Broughty Ferry), James Galloway (Buckhaven), R. McKillop (Perth), Wm. Ballantine (Laurieston), Alexander Roberton (Crieff), J. Barker (Dumfries), T. Goodwillie (Dumphries), A. A. Turiff (Elgin), A. Goodwillie (Brechin), R. Millar (Greenock), M. B. McBeth (Lochgilphead, Argyll), G. Cruickshank (Hamilton), C. Young (Coatbridge), and Thomas Cole (London), secretary of the institution. Others present were Messrs. Buist, Paton, Noble, Speed, Malcolm, Spence, Perrie, Neave, Don, Macdonald, Watt, Mudie, Scrymgeour, Nairn, High, Johnston, Fraser, Barnes, Girrity, Allan, McCabe, Melville, Nicol, P. Fisher, H. Richardson, A. Yuill, A. H. Miller, W. McGregor, G. Baxter, J. G. Soutar, J. Carmichael, J. H. Thomson, H. Band, D. F. Milne and J. Turnbull (Dundee), Forwell (Monifieth), Smibert (Carnoustie), Soutar (Wormit, Fife), Hunter (West Ferry), C. Massie (Falkirk), D. Robertson (Aberdeen), Grubb (St. Andrews), Alexander (Arbroath), Robinson and W. H. Carmichael (Greenock), and Wilson (Arbroath).

The toast of "The Institution" was proposed by Lord Provost URQUHART, LL.D., who, in extending a welcome to the members, said the Municipality of Dundee recognised that the work of the municipal engineer was a very important one, and they quite approved of the principle of co-operation between them, for the interchange of ideas which resulted must be to the advantage of the public as much as to themselves. Public representatives were for the most part amateurs, and were to a very large extent in the hands of the permanent officials, and not least in the hands of the engineers. In Dundee they were peculiarly fortunate in having thoroughly up-to-date engineers in charge of the various public services, and he thought that would be amply confirmed during the inspections which they were to make later on of the different municipal undertakings.

The PRESIDENT (Mr. R. J. Thomas), in replying, returned thanks on behalf of the members for the hearty reception of the corporation. It was an honour they very keenly appreciated, for it not only showed the goodwill of the town council towards them as a body, but was a clear indication of the esteem with which their fellow members in the service of the municipality were regarded.

Mr. A. D. GREATOREX (West Bromwich), past-president, in proposing the toast of "The Corporation of Dundee," observed that the corporation had proved itself a most enterprising one in many ways. They had already spent no less than £500,000 on the improvement of the city, and he understood that a similar amount was to be expended in its further improvement. He also understood Dundee was the first town in Scotland to undertake the duties imposed on the country by the Town Planning Act, and the first in Scotland to appoint a Town Planning Committee, entering into the question in a most enthusiastic manner. Dundee also was the pioneer in Scotland in the matter of the trackless trolley system.

The LORD PROVOST, in acknowledgment, remarked that Dundee was exceedingly well served by her engineers. The tramways, gas, water, markets and electricity were all under the management of the town council—and successfully so—and although the representatives of the people were primarily responsible for that satisfactory condition of affairs, the chief credit for the success which had been attained was due to their engineers.

On the proposition of Mr. JOHN LINDSAY, town clerk of Glasgow, a vote of thanks was accorded to the Lord Provost for presiding.

At the subsequent business meeting, at which Mr. John Bryce (Partick), vice-president, occupied the chair, the proceedings were opened by the reading of a report from the Roads Committee dealing with the experimental tests of several classes of road material in Scotland.

ROAD COMMITTEE'S REPORT.

From this it appeared that Mr. Ronald, by the aid of a rainfall map and records, had pointed out the various zones where climatic conditions were such as to give valuable results from experiments in road formations. The principle of having experimental lengths of various forms of road construction in Scotland had been agreed to. The factors requiring consideration were traffic and meteorological conditions. It had been deemed advisable to have the several experimental sections in different localities, these being chosen with special regard to climatic conditions, the most important being that of the rainfall. The following districts were proposed: Fort William, which lies in the 60-80-in. per annum rainfall belt; Colmonel, which lies in the 40-60-in. per annum rainfall belt; Nairn or Elgin, which lies in under 25-in. per annum rainfall belt; Pitlochry, which lies in the Highlands; and districts in Fifeshire, Haddington, Peebles, Edinburgh, Lanarkshire, and near Glasgow.

It had been decided that, as far as possible, the first experimental sections should be laid down on a gravelly subsoil, and where the traffic was medium—*i.e.*, where the cost of maintenance was about £60-£70 per mile per annum for a road about 18 ft. wide. The following forms of road construction had been generally decided upon:—

(1) Ordinary water-bound macadam with metal, as generally used—preferably whinstone.
(2) The above surface tarred with distilled tar to Road Board specification.
(3) Ordinary macadam, 3 in. thick, grouted with a mixture of pitch and sand.
(4) Ordinary macadam, 3 in. thick, grouted with pitch alone.
(5) The above, with surface sealed with prepared bituminous mixture.
(6) Ordinary macadam, superimposed upon and well rolled into a layer of tarred chippings, then grouted and surface sealed as above.
(7) Tar-macadam—*i.e.*, tarred material surface sealed with distilled tar.
(8) Tar-macadam, surface sealed with a prepared bituminous material.

Also any proprietary article, at the discretion of the surveyor, provided that the ultimate cost is guaranteed to be not greater than that of ordinary macadam.

It was considered that the stone selected for the above experiments should be that which serves the largest area in the district, and that the tar should satisfy the Road Board specification. It was further decided that letters should be sent to the surveyors of the following districts so as to get their active co-operation in this work: Aberfeldy, Ayr, Dunblane, Edinburgh County, Edinburgh City, Elgin, Falkirk Burgh, Glasgow, Haddington, Hamilton, Kirkcaldy, Lockerbie, Peebles, Thornhill. It was suggested that three lengths should be laid down on the Trossachs road where motor traffic is forbidden. These were to be: (1) Ordinary macadam; (2) ordinary macadam with surface tarring; (3) ordinary macadam with tar grouting.

It was resolved that each section should be not less than 100 yds. in length and about 18 ft. wide, the average cost to be about 1s. 6d. per super. yard. With regard to the cost of these experiments, the view was expressed that application by the various districts should be made to the Road Board for assistance, and that a general statement should be sent direct to the board giving details of the general objects and proposed operations by the committee with regard to the experimental lengths of road construction in Scotland. It was resolved that an effort should be made to secure the construction of the various trial sections this year.

Mr. J. BRYCE (Partick) said he thought the meeting would agree that this was a most comprehensive undertaking that the Roads Committee was taking up in Scotland. The need had been felt for some time that something ought to be done in Scotland. They had had experiments in the South of England at Sidcup and elsewhere, but they all felt that those experiments did not apply to Scotland.

Mr. WALKER SMITH (Local Government Board for Scotland), the chairman of this committee, formally moved the adoption of the report.

Mr. R. SPITTAL (Hamilton) said it occurred to him, as a surveyor in a big commercial centre, that a £70 road was not the only road which ought to be tested. The average cost of the roads in his district was over £100 a mile—that was including both best and secondary roads. He thought the committee should consider a heavier graded road than that of £70 a mile.

Mr. A. D. GREATOREX (West Bromwich), as an English surveyor and a member of the council of the institution, complimented the members of the Scottish District upon the excellent report which they had submitted, and the comprehensive manner in which they had tackled this important question.

The report was adopted, and Mr. Bryce said further progress would be reported at a future meeting.

SUGGESTED MOVABLE COUNCIL MEETINGS.

Mr. D. RONALD (hon. district secretary) said he had received the following letter from the North-Eastern District.—

"I am directed to forward you a copy of a resolution passed at a meeting of the North-Eastern District Committee at Leeds on Saturday last: 'That this committee is of opinion that it is in the best interests of the institution that meetings of the council should be held periodically in various parts of the country instead of, as at present, in London, and that a copy of this resolution be sent to the hon. secretary of each of the various districts asking for their co-operation by supporting a formal resolution to this effect, which will be submitted to the council by the representatives from this district.' Will you be good enough, therefore, to bring the matter before your district committee at the earliest opportunity?

"(Signed) J. P. WAKEFORD."

Mr. BRYCE asked the members to say whether the letter should be passed on to the committee to take steps to co-operate with the North-Eastern District to further the object mentioned. He did not know what it might involve. It might mean that unitedly they would come to some decision, and send up a recommendation to headquarters for the council to consider the matter. He supposed they would agree to that.

The meeting unanimously agreed.

PROPOSED MUTUAL DEFENCE FUND.

Mr. D. RONALD read the following letter from Mr. T. Cole, secretary of the institution, with reference to the proposed formation of a Mutual Defence Fund:

"I am directed to ask you to bring before the special and early notice of the members of your district the question of the formation of the Mutual Defence Fund. The council will be glad to consider any observations which your district cares to offer on the question generally. I shall be glad if you can arrange to have this matter brought before your district at as early a date as possible."

Mr. BRYCE asked whether it meant the formation of a committee for the district. Perhaps Mr. Cole would give them some information.

Mr. COLE said the council had had before them the question of the establishment of a Mutual Defence Fund. The main question was whether the matter should be taken up as a voluntary or as a compulsory measure. It had been finally decided to make it voluntary. All the members of the institution had been informed in regard to it, and the subscription it was proposed to make was: Members, 7s. 6d.; associates, 5s.; and students, 2s. 6d. The question having been discussed, there seemed to be not quite an unanimous feeling, and the council, therefore, were of opinion that it would be well to take every means to get it well digested in all the districts of the institution, so that this letter of his was sent to every district in order that the district secretary might put it before the members and get an opinion expressed as to the advisability or otherwise of having this Mutual Defence Fund. Mr. W. H. Prescott, the engineer of Tottenham, a member of the council, had taken upon himself the duty of taking up the work of this fund, and he would be very glad to receive letters and information from members. It had also been decided that Mr. Prescott should read a paper at the next annual meeting, which was to be held at Great Yarmouth in July, when an opportunity would be given to members to discuss the whole question.

The PRESIDENT remarked that it was very desirable the members should express their opinion. It was a very important step to take, and the council wanted to have the members at their back. It was important that they should get the opinion of the individual members and also the collective opinions of each district, and if those opinions could be obtained by the annual meeting it would materially help that meeting to come to a decision. The question of a compulsory contribution was discussed very minutely by the council, and they were advised that a compulsory contribution was impossible under the Articles of the institution, and the work of getting the Articles altered was so cumbersome and difficult that they did not feel able to advise the institution to have a compulsory scheme.

Mr. COLE said the council had been disappointed at the cold manner in which the matter was received, and the few replies from members.

Mr. BRYCE: Do I understand that the council will defend any man whether they contribute or not?

The PRESIDENT: It is obvious that unless a man subscribes to a fund he can hardly expect the institution to defend him.

Mr. WALKER SMITH said he thought they had insufficient information to express a definite opinion. They were to have the facts placed before the annual meeting in a paper by Mr. Prescott, which he thought would be extremely helpful, and after then the Scot-

tish District could consider it and say Aye or Nay on the matter.

Mr. Bryce: We will await developments and see the opinion of the annual meeting on the matter.

This was agreed to.

STANDARDISATION OF ROAD MATERIAL.

Mr. Bryce asked Mr. Drummond to make his report on the standardisation of road material.

Mr. R. Drummond (Paisley) read the following report:—

"In connection with my appointment a year ago as representative of the institution on the Sectional Committee on Road Materials, under the auspices of the Engineering Standards Committee, perhaps I should shortly state what has transpired and report progress. At a conference on the standardisation of road material, held in London, June, 1912, under the chairmanship of Sir John Wolfe Barry, when, after evidence had been heard from both quarry masters and users, the conference resolved that the standardisation of road stones was desirable, and also all kinds of materials used in the construction of roads, a sectional committee was formed and met in November. At this meeting a sub-committee was formed to consider the sizes and nomenclature of broken stone. This sub-committee have held three meetings, and a very considerable amount of work was got through, including a large number of tests of various quarries all over the country. I took part in all the meetings. I also visited the principal quarries in Scotland, making tests at each one with a view to obtaining reliable information for the sub-committee. It would be too elaborate to go into details; besides the work of the committee is not completed; but I may mention that the outcome of it all is that a report has been drawn up by the sub-committee making certain recommendations for approval by the sectional committee. These recommendations or conclusions only refer to sizes and gauges of broken stones, method of testing, &c., and which will be known as the British Standard Specification for Broken Stone and Chippings. The question of bituminous tar, tools, &c., is yet to be considered.

Mr. Bryce said they were indebted to Mr. Drummond for this report, which showed that this committee were doing good work.

The President said he happened to be a member of this sub-committee, and he thought it was only right that district meeting should know what admirable work Mr. Drummond had done on the committee. Only those who sat with him from day to day, going into all the details, could appreciate the good work he had done. They had to meet the objections of the quarry owners, and although they did not get all they wanted, and all the members wanted, they got a very large measure, and if their recommendations were adopted and loyally carried out he believed this was the beginning of an agreement which would be of advantage to the local authorities and to the quarry owners. They were greatly indebted to Mr. Drummond for the way in which he had worked on that committee.

Mr. Bryce: I am sure we are all pleased with the president's testimony to the value of our representative.

BUILDING BY-LAWS.

Mr. Bryce referred to the draft by-laws prepared by a committee of the Scottish district, and said they were much disappointed at the slow progress of passing these draft by-laws through the Government Department. The Scottish Office had really blocked this thing for several years, and it was high time some improved method was instituted of doing public work in Scotland. It was simply disgraceful that these by-laws had been in hand for three or four years and nothing had been done. The Local Government Board had done their part in regard to the sanitary portion of the by-laws, and it was just a question whether they should not decide to print the part approved by the Local Government Board, leaving the unapproved part to be dealt with by the Scottish Office later on.

Mr. F. G. Holmes (Govan) said the type would have to be left up until they got the approval of the other by-laws by the Scottish Office. They had been labouring at these by-laws for years, and at last they had hoped to have come to a definite decision. He did not think they would retard progress in any way by waiting until they could print the whole of the by-laws. He suggested that they bring some pressure upon the Scottish Office to come to a decision.

Mr. Bryce: We have been pressing them all along.

Mr. D. Ronald said he had been at the Scottish Office every month on this matter.

Mr. R. Spittal (Hamilton) suggested that it should be referred back to the council to see if they could get something done in the matter.

Mr. Young suggested that each surveyor should write to the Member of Parliament for his district, and see that the Scottish Office did its duty in this respect. Some question should be asked in Parliament why these by-laws had not received attention for the last five years.

Mr. A. D. Greatorex (West Bromwich): Does not this delay show the necessity of this institution having some direct representative in Parliament?

Mr. P. C. Smith (Arbroath) suggested the appointment of a deputation to the Scottish Office on the matter. A number of them would shortly be in London at the Roads Congress, and they might appoint a deputation to see the Secretary for Scotland. They could get quite a number of Members of Parliament to accompany the deputation.

Mr. Bryce: The computation of these by-laws was a purely voluntary work on our part.

Mr. Holmes: We were bound to do it for our respective councils.

Mr. J. Lee (Paisley) suggested that they should go ahead, print the by-laws, and issue them to their respective councils, and then let their council present them to the Scottish Office for adoption. If they succeeded in obtaining approval the boroughs would each have to get them approved.

This suggestion was adopted by the meeting, and accordingly the by-laws will be printed and issued to the boroughs as a form of Model By-law to be submitted to the Scottish Office for adoption.

Mr. Bryce said, with regard to the experiment to be carried out on the roads, it was suggested that those surveyors who were to carry out the experiments should be co-opted on the Roads Committee. He thought they would see the reasonableness of that suggestion. They needed the authority of that meeting to co-opt them.

Mr. J. Young (Ayr) proposed that the surveyors in whose districts these experiments were to be carried out should be co-opted on the Roads Committee.

This was unanimously approved, and attention was then given to papers on "Reconstructed Dundee," by Dr. A. H. Miller, chief librarian and curator to the corporation, and "Maintenance of County Roads in Dundee District," by Mr. J. Bell Roberton, Forfar County Council (Dundee district).

RECONSTRUCTED DUNDEE.

By A. H. Miller, LL.D., F.S.A.Scot.,
Chief Librarian, Dundee.

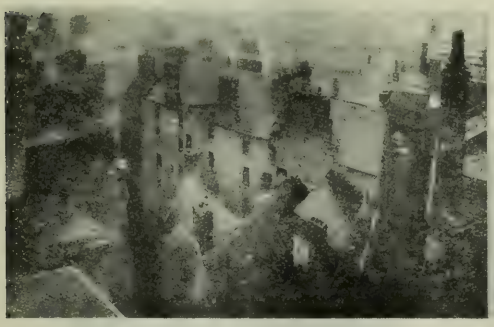
[*From Photo by W. Lowden & Son, Dundee.*]

In his opening remarks Dr. Miller pointed out that until lately there was no intelligent attempt to regulate the development of a great city so that in the future it might be both beautiful and useful. The science of town planning was yet in its infancy,

though the need for it had been clamant for centuries. Old buildings had been removed and new structures erected in a haphazard fashion, and the result in most cities had been a mere collection of incongruous items, forming a heterogeneous mixture of different styles of architecture, each shouting loudly in derision of its neighbour. It was not so in ancient Rome. There the erection of new buildings was governed by the Senate through the Aedile and his officers, and the result was a harmonious city that was still impressive and glorious even in decay. Unless similar control was exercised in our modern cities by far-seeing designers and competent officials we would never make our cities ornate yet commodious, pleasant to the eye yet fitted for all the requirements of modern life. Fortunately that was now being largely adopted in most large cities, and Edinburgh, London, Glasgow and Dundee had all experienced in some degree the beneficial effects of this method.

The centre of Dundee was laid at Craig Pier, and from this primitive nucleus there had been evolved, by a long process, their own beloved city. Dr. Miller said he would not relate in detail how the Castle of Dundee arose, how the Church of St. Mary was founded to eclipse the earlier Church of St. Clement, the patron of sailors. All he could do now was to say that for the first five centuries of the Christian era Dundee flourished exceedingly—that was having regard to the slow progress of those leisurely days. No doubt there were slums even in that remote period; but every now and then their enemies of England sailed up the Tay and demolished with their cannons some of the worst of their wynds and closes. These English invaders—quite unintentionally—led their ancestors to see the horrors of overcrowding, though they did not do so in a kindly spirit.

Turning to recent times Dr. Miller said it was in 1870 that the late Mr. Frank Henderson, who was a town councillor in 1868, and Member of Parliament for Dundee in 1880, took up the question of the improvement of his native city, and brought out a scheme which transformed the centre of Dundee into a comparatively pleasant civic paradise, fully half a million sterling being expended on the works. Another scheme, for which the city engineer, Mr. James Thomson, was responsible, and on which it was proposed to spend a further half million, had now been placed before the citizens of Dundee. Mr. Thomson, observed the reader of the paper, had been concerned in all the schemes of their urban improvement that had been proposed and carried out during the past thirty years. Were the community of Dundee, asked the reader of the paper, going to neglect the magnificent topographical opportunities which were presented? They had the place—a magnificent location—they had the men and they had the money too. His view was that it would be a lasting disgrace upon the present generation of Dundonians if they did not rise to the occasion and initiate a scheme of town reform and town planning which would receive the cordial applause of coming generations.



DUNDEE IMPROVEMENT SCHEME: VIEWS ILLUSTRATING CITY ENGINEER'S PROPOSALS FOR DEALING WITH AREA BEHIND TOWN HOUSE.

(Area to be cleared is shown in view on left.)

It was not necessary to go into the vast subject of the cost of Mr. Thomson's scheme; every business man knew that it was extremely difficult to estimate the cost of the work, and still more difficult to state the revenue of such a gigantic proposal, but reliance was placed by those in authority on Mr. Thomson's experience, and if it were possible to carry out the scheme for a loss, as he estimated of £200,000, the speaker should say that Dundonians of the present day, if they were to reject these proposals, would call down upon themselves the objurgations of their successors. The city engineer recorded, in his report upon the scheme, that while "the works taken as a whole form a scheme of some magnitude, it has been devised, as any such scheme should be, in a comprehensive manner, more than adequate for the requirements of the present day, and with due regard to the future of the city." And all would agree that had Dundee and other large towns had a well-considered and comprehensive town plan, millions would have been saved to the ratepayers of the country by forbidding work that should never have been done.

DUNDEE IMPROVEMENT SCHEME: CITY ENGINEER'S PLAN FOR DEALING WITH HIGH-STREET AND OVERGATE.

A large number of lantern views—a selection of which are reproduced herewith—were exhibited by Dr. Miller in the course of his address, and enabled the members to appreciate more clearly the ideas put forward by the city engineer, the different areas as they exist and as they would appear after improve-

ment being clearly shown. In the report in which he outlines his proposals Mr. Thomson says that realisation of the scheme in its entirety may not be possible in the immediate future: but he hopes that such parts as may be undertaken will be carried out in accordance with one well-considered plan, from which no material deviation will be made. Having regard to its commercial importance, Mr. Thomson considers that Dundee is sadly behind other cities in several respects, and that it would be difficult to find any other place of equal size so badly equipped with suitable public buildings and markets, and so deficient centrally in good architectural work, while possessing such possibilities for development and improvement. He insists that the work must be undertaken at some time, adding that the likelihood is that longer delay means greater cost, as the tendency is to erect and add to important business premises which must hereafter be acquired for improvement purposes.

Dr. Miller, in closing his observations, said that if what he had described to them proved to be but a dream, he thought they would agree it was a glorious dream.

The President (Mr. R. J. Thomas), in proposing a vote of thanks to the reader of the paper, said he was sure it must have been a very great pleasure to all present to listen to Dr. Miller. Those who had read his paper would appreciate his point of view, as well as his kindly references to the city engineer, Mr. Thomson. He did not know whether the members wished to, or could, discuss the paper; it was, however, a paper which entitled the author to their very keenest thanks. One remark of Dr. Miller had tickled him immensely. Going back to pre-Roman times he had told them that when there happened to be a disagreement on any point a simple method was adopted to "get rid of the obstruction." The city architect of the period merely took out his stone hammer and cracked the skull of his opponent, in order to learn whether that opponent had any brains at all. Many of them would sometimes greatly appreciate the possession of a stone hammer, but he imagined that the hatpin of a suffragette would suffice to pierce the heads of some of their critics and let out the hot air. (Laughter.) It might be that Mr. Thomson's scheme for the transformation of Dundee might, after all, be nothing more than a glorious dream, but from the results he had already achieved it was clear that he carried out his ideas in a practical way, and it might be hoped, therefore, that before long they would see the completion of his admirable scheme.

Mr. J. Walker Smith (Local Government Board, Edinburgh), in seconding the vote of thanks, said he would be quite sorry if a paper such as Dr. Miller had presented to the meeting were to pass entirely without discussion. He agreed that the tone in which the paper was written was very high, and it was difficult for men in their profession to rise quite to the tone the author had struck. Personally, he had been immediately attracted by the subject of the contribution, and delighted with the manner in which it had been presented—a manner in every way creditable to the literary reputation of the author. The plans which Mr. Thomson had prepared were really more than plans—they were works of art, and an art gallery such as they were assembled in at that moment was the most suitable place for their display. The scheme, while certainly ambitious, was not more ambitious than the beautiful situation of the city of Dundee justified.

The vote of thanks was passed with acclamation, and Dr. Miller briefly acknowledged the compliment.

MAINTENANCE OF COUNTY ROADS IN DUNDEE DISTRICT.

By James B. Roberton,

County Road Surveyor, Dundee.

The following notes, submitted at the invitation of the hon. district secretary, are made through a desire to contribute to the general stock of reliable practical information which is so much required by road surveyors at the present moment in their arduous task of facing the new conditions of road traffic which have arisen in recent years.

When considering the question of road maintenance it is well to remember that it is much more difficult to deal with the repair and improvement of existing roads than it is with roads which have been originally well constructed. In other countries, such as France, for example, the roads were made primarily for military purposes, and were properly laid out and constructed from one centre to another regardless of cost, and it is well known the French roads, up to recent years, were the admiration of the world. In Scotland it is otherwise, as, with the exception of the old main turnpikes—General Wade's roads in the Highlands and Telford's roads in the North—which were laid out with much engineering skill, it is well known that the public roads in Scotland have become what they are through the process of evolution—first as pack-horse roads, which later developed into roads suitable for wheel traffic. Taking a retrospect of the last forty years, it must be owned that much has been done to improve

[*From Photo by D. & W. Prophet, Dundee.*]

Mr. J. B. Roberton.

[Mr. Roberton was born at Dennyloanhead, Stirlingshire, in 1855. He entered the service of the late Mr. John MacConnell, a nephew of Macadam, who had charge of a great number of the main turnpike roads in Scotland and England up to the abolition of tolls in 1883. His first appointment was as an assistant to the late Mr. D. Stratton, the superintendent of roads in the county of Midlothian under Mr. MacConnell. He was afterwards transferred to the late Mr. Anderson, superintendent of turnpikes for the counties of Stirling, Kinross, Clackmannan and part of Dumbartonshire, also under Mr. MacConnell. After 2½ years' service Mr. Roberton was promoted to the Road Office in Edinburgh, where a most complete and comprehensive system of keeping road accounts was in existence. After one year's service there he was entrusted with the charge of the roads in the Straiton branch of the Lasswade and Wright-houses districts under Mr. Stratton, and on the abolition of tolls in 1883 in Midlothian was promoted to the care of the roads in the Calder district of Midlothian. After being located there for four years he was appointed surveyor for the western district of Perthshire, and remained there for seven years. For the past twenty years he has been surveyor for the Dundee district of Forfar County Council.]

Scottish roads, and road authorities have not been slow in acquiring steam rollers and other modern machinery to aid in this work. Many of the Scottish roads, however, have even yet but a skin of metal on the surface, and require strengthening to withstand the effects of the new conditions and kinds of traffic which have arisen. Suffering from the effects of traction-engine, motor-lorry, motor and general heavy traffic, there is a danger of being carried away by novelties in road maintenance which it may be prudent to avoid.

In this district, and under the conditions described above, the roads have been strengthened in some instances by increasing the thickness of the crust with 3-in. hand-broken metal, and in other cases where traction-engines and motor-lorries had to be taken into account the entire reconstruction of the road was taken in hand. This reconstruction consists in putting down a layer of 6 in. of bottoming with a top coating of 6 in. of 3-in. hand-broken metal, bound with whinstone chips from the breaking machine. It is hoped that it will be possible to apply the most up-to-date surface preservative and binder in the market. In the writer's judgment this was the only possible way of meeting the difficulty in a satisfactory and lasting manner, and with some chance of keeping the road in fair condition at a moderate expense in the future. The Imperial Road Board, after a careful inspection, were satisfied that the right steps were being taken, and accordingly voted a grant of £3,000 towards a total expenditure of £7,500, which was required for strengthening the Perth-road, and for putting 5

miles of the Dundee-Coupar Angus road in a fit and proper state for carrying the mechanically-propelled traffic to which it is subject at the worst period of the year—namely, the early spring months. The cost of this reconstruction of 5 miles of the Dundee-Coupar Angus road works out at 2s. 2d. per super. yard. A lighter form of reconstruction previously carried out on another portion of the same road was done at 1s. 10d. per super. yard. The cost of strengthening the crust of the Dundee-Perth road with 6 in. of 3-in. hand-broken metal, with a finishing coat of 2½ in. machine metal, cost 1s. 4½d. per super. yard. In the writer's opinion the county council are receiving good value for their money, as the material is in the road, and is a valuable asset.

With regard to the question of whether the foundation should consist of stones set on edge and wedged on top on Telford's principle, or by Macadam's method of roughly breaking the stones and spreading 6 in. thick with the metal applied on top in both cases, in the usual way, the writer found that, taking into consideration that the traffic must be kept going, the Macadam principle was preferable, and the wearing results after three years were much the same, as was also the cost. The writer, however, is of opinion that for heavy traction-engine work stones set on edge, like the cope-stones of a dry-stone dyke in Scotland, are more fitted to withstand the pressure of the heavy loads.

Macadamised roads are often talked of as if the mere application of broken stones constituted such a road, but Macadam himself laid down as an indispensable rule that the foundation of the road should be thoroughly dry and above the level of the adjacent land. He pointed out that the stones should unite by virtue of their own angles, and form a crust or roof over the foundation to keep it dry. The surface also was to be kept clean. Telford, again, stipulated for a rough stone causeway as a foundation with small metal on top. Whichever foundation be adopted, it must be kept dry by efficient drainage. Unless the foundation of a road be kept dry no bottoming will avail, and the crust must also suffer. Roads, like bridges or houses, must have a good foundation. In the writer's opinion, close attention to the elementary rules of road mantenance is being insisted on, and with the best results.

Owing to the geographical position of the Dundee district, which lies in the form of a crescent round the city of Dundee, with 170,000 inhabitants, and from the fact that Dundee, in addition to being an industrial town closely connected with numerous towns in the neighbourhood having populations varying from 5,000 up to 20,000 inhabitants, is the port for a large tract of country extending for miles outwith Dundee, it will be readily understood that the district main roads are subjected to an enormous amount of heavy traffic. The means used for conveying goods and commodities to and from the various towns and districts are traction engines, motor lorries, and such like, in addition to double-horse lorries and ordinary double-horse carts. In fact the roads were used night and day in place of the railways, which at one time commanded this traffic. Unfortunately, much of the valuable assessable area has been annexed by the city of Dundee, while the suburban traffic practically remains.

The great fact which must impress most road surveyors is that there is no lack of skill or mechanical appliances for carrying out the work of strengthening and improving the Scottish county roads, except one thing, and that is—the necessary funds. If sufficient money were available to put the main roads, at all events, into a good state of repair, there is little doubt that the maintenance would be simplified, as every stone put on the road afterwards would tell. At present in many cases there is only sufficient metal to keep the roads in passable order without building up a reserve of strength for emergencies.

Comparisons are made at times between districts of roads, but unless the conditions in each district are similar as regards traffic, subsoil, kind of road metal, &c., such comparisons are quite unequal. It must always be borne in mind that the foregoing remarks apply chiefly to county roads. Burgh roads can be dealt with in a different fashion, as their mileage is generally small and the financial resources greater.

DISCUSSION OF MR. ROBERTON'S PAPER.

Mr. M. B. McBeth (Lochgilphead, Argyll), in thanking Mr. Roberton for his excellent paper, remarked that of course the prices of materials and several other points had to be taken into consideration in making comparisons and forming estimates. His council had recently received from the Road Board a grant of £3,000. That meant a considerable amount of extra work for the engineer and surveyor having charge of the operations, and having regard to that he would like some expression of opinion to go forth from the meeting to the Road Board as to the remuneration of the engineer engaged in the carrying out of the operations. As surveyors they were delighted to get these grants and see the roads improved, but not when it affected them as he had described. On Form 18 they would find an item at the bottom of the page marked "Other expenses in which supervision, watching and lighting are to be included." A friend of his who finished a contract a year before him included his expenses in connection with the work, and these were passed without demur; but a few months ago he (the speaker) had occasion to send in his own completed Form 18 in which he charged his expenses. He found it impossible to undertake his duties and carry them out to the satisfaction and credit of himself and council, and so he had to employ an assistant whom he had to pay out of his own pocket because no allowance was made for it. His form was rejected, and he was told that it would not be paid until the charge he made for the assistance he had obtained was deleted. Another friend of his put a question to the Road Board, and in reply he was given to understand that no portion of the salary of a surveyor or a clerk of works ordinarily employed by the council could be included in the estimates submitted to the board. If, however, for work to which the Road Board were asked to make a grant it was proposed to employ an additional surveyor or a clerk of works for that particular work, or to pay a surveyor or clerk of works already in the employment of the council an additional and special fee, then the remuneration of the additional officer or the amount of the special fee might be included in the estimates. In sending up their estimate provision was made for the payment of additional assistance, and that statement was approved by the Road Board; but when they submitted their final estimate it was rejected. In his district there were 369 square miles, and the valuation was only £49,000, a 1d. in the £ producing only £240. The first contribution was seven-eighths of the total cost of the work, which meant that if they were to carry out the work the rates of their already over-burdened district would be increased by 4½d. in the £. So they could understand how little the ratepayers would feel inclined to pay officials an extra salary. Under those circumstances he thought the institution should endeavour to get an arrangement made by which they could be allowed extra remuneration, providing for its payment from the Road Board grant.

Mr. R. Drummond (Paisley) thanked Mr. Roberton for the paper giving them information of what he was doing round Dundee.

Mr. J. S. Brodie (Blackpool) said the first thing that struck him in the paper was that Mr. Roberton had experienced what most of them were experiencing, that with the greatly increased use of the roads there was a corresponding increase of cost. That was the secret of the whole thing, and they would have to meet that increase of cost in the most economical way they could. He was glad to see that Mr. Roberton was carrying out certain experiments which were in the right direction. They lived by experiment, in a measure, and only those who did something new could add something new to this road problem. With regard to Mr. McBeth, he did not think he was any worse off than they were in England. Not only were they not allowed to receive any gift from the Road Board, but they were not allowed to receive anything from expenditure by the municipality of their own money. That was a *sine quâ non* of all loans sanctioned by the Local Government Board. What they did was to worry their own people to raise their salaries, and some of them with success, and others with not so much success. It was a grievance that it should be laid down that if a corporation spent thousands of pounds the man who did the work should not benefit, even though it was their own money and not given to them by the philanthropy of the Road Board. The only way they could remedy this was to keep pegging away, and to say to their people: "If you want me to spend half a million you must make it worth my while or I am going elsewhere." He commended that to Mr. McBeth. The public authorities must remember that this road

problem was no light matter. It was additional expenditure caused by the additional traffic thrown upon the roads, and surely any council must be aware that the expenses on the roads were increasing, and that the duties were increasing, and the remuneration of the officials must increase *pari passu* with their expenses and duties. All they had to do was to insist upon a proper salary being paid to them. If the matter was put before them their councils would rise to the occasion, and they would see that the maintenance of the roads was an increasing expenditure, and they must raise their officers' salaries to meet those duties. They did not want to go cap-in-hand asking for charity, but they wanted to be fairly and properly remunerated for the hard work which they put in.

Mr. McBeth pointed out that grants from the Road Board were not regular. Every committee would be prepared to increase the salary for work which would be regular, but it might not occur again for ten years. The committee would grudge giving an increase of salary for that, but if there was a good grant they would not mind 5 per cent or 2½ per cent allowance to the surveyor on the expenditure.

Mr. J. Cameron (Strathaven) said they all knew that this extra traffic had been thrown upon the roads, and they had got to put up with it; but the question was, who was to bear the cost? The additional expenditure on the roads was not for the residents and ratepayers. They had country roads which might meet the requirements of the district at a cost of £3 or £4 a mile per year, but they had to be made suitable for a great deal of motor traffic, and to put the road in a condition for that traffic might cost £1,000 a mile. In the county of Lanark this was a very serious matter, and it was coming before them every day, because the motor cars and the heavy commercial motors on the roads were competing with the railways on every hand. Where was the money to come from?

Mr. J. Scott (Perth) remarked that Dundee was a very large city, with 170,000 inhabitants, and with the surrounding districts probably 300,000, which meant that there was a very large traffic from the city radiating through Mr. Roberton's district and thence on to his district. Mr. Cameron had asked where the money for the roads was to come from. Lanarkshire, of all the counties in Scotland, ought to know where the money was to come from. Why they did not know what to do with their money in Lanarkshire. With regard to the remarks of Mr. McBeth as to getting a commission on their work from the Road Board, he happened to meet one of their committee who interviewed Sir George Gibb on that matter, and he said, while they were well received, they had no hope held out that they would receive anything at all from the Road Board. It was entirely left to their committees. Mr. Brodie had suggested that they ought to keep hammering away at their committees; but their committees were not exactly like what Mr. Brodie's corporation might be. A great many of their members were subsisting on half what the surveyor was. It was most difficult to approach these men on the matter of salaries. He thought Mr. Roberton had proceeded carefully by starting with the strengthening of his roads, and possibly in a year or two Mr. Roberton would find it was paying him to put some bituminous binding on the roads.

Mr. Hamilton (Lanarkshire) said they were there as a deputation from Lanarkshire to hear what the road surveyors and engineers had to say about road making and the upkeep and maintenance. They had had considerable discussion about this matter in Lanarkshire. Their roads were kept up not only for their own, but for through traffic which simply passed through to Edinburgh and Glasgow and other places, and their roads had to be strengthened to meet that traffic. Mr. Cameron had put it to them—where the money was to come from. It was not that Mr. Cameron was in doubt whether they would get the money, but what was the proper place to get the money from. Twenty years ago their roads were made up equal to the traffic which passed over them, but a new traffic had been created, and that traffic had to be met. Who was to pay for it? He was not there to argue against these gentlemen asking for increases of salary. No council would wish engineers to work for nothing. He expected that their engineers would give them the whole of their time, and the best of their ability, and if extra work was placed upon them they would expect them to do that work, but if it meant an addition to the work, they were willing and ready to pay additional salaries. But that was not the question at all. The question was the maintaining of the roads to the standard required. They had heavy motors and traction engines passing over the roads, and they ought to be taxed heavily, and then the Government ought to subsidise the county councils for the difference it cost to maintain the roads as they were now required.

Mr. J. Lee (Paisley) said they had had two very interesting speeches from county councillors. It was rather difficult to understand why Mr. Cameron and Mr. Hamilton should want to know where the money was to come from. It was the duty of the county councils to find the money, and of the surveyors to spend it, and spend it judiciously, and he had no doubt the Lanarkshire engineer was quite competent to advise them how to make the roads, and make them well, if they would find the money. All he would say to Mr. Cameron was that he was a very practical man, and did not require to know how roads were to be made. What he had to do was to make up his mind how much money was to be spent in Lanarkshire.

The President remarked that Mr. Roberton had made reference to the Telford road. He thought they might take it that Telford, although he had a very definite theory as to the practice of road making, did not always carry it out. He (the president) had to strengthen a portion of the Shrewsbury and Holyhead road, and they would be surprised that for miles there was no pitching at all. Telford was like other engineers—an opportunist. It was not, therefore, correct to say that he always adhered to this pitching theory. It was true that the average English country road was not pitched at all. It was also obvious that with the funds at their disposal it was almost impossible to strengthen any great portion of the roads by taking them up and pitching. The only thing was to go on increasing the coating upon them. The one thing which appealed to him was the extremely low price of the roads. He wished he could make his roads at anything like their price. When he told them that a ton of granite cost them anything from 13s. to 16s. per ton they would be surprised to compare it with their figures. Mr. Roberton referred to pitching, and recommended that the stones should be set on edge. He did not know what was the practice in Scotland, but his practice was to put down the flat portion of the stone on the bottom and wedge it from the top, for the obvious reason that the flatter portion on the subsoil the less likely was it to move with the traffic. He believed it was the general practice in the South of England to put down the largest face of the stone underneath. Reference had been made to heavy motor traffic. He was sorry to find Mr. Roberton had this difficulty to deal with. It was an anomaly that the heavy motor was entitled to travel any road in the kingdom without paying a cent tax. It was anomalous because it only applied to the heavy motor driven by steam. The heavy motor driven by petrol did contribute to the Road Board petrol tax. It was an anomaly that the heavy motor driven by steam, and a much heavier weight than the traction engine, paid nothing to the cost of the highways. It was also anomalous that while the driver of a heavy motor must have a licence to drive, which could be revoked after three offences, when it had been revoked he could get up the next morning and drive a traction engine. In Buckinghamshire they had put down a weighbridge to ascertain the weight of these heavy motors, and they would be surprised to find the large proportion of these heavy motors which were considerably in excess of the weight permitted under the Heavy Motor Order. He would suggest to them that they should consider the question of providing these weighbridges and recouping themselves some of the extra cost upon the roads of the wear of these motors, and at the same time compel the owners of these heavy motors to comply with the law.

The vote of thanks having been passed,

Mr. Roberton, in reply, thanked the members for the way in which they had received the paper. He had prepared it at a very busy time. His one desire was to show them what they were doing locally. His brother surveyors would realise his position. With a great many of their Scottish roads, which had to carry heavy motor traffic, the first thing to do was to put in a foundation and make them strong

enough to carry the traffic. The question of putting a surface on them would come in due time. With regard to Telford and the foundation of the Holyhead and Shrewsbury road, to which the president had referred, he was quite aware of that, and that he did not always carry out his theory. They experimented with the stones laid both ways—with the stones laid on edge and laid flat—and there was very little difference. With regard to the Road Board, they had a difficulty in getting the money they would like to have to strengthen the roads, but they had got some, and they had tried to utilise it to the best of their ability. He hoped they would get some more. He made a claim for his services, but he was sorry to say he did not get any compensation from either the Road Board or the county council, but he would put in again on some future occasion.

SATURDAY'S EXCURSIONS.

On Saturday morning the members left Dundee for Lintrathen, where a small natural loch, 180 acres or so in extent, has been converted into a reservoir having a capacity of 3,060 million gallons, of which 2,130 million gallons, or 70 per cent of the total contents, are available as storage for the area supplied by the Water Commissioners. The loch is about 1½ miles in length, and has a maximum breadth of ¾ of a mile, its greatest depth being 80 ft. The drainage area extends to about 19,000 acres—nearly 30 square miles. The embankment forming the dam is over 1,000 ft. long, and is composed of earth materials with clay puddle core, and protected in the usual way by stone pitching. The embankment is protected against flooding by a stone waste weir, 300 ft. long, over which it is not an uncommon experience to have 12 in. of water pouring down to the river below, representing a flow in twenty-four hours of 370,000,000 gallons. The water is not filtered. It is drawn from the loch at various depths at the discretion of the management, passed through a tunnel partly cut in solid rock, and flows to a large measuring cistern at the Den of Airlie, where it is carefully screened to remove leaves and so forth. It is then conveyed to Clatto reservoir in two cast-iron pipes, each 27 in. internal diameter, where it is again screened through copper wire screens. Here it enters the trunk mains, which distribute the supply to other service reservoirs.

The luncheon which followed the inspection of the waterworks was presided over by Bailie Forwell, who, after the toast of "The King," proposed that of "The Institution of Municipal and County Engineers." All recognised, he said, that the institution was a great and important body doing magnificent work, and it was right and proper that its members should meet together and discuss the great problems that confronted them.

Mr. A. H. CAMPBELL, of Edinburgh, who was called upon to respond, after some personal references to his association with the neighbourhood and its works, observed that as a body of municipal engineers they owed their livelihood and all that made their public life worth living to the existence of the public bodies whom they served; it was meet, therefore, that they should thank them. He remembered many receptions given to the institution at the various towns visited, but he thought that of all the authorities by whom they had the honour of being received there was none, either in England or Scotland, that excelled in her hospitality that of the City of Dundee. That was no commonplace, for he felt that the further north one went, the warmer was the welcome accorded, and that the thanks which had already been conveyed to the corporation on behalf of the institution were certainly well deserved. Concluding, Mr. Campbell said that he had recently, by the courtesy of Mr. Thomson, had the opportunity of looking through the Parliamentary plans of the street and other city improvements contemplated in Dundee, and the remark he made was that "outside of London he was not aware of any other city in England—and certainly not in Scotland—that had approached by one great effort the problem of slum clearance in the whole-hearted, determined and thorough manner disclosed by the plans," and he cordially wished success to the scheme.

Mr. J. BRYCE, burgh surveyor of Partick (vice-president of the institution for Scotland), proposed "The City of Dundee." Altogether, he said, their visit to Dundee would be a very memorable one, and he was sure they would all look back upon it with much satisfaction, and derive from it a considerable amount of profit. They wished the city every prosperity in the future.

Bailie MCDONALD, in responding, remarked, with regard to the improvement scheme, that the corporation were thoroughly in earnest, and meant to proceed to carry the scheme into execution at an early date. It was no merely paper project, but one that would speedily materialise.

A delightful hour was spent later in the day at Glamis Castle, Kirriemuir, made famous in recent years by Barrie's "A Window in Thrums," being passed on the way.

Glamis Castle is the hereditary seat of the Earl of Strathmore and Kinghorn, and is interesting both on account of its historical associations and the elaborate style of its architecture. "I was only nineteen or twenty years old," says Sir Walter Scott, "when I happened to pass a night in this magnificent old baronial castle. . . . It was the scene of the murder of a Scottish king of great antiquity; not, indeed, the gracious Duncan, with whom the name naturally associates it, but Malcolm II. It contains also a curious monument of the peril of feudal times, a secret chamber, the entrance to which, by the law or custom of the family, must only be known to three persons at once. . . . The extreme antiquity of the building is vouched by the immense thickness of the walls, and the wild and straggling arrangement of the accommodation within doors. I was conducted to my apartment in a distant corner of the building, and I must own that, as I heard door after door shut after my conductor had retired, I began to consider myself too far from the living and somewhat too near to the dead."

Among the rooms seen by the members of the institution last Saturday were the apartment where King Malcolm II. was murdered, Sir Walter Scott's bedroom, the dining room and the drawing room or Great Hall—a magnificent apartment, with old, arched ceiling and portraits of Graham of Claverhouse, Charles II. and James VII.—communicating with a quaint little chapel in Jacobean style. The older part of the building was completed by John, Earl of Strathmore, about 1621, from plans made chiefly by his father, Patrick, Lord Glamis.

COUNCIL MEETING.

At a meeting of the council held at the offices of the institution on Saturday, May 24th, there were present: Messrs. R. J. Thomas (president, in the chair), A. D. Greatorex, T. W. A. Hayward, J. W. Cockrill, O. E. Winter, G. F. Carter, H. E. Stilgoe, H. T. Wakelam, W. N. Blair, W. H. Prescott, J. Patten Barber, J. S. Pickering, N. Scorgie, T. Moulding, W. T. Lancashire, C. F. Wike, J. S. Brodie, Thomas Cole (secretary) and H. A. Giles (assistant secretary).

Elected as Members: Messrs. E. Park, engineer to Sedbergh Rural District Council; T. G. Cairk, borough engineer, King Williamstown, S. Africa; J. C. Midgley, deputy town surveyor, Newcastle-on-Tyne; G. W. Thompson, engineer and surveyor to the Hipperholme Urban District Council, and P. Coughlan, engineer to Michelstown Rural District Council.

Transferred from Associate-Member to Member: Mr. R. R. Knight, city engineer, Fort William, Ontario, Canada.

Elected as Associate-Members: Messrs. E. F. Edwards, assistant surveyor, Chertsey Urban District Council; R. L. Fairclough, assistant surveyor, Blyth Urban District Council; J. W. Ingham, engineering assistant, Enfield Urban District Council, and A. C. Box, engineering assistant, Staines Rural District Council.

Elected as Students: Messrs. G. H. H. Cook, borough engineer's office, Bridlington; F. N. McRae, assistant surveyor, Saffron Walden; H. V. Slayton, city surveyor's office, Lincoln; T. H. Rawnsley, borough surveyor's office, Ossett; F. Kirby, assistant surveyor to the Sedgefield Rural District Council.

The following gentlemen were elected as hon. members: Messrs. A. W. Bos, Director of Public Works, Amsterdam, and I. A. Lindo, Director of Public Works, The Hague.

ARBITRATION CLAUSE.

The committee reported the reception of a deputation from the Builders' Merchants' Alliance in support of their views that there should be inserted in all contracts relating to the supply of materials (1) a Strike Clause, (2) an Arbitration Clause, and (3) a clause relating to the payment for the loss and use of sacks, drums, packages, &c. The chairman pointed out that the council of the institution had already agreed that the suggested strike clause was a reasonable one, and might be inserted in all contracts for the supply of articles and materials. The deputation accepted the decision of the council already conveyed

to them, "that, while agreeing with the principle of the clause relating to the payment of loss of sacks, &c., it is not one which should be included as a general clause in a contract, inasmuch as it relates to details which should be dealt with in each case as circumstances may require." The deputation promised to submit a clause in reference to arbitration which would provide that the matter in dispute should be referred to an arbitrator to be nominated by the president for the time being of the Institution of Municipal and County Engineers. The deputation were informed that such a clause would receive the careful consideration of the council.

AN INSTITUTION JOURNAL.

On the recommendation of the Journal Committee it was resolved (1) that a committee be appointed to take charge generally of the production and publication of the Journal; (2) that the Journal be published at the registered offices of the institution; (3) that the secretary be the Editor of the Journal; (4) that the Journal be issued in sixteen parts, one part in the first week of each calendar month, the remaining four parts to be issued in the middle of the months of April, May, June and July; (5) that advertisements be accepted for inclusion in the Journal, but that no advertisements be included in or interleaved among the letterpress of the Journal; (6) the Journal to be approximately 10 in. by 8 in. in size, and to consist of forty pages of text, excluding advertisements; (7) that quotations be invited from printing firms and advertising agents for obtaining advertisements, and that tenders be also obtained for printing the Journal, and that the committee be empowered to accept tenders and to act generally.

The following were appointed as the Journal Committee: Messrs. Barber, Cockrill, Prescott, Hayward, Scorgie, Wakelam and O. E. Winter.

NEW OFFICES COMMITTEE.

The committee reported sundry further purchases of furniture which were approved. It was unanimously resolved that the council acknowledge with much pleasure their appreciation of the time and work expended by Mr. G. F. Carter, the chairman of the New Offices Committee, in securing the new headquarters of the institution, and in the decorating and furnishing of the rooms.

CONSTITUTION COMMITTEE.

The report of this committee was referred back for further consideration.

TOWN PLANNING CONFERENCE.

The committee reported that the programme of the conference and their request for the appointment of delegates had been issued to the membership and to local authorities. The committee reported that Mr. Thomas Adams, an inspector of the Local Government Board, had been appointed by the board as their delegate to the conference. The committee reported an extract from the Local Government Board Report, 1911-12, expressing approval of the Town Planning Conference held in connection with the annual meeting of the institution at West Bromwich. It was resolved to ask Mr. Adams to act as assessor in the competition to be held in connection with the forthcoming conference. (Mr. Adams has kindly consented to act in this capacity.)

PAST-PRESIDENT'S LOSS.

On the motion of the president, a very sincere vote of sympathy was passed to Mr. J. Patten Barber in his recent bereavement by the loss of his wife.

AWARD OF PREMIUMS.

The award of premiums in Vol. 38 was referred to the Journal Committee, and the president announced his intention of awarding a President's Prize.

APRIL EXAMINATION RESULTS.

Of the twenty-one candidates who sat for the seventy-seventh examination the following were granted the institution's testamur: Messrs. G. Whitaker, F. L. Boydell, P. H. Wakefield, R. E. Holding, C. Greenwood, W. A. Pover, J. Johnson and J. W. Hill. Eight candidates were relegated for re-examination.

Of the twenty-four candidates who sat for the seventy-eighth examination the following were granted the institution's testamur: Messrs. J. Wrest, A. Cheyne, W. H. Parham, W. Dunbar, C. G. Atkinson, T. L. Williams, F. W. Mozley, F. J. D. Lewis, W. H. Rean, A. Clibbens, H. T. Jones, D. R. Morgan, D. Hincheliffe, A. Dickinson, W. Metcalfe and S. C. Percival. Six candidates were relegated for re-examination.

THE VISIT TO AMSTERDAM.

The president reported a successful visit to Amsterdam at Whitsuntide, and on his motion Mr. A. W. Bos, Director of Public Works, Amsterdam, and Mr. I. A. Lindo, Director of Public Works, The Hague, were unanimously elected as hon. members of the institution.

SANITARY INSTITUTE CONGRESS.

Mr. Yabbicom and Mr. Pickering were appointed delegates.

COUNCIL MEETING.

The date of the next council meeting was fixed for June 21st.

PARIS WATER SUPPLY.

A SCHEME FOR RESERVOIRS IN NORMANDY.

It is calculated that by creating reservoirs in valleys in Normandy, and collecting the waters stored in these reservoirs, it would be possible to deliver to Paris more than 40,000 million gallons of water per annum, or well over 100 million gallons a day, in addition to considerable supplies which would be utilised elsewhere. The storage reservoirs would be situated in the forests of Andaine, Ecouves, Persaigne, La Motte, and in neighbouring areas. In the forest of Andaine there is a valley, lying between Chamsecret and Perraux, where, by the construction of a large dam the waters of a catchment of considerable size can be intercepted. The chief stream in this catchment is the Andainette, a tributary of the Varenne. The reservoir will have a waterspread of 1·16 square miles, and will contain 8,800 million gallons. Similar dams will store the waters of four other streams in the neighbourhood of Bagnoles, and all these waters will be carried by canal to join contributions from the Maire and the Ecouves in Vrigny Lake. The dam across the valley of the Maire will create a reservoir with a waterspread of about 1½ square miles and a capacity of nearly 12,000 million gallons. This reservoir will also collect the water diverted by a line of dams and canals alongside the lakes of Dieufit and Le Grais, and there will be contributions from the Rouvre and its tributaries.

A large canal will traverse the forest of Ecouves, collecting, first the waters of the Gourbe, stored by a dam above Motte-Fouqué, and further on those of the Chérisé, from the forest of de la Motte and Saint-ursin.

These will be gathered into a reservoir with a capacity of 6,600 million gallons. About a dozen other streams in this neighbourhood will contribute to this supply.

In the forest of Persaigne two dams will be built, the largest, that of the Bienne, having a capacity of 4,400 million gallons, and a waterspread of about 0·4 square mile. A canal, passing by Chassée, Hauterive, and Radon, will unite this supply with that from the forest of Ecouves. All the water stored, above the Maire dam, will flow by a canal 16 miles in length to the Vrigny Lake, which will be more than 1 square mile in area; and here will be situated the intake of the aqueduct by which the water will be conducted to Paris. The channel will pass Saint-Hilaire, La Chapelle, Bonmoulin, Notre Dame d'Areps, Chandai, Vourthe, and Verneuil. It will unite with the channel from the Arve, continuing alongside this river to the reservoirs of Saint Cloud, the total distance traversed being about 136 miles. Saint Cloud, at 360 ft. above sea-level is 312 ft. below Vrigny Lake (672 ft.), which provides an ample fall for the length of 136 miles. The canal will be so situated that it will not interfere with the river alongside which it will run, the crossings being either aqueducts or inverted syphons.

The catchments are situated at altitudes above 650 ft., the streams of Mayenne being more than 900 ft. above sea-level, and there is a natural fall towards the Vrigny Lake. The total area of the catchment basins is about 210 square miles, and of this area 92 square miles are wooded. It is considered that the nature of the catchment is such as to ensure the supply of water of excellent quality.

Wimbledon Park as an Open Space. Wimbledon Town Council has decided to purchase Wimbledon Park estate of 155 acres from Lady Lane, for £66,500, and to keep it as an open space.

Sewage Disposal at Bolsover.

INAUGURATION OF NEW WORKS.

The official opening of the Bolsover Urban District Council's new sewerage and sewage disposal works at Carr Vale on Tuesday afternoon, May 27th, was made the occasion of an interesting and pleasant ceremony in which councillors, officials, and prominent ratepayers participated.

The works, which were begun just over a year ago, and have cost about £2,300, provide an object-lesson in economical administration, and reflect infinite credit upon the council and their engineer (Mr. W. G. H. Browne).

For some months prior to the commencement of the work the council were faced with an ever-growing list of complaints incidental to a defective sewerage system. A serious trouble arose at the main outfall, which was designed to deal with the sewerage from Bolsover alone, and was taxed to its utmost capacity by the additional flow from Carr Vale. Happily the council realised that it was useless to attempt to effect an improvement of the existing system, and hence, upon the advice of their engineer, resolved upon a comprehensive scheme of sewage disposal. Mr. Browne decided to make Carr Vale a separate drainage area, and to collect all subsidiary sewers into a main low-level sewer. The latter has been carried clear of the village by a route permitting of all the property being connected, and discharged on to the new works, which are situated on the western side of the Midland Railway, in close proximity to the Doe Lea.

The works were designed to deal with the sewage from 650 houses, and it is assumed that the volume will be 32,500 gallons for twenty-four hours' dry-weather flow. The anaërobic tank can deal with 100,000 gallons daily, and the capacity of the detritus tank is 5,000 gallons, while there is also that essential part of all modern disposal works—a humus tank. Old 6-in. sewers in Charlesworth-street and Railway Sear-street have been replaced by 9-in. sewers, and 6-in. sewers in Bathurst-road and Scarsdale-street have been utilised as surface-water drains, and new 9-in. sewers laid beside them.

Under the able guidance of the engineer, the visitors followed the pipe track and thoroughly inspected the works. They commented upon the substantial character of the brickwork, and were delighted with everything they saw, especially with the purity of the effluent; their attention, however, was chiefly directed to the anaërobic tank, in the construction of which "Pudlo," a preparation supplied by Kerner-Greenwood & Co., King's Lynn, has been used. The engineer pointed out the marble-like appearance of the walls of the tanks, the entire absence of cracks and "weeping," and the stability of the structure. The gratifying results he had obtained he unhesitatingly attributed to the use of "Pudlo." Councillors were deeply interested in the tank, and were unanimously of opinion that it was far superior to those made in other parts of the parish.

After the inspection the chairman of the council, Councillor W. H. Carter, entertained the gathering to tea in the Colliery Institute.

In moving a vote of thanks to their host, Councillor R. Palmer, chairman of the Finance, Sanitation and General Purposes Committee, said the new works were a credit to the council, the engineer, and the clerk of the works (Mr. H. Jackson), and every penny they had cost had been well spent. It was gratifying to reflect that, despite the increase in the cost of materials, everything had been completed satisfactorily, and that the cost of the works was only slightly in excess of the estimated sum of £2,000. Councillor G. H. Adin concurred. They had got for their money not only full value, but 50 per cent more than they obtained when carrying out similar schemes in years gone by, and they had had considerable experience of sewerage works. They were not afraid of any ratepayer inspecting the works, because no one could say that they had not spent wisely every penny of the money they had had at their disposal.

The chairman remarked that the works were thoroughly up-to-date, and he was very pleased with the appreciative references that had been made to the work of the engineer.

Bolsover Sewage Works.

Rocmac in Lewisham.—Mr. E. Van Putten, borough surveyor of Lewisham, has been authorised by the Works and Highways Committee to put down "Rocmac" in certain parts of the borough, which, being hilly, are (in the opinion of the committee) unsuitable for tarred macadam.

Tramway Paving at Portsmouth.—A special committee of Portsmouth Town Council recently appointed to investigate the question of the class of paving most suitable for use for the corporation's newly constructed tramway tracks have recommended the adoption of the improved modern type of wide granite blocks, finely dressed to a smooth surface and laid with close joints. It is claimed that, in addition to being comparatively noiseless under traffic, this type of paving, by reason of its close-fitting joints and imperviousness, permits of very great stability of structure, durability and low cost of maintenance being other advantages attached to its use. The Portsmouth Corporation are stated to be so satisfied with their experience of the paving that it is to be adopted throughout the extensions about to be carried out.

Road Making Developments.

MAIN FEATURES OF RECONSTRUCTION WORK.

The highways of the British Isles are, on the whole, maintained in an efficient state, and at a cost which compares favourably with the expenditure in some countries. What is, after all, more important is the fact that the expenditure, though it could be considerably reduced, is reasonable when looked at in the light of absolute data. Comparisons with other countries are not informative to engineers generally, since it is only the highway engineer with experience of a number of different kinds of country who can really take into consideration the various factors which make for high or low costs of maintenance, and estimate their importance in different areas and under divers traffic conditions. Further, unless we know the original costs of construction of the roads compared—and usually we do not—we cannot gauge the economic significance of the difference in the costs of maintenance of a well made road and a badly made road. There are three main elements in the absolute economy of a road or a system of highways—namely, first cost, cost of maintenance, and efficiency. A high first cost may be justified by a low cost of maintenance or by high efficiency, or both, and a high rate of expenditure on maintenance may be justified by and at the same time justify a small cost of construction, if the latter be low enough and the former not too high. When, however, the maintenance cost of a road is much greater than that of roads with similar crusts, and carrying traffic which is not more severe, it is usually the case that there has not been a sufficient expenditure on construction or reconstruction to meet the bad effects of unfavourable conditions. The road as an earthwork does not adequately suppress the effects of factors tending to a high cost of maintenance, or the alternative, in some cases, of an efficient road. These considerations are, of course, subject to the general one—that a road in an unfavourable area may cost, one way or another, many times as much as a similar road performing the same kind of service in a favourable area.

In the British Isles road making in its relation to maintenance and efficiency is chiefly confined to the matter of reconstruction or deferred construction. There are roads which were so well made out of old tracks or on fresh ground that no reconstruction is needed except, in some cases, the strengthening of the crust of the carriageway. Other roads are well engineered on the whole, but the greater obstacles were not adequately dealt with, or, in other cases, the small matters were ignored, with the result that reconstruction is desirable for longer or shorter stretches here and there. Other roads have been made throughout their length with due regard for some elements of eventual economy, but with no adequate recognition of others. Lastly, there are roads which have been developed, often within narrow limits of width, without engineering work of any importance, and mainly by the strewing of stone and the passage of vehicles, ditches being provided only where this could be done easily, and developed in recent years under restrictions which made it impossible to turn them into effective works. Many such roads now carry a large volume of traffic, and are used by heavy vehicles. In the worst of such cases the reconstruction of the road is economically undesirable, not only because the land beside it is valuable, but also for quite independent engineering reasons, and it may be better to make a new road either near the old one or at a distance from it, according to whether it is intended only as a development of the old route or will also be useful as a part of other routes.

RECONSTRUCTION OF ROADS.

In order to narrow our subject to one which can usefully be discussed within the limits of a single article, let us leave out of consideration the development of good but somewhat inadequate roads and of cases in which the construction of relief roads is desirable, and turn our attention to what is, in this country, the most important part of the subject—namely, the reconstruction at considerable expense of fairly important roads which are in a condition corresponding to that of roads made with an insufficient expenditure of capital, or of skill, on original construction. On such roads the problem generally is this: A hard and strong road crust is being maintained in a state fit for the traffic, under conditions which are far from being those necessary to secure the greatest possible stability of the crust as a structure, and the least possible wear of materials in proportion to the amount and severity of the traffic. The road is costly or unsatisfactory, or both, for definite reasons; and each of these may be traced to a cause which would not exist, or would be relatively unimportant, if the length of road in question had been designed and made by a qualified engineer, and with the expenditure of a sufficient sum per mile. The practical question in each case is this: to what extent can matters be remedied by reconstruction—that is, by works other than those of the renewal of the road crust by additions from the top and by the ordinary spade work in the ditches and margins? Works of considerable importance have been done at long intervals on many of our roads, but so little has been done recently that the title of this article would be unsuitable were it not for the fact that the mere recognition of the need for such works and some definite suggestions as to the manner in which the different operations should be carried out constitute the beginning of improvements, this being the result, it seems, of the initiative of an exceedingly small number of persons. The local road surveyors and the Road Board, which now performs the duties of a central office in highway matters, were all, a very short time ago, inclined to embark upon a policy of crust improvement with little consideration of the prior claim of reconstruction work; but they now take a different view, and seem to be, to a considerable extent, convinced that in many cases some expenditure on work of other kinds should precede or accompany the strengthening and improvement of the crust itself. The idea is recognised in a circular which the Road Board issued to county councils about a year ago. At the same time this conviction is by no means general, and few surveyors seem inclined to contemplate such expenditure on reconstruction as seems justified by the large sums spent on annual maintenance, and in resurfacing under the head of "improvement." Work actually being done includes, however, some methods of strengthening the crust, which involve the recognition of important principles not generally recognised of late years. In some cases it seems to be good policy to spend a portion of the allowance for maintenance upon work other than that of ordinary crust renewal, the slight set-back in the condition of the road during the ensuing year being more than justified by the reduced rate of wear resulting from the improvement in strength. This applies especially to local thickening of the crust and to replacing bare earth by hard materials in a strip between the crust proper and the turf margin or bank. Small sums expended as capital in work of this kind may prove to be very well invested, and such expenditure is a matter demanding careful attention. Still more important, however, is the fact that there are many single works, and many works needed, here for a furlong or so and there for a mile or two, and involving considerable expenditure, which would be justified partly by reduced maintenance cost and partly by the greater efficiency of the road as regards both convenience of travel and cost of haulage.

THE WIDTH OF THE ROAD.

There are several ways in which such works could be justified. Looking at the subject as a whole, we may conveniently describe them as pertaining, respectively, to width, earthwork, water, foundations and air currents; noting that in many cases a particular work may come under two or more of these heads.

Taking, first, the matter of width; there are many cases in which the width of the carriageway is uneconomical, the rate at which the road metal is worn away being greater than it would be if a wider surface were presented to the traffic. Sometimes a cheaper stone would give equally good results if a wider carriageway were provided, or could then be used for the shoulders of the road. Further, an increase in width may be needed in order to allow more passing room and to permit of vehicles with wide loads using the part near the edges instead of adding to the concentrated wear near the middle. Width not actually added to the carriageway may be wanted for the work necessary to afford support and protection for the

edges of the crust, to allow of the maintenance of a turf margin, and to make it possible to place ditches of sufficient size at the proper distance from the edge of the crust. In many cases additional width is required for other purposes, such as setting back the toe of a steep bank, the substitution of some better fence for a solid masonry wall, the making of a catchwater drain beyond the highway proper, and the support, on sidelong ground, of the down-hill edge of the road or the ground above the road on the up-hill side.

EARTHWORK AND HYDRAULICS.

Under the head of "Earthwork," the following are the matters chiefly needing attention: Slight embanking is needed where the road is flush with wet ground, and when such a stretch of road is a dead flat the opportunity afforded when the embankment is made should be made use of for the purpose of creating a gradient, since a dead flat is a serious factor in the annual cost of maintenance, and reduces the average efficiency of the road. A good many stretches of road are satisfactory as regards the crust and its immediate margins, but are not satisfactory as earthworks. Where the removal and replacing of the crust would be a costly work, it may sometimes be possible to make the road into a good earthwork by excavation and filling, which does not disturb the road bed, but diverts the flow of water from it and gives support to it where that is lacking. Much work of this kind needs to be done, sometimes without and sometimes with further and heavier work, involving changes in the levels of the road bed in some places.

The sadly neglected subject of hydraulic conditions claims attention over a large mileage of roads. The provision of catchwater ditches or of side ditches is, in many places, the most obvious requirement. In some cases other, and often very simple, works are required to deal with surface or seepage water, though in deep cuttings in unfavourable situations it may be cheapest in the end to widen the whole cutting. When the water cannot be kept away, provision must be made to drain it away, and this, though the fact is not generally recognised, involves some of the most difficult designing work encountered in highway engineering. An important matter in some parts of the country is the provision of properly designed culverts to replace the small and frequently choked drains which carry storm water across the road, or take the water of the side ditches under road turnings and field and house approaches. On many narrow secondary roads, and not a few main roads, some expenditure is called for in order to provide, in numerous cuttings or sunken stretches, shallow-paved surface drains, which are continuations of the road crust proper. Where such drains are provided the crust is saved from destruction by scour, or by breakage under wheel loads, and the work needed to keep an earthen strip from being scoured away is saved.

FOUNDATIONS.

As regards foundations, the position generally is that on soils which are good ones from this point of view the present road crusts are sufficiently strong. On many moderately good soils they would be strong enough if they were a little thicker, or a good deal thicker; while on bad soils the crusts are often broken or distorted, and are sometimes completely crushed in places, the rate of wear being greatly increased by such conditions. In these cases the provision of a foundation of some kind would always be an advantage, though a single thick crust is sometimes a cheaper alternative. It cannot always be shown that such an improvement will pay for itself out of a reduced cost of maintenance, the increased efficiency of the road being then the main consideration. The nature of the foundation to be provided is often decided by local prices, since it is not usually necessary to use materials which are very strong, or hard, or tough. Sometimes, however, the nature of the soil has to be reckoned with, demanding, for instance, the use of large gauge stuff, and in other cases the material chosen will depend upon whether the foundation course will also be a drainage course.

AIR CURRENTS.

This brings us to the last of our heads, "Air Currents," a subject which is of much greater importance than is usually supposed. Roads should not, as a rule, be exposed to the full force of gales of wind, snowstorms, and driving rain, and the various kinds of protection afforded by Nature and local custom form pleasing and useful features of our country highways. But a highway should not be deprived of that movement of the air which, if the road be exposed to sunshine, helps to keep it cool, which is so much more effective than sunshine in drying a wet road surface, and so much less damaging as a drier of the crust, and greatly tends to cut short the duration of muddy conditions after wet weather or in the intervals between showers. Fortunately, an ordinary fence or hedge, while it greatly reduces the force of a strong wind, checks a gentle breeze very much less in proportion, the light wind, usually steadier than a strong wind, creeping through the fence and being distributed usefully over the road surface. A belt of trees acts in a similar way on a larger scale, effectively arresting drifting snow and breaking the force of a gale, but not preventing the establishment of air currents across the road, even when the undergrowth is fairly thick. The masonry wall, on the contrary, is one of the worst enemies of the road. It effectually prevents the crawl of air across the surface, and in cross winds creates a more persistent calm immediately over the road than do most other obstacles of equal height or with the same angular elevation. Its even top makes a wall very effective in arresting snow drifts, but its smooth front tends to the piling up of big drifts by the establishment of currents of air along it when the wind blows aslant, and, unlike a hedge, it has itself no capacity for snow. When walls closely flank a road, that on the windward side is not much more effective in keeping rain off of the road than is an ordinary hedge of the same height, while that on the lee side of the road returns to the road a larger proportion of the rain which strikes it than does any kind of hedge. Generally, then, walls close to the carriageway tend to cause muddiness in winter and to keep the dust on the road in the summer, the latter effect being often painfully noticeable on long bridges. Old country houses often have large walled gardens, and are situated in sheltered bottoms, not, like new houses, on slopes. As a result of this the combination of dead flat, closely flanking walls, and a high subsoil water level is often found, the result ing dampness and softness of the road being erroneously attributed to the trees which are often a feature of such situations. The foundations of a wall sometimes prevent the drainage of water from the road bed, and besides serious trouble is caused on sidelong ground by seepage water from that very effective catchment—a levelled and well-dug garden. In this case the water pressure from the higher level is sufficient to carry water through or under the foundations of the wall into the road bed, or even on to the surface. In such a case the owner of the garden should be induced if possible to allow an effective drain to be placed on his side of the wall, and, generally, some careful drainage work is needed where there are walls near the road, unless the soil is very porous and the lie of the ground very favourable. In many cases what is really needed is the acquisition of a strip of ground and the removal of the wall, the road being often much narrower than is desirable, and the wall forming in some cases a source of danger as well as of high cost of maintenance.

Of other conditions which shut out air currents, the chief is the situation of the road in a deep cutting, especially a steep-sided cutting, and the works then necessary for drainage and stability may also be those desirable in order that the road may be sufficiently exposed to winds. The muddiest stretches of road, tarred or untarred, are those between walls or in deep cutting, the extent to which flatness or lack of lengthwise gradient is responsible for the muddiness being a matter depending on a number of factors, including the climate and the orientation of the road. The practical consideration of chief importance in this connection is that, cost for cost, it may be more worth while to give a good gradient to the road than to deal with the other causes of muddiness, especially if the road runs nearly in the direction of the prevailing winds of wet periods.

These brief sketches will serve to indicate the scope of the chief works of reconstruction which are needed to make a large mileage of our main and secondary roads more efficient and somewhat less costly in maintenance, such reconstruction being distinct from repairs on the one hand, and, on the other hand, forming a class apart from that which includes the large works of duplication and deviation.

Assistants' and Students' Section.

Conducted by SYDNEY G. TURNER, Assoc.M.Inst.C.E.

All communications in regard to this page must be addressed to The Editor, St. Bride's House, 24 Bride-lane, Fleet-street, E.C. *Envelopes must be marked "Assistants' Section" in the top left-hand corner. Correspondents are invited to submit questions for consideration and answers to the questions which appear. For the contributions considered to be the most meritorious, one or more premiums in books will be awarded monthly. Diagrams must be drawn to scale on separate sheets, ready for reproduction.*

QUESTIONS.

This week answers are invited to the following questions:—

324. Oil Engines.—Assuming two engines of equal horse-power (4-h.p.), one an oil engine and the other a petrol, what would be the approximate cost for running each engine for fuel and repairs? How would the costs compare with each other, including first outlay and oil, repairs, &c.? In regard to efficiency, which engine would be the more efficient from an economic standpoint? ("Griffo.")

325. Air Compressors.—How is the size of an air receiver calculated in connection with an air compressor? Of what thickness of metal would it be made if (1) of cast iron, (2) wrought iron, assuming it had to withstand a pressure of from 15 lb. to 40 lb.? Give any further particulars regarding same. ("Griffo.")

327. Flow of Sewers.—State the advantages of egg-shaped and circular sewers, and give conditions under which such advantages would occur. Give proofs of velocities and discharge. (D. G. B., *Darlington.*)

329. Sewerage.—Using the generally accepted most accurate formula, at what gradients must 9-in., 12-in. and 15-in. pipe sewers be laid to give a uniform velocity of 4 ft. per second when flowing two-thirds full? ("M. C. E.")

330. Sewage Disposal.—Design a small sewage disposal system for a gentleman's residence, capable of dealing with 500 gallons per day. The sewage is fairly strong on account of the drainage from a small cowshed. The available fall can be neglected, and the earth is of a sandy-clay nature. State approximate cost. The effluent should discharge into a soakaway. ("Inky.")

331. Sewerage.—In the case of the oval sewer in the sketch, 5,790 lin. yds. long, having a total fall from inlet to outlet 15 ft., what flow will be discharged when quarter, half, three-quarters, and full?

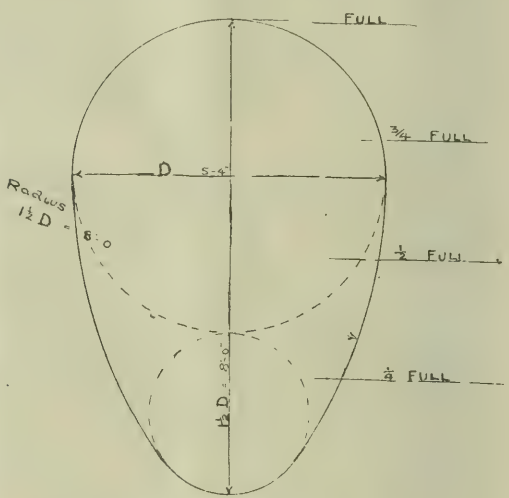
[The Editor is at all times glad to hear from readers who desire to submit questions regarding matters of general interest, points of daily practice, &c., for insertion in the "Assistants' and Students' Section." Questions which are published are taken into consideration, as well as other matter, in awarding the Monthly Premium.]

REPLIES TO QUESTIONS.

328. Concrete Paving.—Give details of the construction of wooden moulds for concrete pavement slabs, and explain the method of using them. ("Beginner.")

The sketch shows a simple form of wooden mould for concrete paving slabs. It consists of two moulds for 3 ft. by 2 ft. slabs, and two for 2 ft. by 2 ft. slabs, 2in. thick, these being the usual sizes made. It is merely a framing without top or bottom, fastened together with ¾ in. bolts, the distance pieces being housed into the sides.

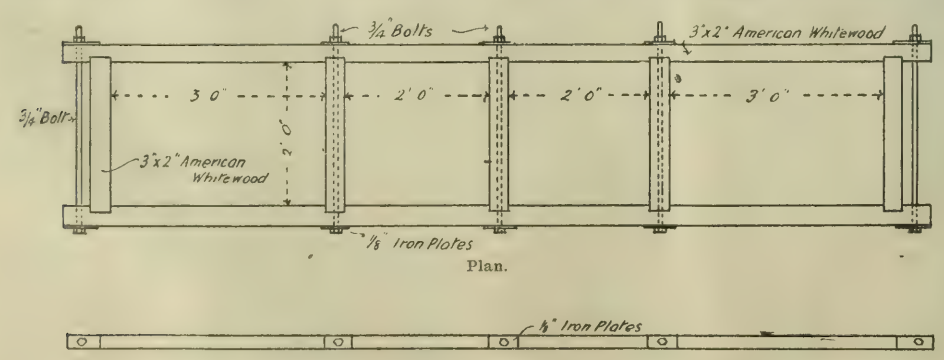
There are two methods of making the slabs, one to bring the concrete to a smooth surface by floating, and the other to lay the mould on a smooth surface and make the slab face downwards. In the first case the mould is securely bolted together, greased with soft soap or petroleum jelly and paraffin mixed, and laid on a sanded surface, the concrete being tamped in the usual way and floated to a fair surface. The top of the mould being quite flush renders this easy. After the concrete has set the bolts are undone and the mould taken off. The slabs left lying on the ground can now be used as a surface (sand being spread over them) for making the next batch, pieces of hoop iron being laid across the 3 in. separating them to support the mould. In this way a very large number of slabs can be made on a limited area.



Sketch Accompanying Question 331.

In the second case, the mould is laid on a greased board and the concrete filled in; this is the more satisfactory way if space allows.

Very good results are obtained from slabs made of ¼-in. granite siftings mixed with cement in the proportion of 4 to 1, or granite siftings, clean, sharp sand and cement, as 2, 2, 1. (E. D. A., *Sidcup.*)



Wooden Mould for Concrete Paving Slabs.

SOME RECENT PUBLICATIONS.*

Specifications for Street Roadway Pavements: With Instructions to Inspectors on Street-paving Work. By S. Whinery, M.Am.Soc.C.E. (Second Edition.) Price 4s. 2d. nett. New York: The McGraw-Hill Book Company. London: The Hill Publishing Company, Limited, 6 Bouverie-street, E.C.

The first edition of this book was published in 1907, and it is to meet recent advances in design and construction that the author has prepared this new edition. The "Instructions to Inspectors" are based upon a set of instructions prepared by the author for use in an American city, parts being re-written in a more general form; and while, as Mr. Whinery points out in his preface, they would need some revision and modification to meet the conditions and special specification provisions in any particular city, they must certainly be regarded as doing much more than "suggesting the points to be covered." It should clearly be understood that these specifications are written by an American engineer with a view to conditions prevailing in the United States; but they are well worth the attention of surveyors to British urban authorities, who are able to decide for themselves which are the points affected by local conditions, and which are of general importance. It is sufficient that the reviewer should point out that the matter itself is very good, and then indicate the scope of the work. The size of the page is large octavo, and the average size of the type fairly small, so that the 116 pages cover a good deal of ground. The first twelve pages are introductory, the subjects dealt with including "relations of contractor to municipality," "relation between specifications and contract," "engineer as arbiter," and so forth. Then follow some ten pages under "general," including a consideration of such matters as: Changes in plans and specifications; quality of material and work; injury to persons and property; order and progress of work; incidental and extra work; and other matters pertaining to the interpretation of specifications. There are individual specifications for foundations, including old paving-stone and broken-stone foundations, concrete kerb and gutter, concrete sidewalk, experimental or untried pavements, and for the following pavements: Sheet asphalt, asphalt block, granite block, brick, wood block, bituminous concrete and hydraulic concrete.

As regards the specification for a sheet asphalt pavement, the author points out that it is exceedingly difficult, if not impossible, to frame specifications which will be suitable for all the kinds of asphalt employed. In his own specification he gives us a typical mixture for the surface material: 100 lb. of sand, 17½ lb. of pulverised mineral matter passing No. 200 screen, including that found in the paving cement, and 13½ lb. of pure bitumen (in paving cement). A typical mixture for the base course is given as: Crushed stone, 100 lb.; sand, 42 lb.; pure bitumen (in asphaltic cement), 7 lb.; pulverised stone, 7½ lb. In an introductory note to this specification we find the following: "A sheet asphalt pavement is composed of two essential elements—a mineral aggregate made up of sand of assorted sizes and mineral 'dust,' and a bituminous cement." No mention is made of natural rock asphalt. The specification for wood block pavement is one which may be compared with British specifications. Creosote oil, "the best preservative of wood so far found," is specified as the preservative material. In the hydraulic concrete pavement the cement specified is Portland cement, a separate specification for which is given, but Mr. Whinery points out that natural cement concrete may be used with perfect confidence for pavement foundations, and he gives a specification for such a material, in so far as it differs from that for Portland cement.

Having regard to the advances which have recently taken place, this second edition of a book of recognised value must be regarded as rendering the first edition obsolete, and among senior members of the profession, engaged in definitely urban work, there are probably but few who will not obtain a copy; but it is desirable that it should further be pointed out that the matter is so presented that it is quite suitable for the use of junior men, the numerous notes being most useful in indicating the why and wherefore of leading points in the specifications themselves.

*Any of the publications reviewed, or referred to as received, will be forwarded by the St. Bride's Press, Limited, on receipt of published price.

Bulletin of the Permanent International Association of Road Congresses.

The March issue of this bulletin contains the outline programme of the Third Congress, London, June 23rd-28th, and the list of "Reporters." An account of the trial of signposts and distance posts of new patterns on the Paris-Trouville road is contributed by Mr. Lorieux, a chief engineer of the Ponts et Chaussées, and Mr. Auvray, city engineer of Versailles, describes a mudguard competition conducted by the Automobile Club of the Seine et Oise. An account of the general results of the American Road Congress, held at Atlantic City in September and October last, is furnished by Mr. J. C. Pennybacker, general secretary of the American Highways Association; and Mr. W. W. Crosby contributes a note on the Cincinnati Convention of the American Road Builders' Association of last December. The "Bulletin" contains several other papers and short notes relating to recent advances in highway work.

Journal of the Regina Engineering Society.

This is a first appearance (Vol. I., No. 1) of a new monthly, the main object of which is to ensure the publication of papers read at the meetings of the Regina, Saskatchewan, of which Mr. R. O. Wynne-Roberts is corresponding secretary. The issue before us is mainly devoted to the first annual address of the president, Mr. A. J. McPherson, chairman of the Provincial Board of Highway Commissioners, on "Roads of Saskatchewan."

A new edition of "Income Tax Simplified," by Arthur Fieldhouse and E. Ewart Fieldhouse, B.A., LL.B., has been published by Messrs. Simpkin, Marshall & Co. This excellent little work, which is obtainable at the price of 1s., is a really practical guide to the preparation of returns for assessment, and gives full instructions for obtaining repayment of tax.

THE DEVELOPMENT OF MORECAMBE.

BOROUGH ENGINEER'S SCHEME.

The borough surveyor of Morecambe, Mr. J. W. Hipwood, has presented to the council a report with respect to the prospective development of this rising seaside resort, in which he states that the future of the town is inseparably bound up in a scheme of town planning. One of the first essentials in a town-planning scheme for Morecambe which Mr. Hipwood puts forward is the extension of the borough boundaries to Hest Bank, and the continuation of the promenade from Bare to Hest Bank Station. The London and North-Western main line would then be tapped, for Hest Bank stands on the main line from Euston to Carlisle. With a double line of tramway track, carrying a frequent service of electric cars along this extended promenade, Morecambe would practically become a station on the main line—one of the few seaside towns on that great railway system. The vital concern of Morecambe is to tap as many sources of supply to population as is possible, and that is the key to Mr. Hipwood's scheme, and to the emphasis it places on the road factor. Owing to the enormously increasing motor traffic of the present day, he maintains it will be as essential to tap the motor traffic in the future as it is to tap the railways to-day.

Jointly with the road extension schemes Mr. Hipwood advocates what he terms "a ward-connecting inner circle road," a semi-circular thoroughfare linking up the West End by way of Regent-street with Out Moss-lane, Balm-hill, Lancaster-road near Halfway House, the South-road district and the golf links estate, and joining the promenade again half-way between Newlands Bay and Thornton-road. Mr. Hipwood suggests for the construction of this boulevard that it should be made at least 100 ft. wide, the central portion of the road—about one-third—to be reserved exclusively for tramway purposes.

Lexden and Winstree Roads.—The annual report of Mr. J. Ennals, surveyor to the Lexden and Winstree, Essex, Rural District Council, states that great improvement has been effected on the roads of that district by the larger amount of granite used during the past year, and by the continued use of this material on the principal roads it is hoped gradually to reduce the great wear and tear caused by modern traffic.

Law Notes.

EDITED BY J. B. REIGNIER CONDER, 11 Old Jewry Chambers, E.C., Solicitor of the Supreme Court.

The Editor will be pleased to answer any questions affecting the practice of engineers and surveyors to local authorities. Queries (which should be written legibly on foolscap paper, one side only) should be addressed to "The Law Editor," at the office of THE SURVEYOR, *accompanied by the writer's name and address, but correspondents who do not wish their names to be published should also furnish a "nom de plume." Where necessary, copies of local Acts or documents referred to should be enclosed.* **All explanatory diagrams must be drawn and lettered in BLACK ink only, and in such style as to be fit for direct reproduction** — *i.e.*, **without re-drawing or amendment.** *Unless these conditions are complied with we cannot undertake to reply to queries.*

QUERIES AND REPLIES.

In order to avoid confusion querists are requested to use distinctive words as noms de plume. *The letter* X, *combinations such as* X.Y.Z., *and words such as* "engineer" *and* "surveyor," *should never be used.*

PRIVATE STREET: NUISANCE: EXPENSES: BUILDING LINE.—"Perplexed, No. 2" writes: I should be pleased to receive your opinion upon the following: There is a private road, named or known as F road, leading from the county main road in a southerly direction. On the southerly side of the main road it is built up with dwelling-houses with the gable ends facing the easterly and westerly sides of the private road. On the westerly side of the private road are sixteen cottages built in line with the gable line of the property marked C, and on the easterly side of the private road is a piece of vacant land for building purposes. Certain property, A, was built long before the district obtained urban powers, and is the only property or land owned by A on the estate. No doubt when the estate plan was submitted by B it was his intention that the side of the private road should be the garden wall running parallel with the gable line of A property; however, when C began to build he did not keep in line with A line, and as a consequence the private road at the boundary with the main road is only 35 ft. 6 in., and at the rear of A property it is 37 ft. Afterwards D, E, F and G build down the road, and the building line is parallel with the gable line of C. A has no opening into the private road, nor does he own any land outside the garden wall, therefore there is a narrow strip of land which no one wants to own. The Private Street Works Act is in force in the district, but not the 1907 Act. The council, in consequence of stagnant water standing in the private road opposite A property, have served a notice to abate the nuisance. This, unfortunately, is a very difficult matter; as the district is not sewered, the sewage at the present time emptying itself into a large cesspool constructed by the council. Between the rear of the property and land belonging to A and the rear passage is a narrow strip of land belonging to B, so A boundary line does not abut either on the private road or the passage leading from the private road, nor has A any access to either of them. Now the question arises (1) Who is responsible for the nuisance opposite to A property? (2) In case the street is made up under the Private Street Works Act, is A liable for that portion opposite to his property? (3) In case A is liable for the said portion of the road, can the council enforce the requirement for the making up of the road, except sewering, and afterwards call upon the different owners to pay again for the breaking up of the surface which would be necessary to enable them to sewer? (4) Also, in case A is liable, will B be compelled to follow A's garden wall line as the building line? If so, the road will then be 35 ft. 6 in. at one end and about 42 ft. at the other, and thus not of uniform width.

(1) *Prima facie* I think the strip of land to the west of A's garden wall (which strip I assume to be unenclosed) must be taken to be part of the private road. It is not stated whether the private road is a highway, but I presume it is, as houses are erected on one side of it. It is an offence under sec. 72 of the Highway Act to suffer any filth, dirt, lime, or other offensive matter or thing, to flow into a highway from adjoining premises. But it is not clear from the query whether this stagnant water emanates from A's premises, or whether it is of such a nature as to be within the section. It is not an offence under this section to allow rain to drop from the eaves of a house on to a road (*Crosdill* v. *Ratcliff*, 26 J.P., 165). Unless the section applies it would appear that no one is responsible in the present case. (2) Yes, on the assumption that the strip forms part of the private road. (3) There appears to be nothing in the Act to prevent this. Sec. 6 (1) empowers the authority to do "any one or more" of the works therein specified. (4) Assuming this to be an urban district, then, under the Public Health (Buildings in Streets) Act, 1888, B will have to keep back his buildings to the south-western corner of A's wall, unless the council consent to his doing otherwise. But it does not follow that he must build *in the same line* as A's wall. He can build parallel to the opposite side of the street (making a uniform width of 37 ft. from A's corner), unless by so doing he will encroach on ground forming part of the street.

WATER SUPPLY: METER: DOMESTIC PURPOSES.—"Hazelwood" writes: A water company desire to put in meters on certain domestic supplies, and are anxious to know whether they have the power to insert a meter on the service pipe when the consumers strongly object. The company is incorporated by Act of Parliament and the Waterworks Clauses Acts, 1847 and 1863, are incorporated with the Private Acts. A clause in the original Act states that the company—"subject to the provisions of that Act—may enter into agreement to supply water for domestic purposes by meter." The next clause authorises the company to "let meters at such rent as may be agreed upon." A clause in the company's second Act reads as follows: "The price to be charged by the company to those who shall elect to take a supply by meter, or who shall be required by the company to take a supply in that way, shall not exceed the following": [Here follows the scale per 1,000 gallons.] "The company shall not be compellable to afford a supply by meter for a less sum than would be receivable by the company if the charge were made on the rateable value of the premises as provided by the original Act." The last clause really is a clause giving charges by meter, but—(1) Does it also enable the company to insist upon a consumer taking his supply by meter instead of on the rateable value of the premises? (2) Can a doctor be made to pay a special rate for cars used partly for professional purposes and partly for pleasure when he uses a hose for washing the same? (3) Can a meter be demanded by the company here? The Private Acts give no additional powers beyond those quoted above. (4) Is a supply of water to a bakehouse a trade supply when the building is assessed with the house and charged on the total assessment? (5) Can the company make an additional charge for the bakehouse on the ground that it is an additional charge to cover trade purposes?

(1) In my opinion this clause does not authorise the company to insist upon a consumer taking a supply for domestic purposes by meter. (2) No. See *Harrogate Corporation* v. *Mackay*, 1907, 2 K.B., 211). (3) If by "here" is meant "in the case of the doctor," the answer is in the negative. (4 and 5) I think this will depend upon the use to which the water is put. A supply to business premises is not necessarily a supply for non-domestic purposes. See *Metropolitan Water Board* v. *Colley's Patents, Limited*. (THE SURVEYOR, vol. xl., p. 652.)

BUILDING PLANS: NON-COMMENCEMENT OF WORK: PUBLIC HEALTH ACTS AMENDMENT ACT, 1907, SEC. 15.—"G. L. M." writes: I would be pleased if you would give me your opinion on the following: A builder submitted plans to my council showing the laying out of a building estate, and these were approved by my council. In front of certain houses the requisite quantity of air space is provided—viz., 24 ft. but not a full 36-ft. carriageway. At that time it was my council's custom to pass plans of a similar nature, and compel the builder who built opposite to give up additional land to make the carriageway 36 ft. wide. Since then we have had a case in the High Court, where it was laid down that the first builder was the one who should make the road 36 ft. According to sec. 15 of the Public Health Acts Amendment Act, 1907, the council have power, after certain notices have been served, to revoke any plans passed by them, and it is just a question whether this section covers a case like the following: The plans were submitted about seven years ago, and the houses were built almost immediately, and a carriageway defined; but with the exception of a 6-ft. cement footpath in front of the houses there has been no attempt to make up the road. Notices have been served on the builder according to sec. 15 of the Public Health Acts Amendment Act, 1907, revoking his plans, as there has been nothing done to the estate for five years; but he holds that, inasmuch as his plans were commenced with and as the 24-ft. road was defined, we have no power to revoke his plans. My council think, seeing that he has done no building, nor otherwise

The Surveyor
And Municipal and County Engineer.

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interfered with the estate for five years, that they have the power.

So far as buildings are concerned the plan must, in my opinion, be considered as a number of separate plans for each building, so as to entitle the council to give notice under the section declaring the plan to be of no effect with respect to any building or buildings not commenced within the prescribed period. See *White* v. *Sunderland Corporation* (67 J.P., 199); *Harrogate Corporation* v. *Dickinson* (68 J.P., 202). Upon the same principle I think that so far as streets are concerned also the plan must be considered as a number of separate plans for each street. If, therefore, the 24-ft. street was commenced within the prescribed period, the council could not revoke the plan with respect to such street. But if the by-laws in force when the street was commenced required a width of 36 ft. for new streets, the council's approval of a 24-ft. street was illegal and inoperative (*Yabbicom* v. *King*, 1899, 1 Q.B., 444); and the Attorney-General could enforce compliance with the by-laws by an action for an injunction (*Attorney-General* v. *Ashbourne Recreation Ground Company*, 1903, 1 Ch., 101), unless the by-laws give the council a dispensing power or discretion.

CLAIM FROM ALLOTMENT GARDEN HOLDER FOR FLOODING GARDEN.—"T. S. W." writes: I should be glad of your advice respecting a claim for damage done to a garden caused by a flood during heavy rainfall. A watercourse flows past the garden. The watercourse is on private land, and passes under a public highway. Eighteen months ago the corporation widened the road and put in 21-in. pipes (temporarily). The size of the old portion under the road is about 30 in. square, but a portion is filled up with rubbish, almost covering the outlet. The 21-in. pipe is blamed for caused the flooding, but the gardener contends it is much too small. The facts are briefly these: This garden (along with others) had always been flooded during heavy rains long before the 21-in. pipes were put in. The cause of the flooding is that the tide backs up the river Don to the bridge, which is too small to carry the storm water when the tide is holding it back, with the result that the gardens are flooded. The corporation have arranged to divert the Bede Burn, which is the reason why the 21-in. pipes were put in temporarily. (1) Is the corporation liable for the flooding? (2) Is the landowner responsible for the clearing of the stream, which is at present full of rubbish, practically covering the outlet? (3) Taking into consideration the condition of the outlet, and the 21-in. pipes clear, is the corporation liable, ignoring the facts of the tide, &c.? (4) Is the corporation liable from the mere fact of putting in the 21-in. pipes, which are smaller than old culvert, ignoring the fact of the tides, &c.?

(1, 3 and 4) I think the corporation would be liable for any damage directly traceable to their having put in the small pipe, over and above what would have occurred had they not done so. (2) The common law duty of the owner of lands adjoining a highway to cleanse his own ditches does not apparently extend to a natural watercourse (Copnall's "Law Relating to Highways," 2nd edition, page 274). But if the watercourse is in such a state as to be a nuisance or injurious to health it can be dealt with under sec. 91 of the Public Health Act, 1875.

PRIVATE STREET WORKS: ESTIMATE.—"P. S. W." writes: In preparing an estimate and provisional apportionment for making up a private street under the Private Street Works Act, 1892, 5 per cent has been included for establishment charges, and a further 5 per cent for contingencies, thus: —

	£	s.	d.
Total as per details	500	0	0
5 per cent establishment ...	25	0	0
	525	0	0
5 per cent contingencies ...	26	5	0
Total	£551	5	0

Objection has been taken in one case to the establishment charge, and in another case to the contingencies, and I shall be glad to know if either or both these objections can be held good.

By sub-sec. (2) of sec. 9 of this Act the estimate may include a commission not exceeding 5 per cent in respect of surveys, superintendence and notices. If this is the commission described as "establishment," the objection will not hold good. There is nothing in the Act expressly authorising the inclusion of an item for contingencies, and having regard to the fact that unless the actual cost exceeds the estimate by more than 15 per cent the final apportionment cannot be objected to under Clause (*a*) of sub-section (2) of section 12. I think the objection to the item of contingencies would be upheld.

RAILWAY BRIDGE OVER HIGHWAY.—"W. S." writes: A railway crosses over a public highway by means of a bridge, 16 ft. high from the level of the roadway. The rural district council are desirous of laying down a water main under the public highway by powers conferred upon them by sec. 54 of the Public Health Act, 1875. Is it necessary to serve notice upon the railway company, or has the company power to prevent the council from doing this work? The road is not a diverted one or repaired by the company, but is purely a public highway maintained by the rural district council.

In my opinion it is not necessary to serve notice on the railway company, nor have the company power to prevent the council from doing the work.

COMPENSATION FOR LOSS OF OFFICE.—"Looking Ahead" writes: In case of loss of office through the authority by whom you are engaged being absorbed by another authority, what practice is being adopted in such cases with regard to compensation? Is compensation given in the form of an annuity, or in a lump sum, and how are the amounts arrived at? Are any number of years added to length of service, and, if so, is any credit given for time served previously with other authorities?

I think I cannot do better than refer my correspondent to replies to queries on this subject which appeared in THE SURVEYOR of April 5, 1912 (p. 538), and May 31, 1912 (p. 802), where he will find the information he desires.

PRIVATE STREET WORKS: SEWER BEYOND STREET BOUNDARY.—"Major" writes: Notices have been served by the corporation for the sewering, paving, &c., of the street marked A on the sketch, under sec. 150 of the Public Health Acts, 1875. To obtain an outlet for the sewer to be laid in the street it is necessary to lay the sewer between the points *a b*, a distance of about 28 yds. beyond the boundary of the street, and the owners of premises abutting on street A contend that they are not liable for the length of sewer outside the limits of the street, but that it is the duty of the corporation to lay the same. The streets B, C, D are public highways vested in the corporation. Will you kindly state your opinion as to whether the cost of the sewer between the points *a* and *b* ought to be included in the cost of sewering, paving, &c., street A, and apportioned upon the abutting owners, or should the cost be borne by the corporation?

In my opinion the frontagers on street A are not chargeable with the cost of the portion of the sewer beyond the limits of that street.

CORRESPONDENCE.

For every ill beneath the sun
There is some remedy or none.
If there be one, resolve to find it,
If not, submit, and never mind it.
—Anon., *circa* 1843.

SURVEYORS' INSTITUTION EXAMINATIONS.

To the Editor of The Surveyor.

Sir,—Will you allow me to endorse, through the medium of your columns, the sentiments of "Typicus" as expressed in your issue of the 6th inst.?

If a candidate has succeeded in passing the examination in all subjects, with the exception of his typical, is it not too much to expect such a candidate to pass through the final examination before attaining the P.A.S.I. status?

The typical subject is not necessarily the most difficult, and without doubt there are many candidates who, by attaining a high percentage in the greater number of their papers, have made a higher aggregate of marks than many of the successful candidates.

It would therefore appear that such candidates are worthy of a little consideration, and should not be placed entirely upon the same basis as candidates who may enter for the whole examination next year.

I should therefore like to express the opinion that candidates who have only failed in their typical subject should be given a further opportunity before the election in October next; or, failing this, that their success in the examination in March next should give them the P.A.S.I. status without the necessity of passing the final examination.—Yours, &c.,

Tarcus.

To the Editor of The Surveyor.

Sir,—In failing to pass the P.A.S.I. examination by a few marks down in the typical subject, I am unfortunately similarly placed to "Typicus," whose letter appeared in your issue of the 6th inst., and I am quite prepared to appeal to the council of the Surveyors' Institution, as he suggests. Would it not be possible, however, to obtain the names and addresses of the candidates who failed to satisfy the examiners in their typical subject, and so arrange a signed petition to the council? In any case, I suggest that it would be most desirable for as many affected residents in the London area as possible to meet at an early date, and to this end may I appeal for your kind assistance in receiving the names and addresses of such as would be pleased to communicate them to you? "Typicus" might then feel like calling us together. Meanwhile will he ring up East 695? Yours, &c.,

Beta.

London,
June 11, 1913.

[The suggestion of our correspondent is dealt with in a "Minute" on this subject. Ed. Surveyor.]

To the Editor of The Surveyor.

Sir,—It was with pleasure that I read the comments on the above examinations by "Typicus" in your issue of the 6th inst. It certainly seems hard to have to wait two years before being able to qualify for election as P.A.S.I. when one has failed to pass in the typical subject and yet passed the examination as a whole. I would suggest that a petition be got up by "Typicus" and presented to the council of the Surveyors' Institution, in the hope that they might hold a special examination before October for those students who have failed in the typical subject only.—Yours, &c.,

M. H.

June 7, 1913.

To the Editor of The Surveyor.

Sir,—With regard to the letter in your paper last week from "Typicus" re Surveyors' Institution examinations, I am sorry to say I am in the same boat, and shall be pleased to know if anything can be done as regards approaching the council of the institution and trying to obtain some concession.—Yours, &c.,

Likewise.

LOCAL GOVERNMENT BOARD INQUIRIES.

The Editor invites the co-operation of Surveyor *readers with a view to making the information given under this head as complete and accurate as possible.*

INQUIRIES HELD.

Birmingham, Tame and Rea District Drainage Board (June 10th. Mr. R. H. Bicknell).—£37,672 for the purposes of sewage disposal.—With reference to a proposed expenditure of £5,259, excess account on bacteria beds in Minworth Greaves, Mr. E. V. Hiley, town clerk, stated that the amount arose out of considerable work that had been carried on by the drainage board, and which involved the investigation of several amounts sanctioned by the Local Government Board between 1903 and 1909. Other items investigated included a sum of £14,493 for the extension of the bacteria beds and for the construction of three cottages at the Cole Hall sewerage works, Yardley.

Bourne R.D.C. (June 3rd. Mr. W. H. Collin).—£4,065 for the purposes of erecting houses at Castle Pytham, Creeton, Kirkby Underwood, Haconby, and Aslackby.—The council were stated to be the pioneers in dealing with the housing question in Lincolnshire, and at the present time there are fifty-six houses erected and in course of erection. Previous loans applied for amount to about £10,000. Upon the present schemes there is a deficit of £1 per house per annum, to be borne by the rates.

Brixham U.D.C. (May 28th. Mr. R. H. Bicknell).—£2,500 for works of street improvement.—It was stated that the works for which sanction was applied might be summarised as follows: Main roads £903, other roads £169, contingencies £155. The improvements had been passed by the council from time to time during the past twelve years, and mainly on the request of ratepayers and inhabitants of the various streets. Fore-street, upon which it was proposed to spend £537, was the main street of the town, and the condition of the paving was such as to warrant immediate attention. The other portion of the work related entirely to new paving (in all cases fronting occupied property), where such did not and never had existed.

Manchester T.C. (May 29th. Mr. T. C. Ekin).—£75,000 for electricity purposes, and £1,113 for the widening and improvement of Barlow Moor-road, West Didsbury.—Mr. P. M. Heath, deputy town clerk, said the reason for the electricity application was that the last amount sanctioned by the board in 1911 for similar purposes was exhausted on December 31st last year. The sum of £75,000 was made up of £45,000 for mains, £15,000 for services, and £15,000 for consumers' sub-stations. The object of the expenditure was to meet the demands from new consumers. After hearing the case for the electricity department, Mr. Ekin heard that of the Withington Committee with respect to the improvement of Barlow Moor-road. Subsequently, with the committee's surveyor (Mr. O. Hellawell), he went to see the widening work done in Barlow Moor-road, and said he was much pleased with it.

Meltham U.D.C. (May 20th. Mr. A. W. Brightmore).—£600 for the extension of the sewerage works in Helme-lane. The extension, it was stated, would consist of a 12-in. sewer through the recreation ground and along Helme-lane. There would also be a 9-in. sewer running in a south-westerly direction along Helme-lane for 342 yds., and one of 8-in. diameter running in a north-westerly direction for 106 yds. to the crest of the hill. In reply to the inspector, the surveyor, Mr. F. Littlewood, said that he was acting as clerk of works for the extensions. The inspector said that the board did not often approve of that course, for it sometimes happened that the surveyor had not the time to devote to the work. Mr. J. D. Abbey (engineer) said that he would pay frequent visits to the works while they were being carried out. The inspector: You consider that in this case there will be no difficulty? Mr. Abbey: I do not think so.

Narberth U.D.C. (May 27th. Mr. R. G. Hetherington). £160 in order to carry out the Clement's Dale water scheme.—Mr. T. B. Mathias, clerk to the council, stated that Narberth was supplied with water from two different sources, and the supply was not sufficient during dry summers. The council wished to carry out the Clement's Dale scheme in order to augment the present supply. The Clement's Dale scheme was estimated to produce a minimum yield of 5,700 gallons per day.

Thingoe R.D.C. (May 29th. Mr. Courtenay Clifton).—£1,300 for the purchase of land and the erection of six working-class dwellings in the parish of Barrow.—The clerk, Mr. E. J. Graves, stated that the council suggested that a quarter of an acre of garden should be laid out for each cottage. The houses would contain one living room, scullery, and offices, and three bedrooms. The proposed rental was £8 9s. per annum—3s. 3d. per week—or it might be higher.

Willesden U.D.C. (May 22nd. Mr. F. O. Stanford).—This was an application—described by the clerk, Mr. Stanley W. Bull, as a unique one—for consent to the use by the council for highway purposes of a small portion of the sewage farm land at Stonebridge, for the consent to the letting of certain part of the land, and for consent to the borrowing of money for the purchase of a part of the farm now leased by the council. The engineer, Mr. O. Claude Robson, in his statement gave a history of the treatment of sewage in the Brent area leading up to the agreement with the London County Council. The works in regard to the reception of Willesden sewage into London sewers had been in operation eighteen months, and had been in every way satisfactory. The abandonment of farm treatment necessarily left useless an area of land which was the subject of that inquiry. The total area of land purchased by the council at Stonebridge was over 106 acres. Mr. Robson, continuing, said that nearly 82 acres of this land, representing some of the old filtration beds, are fairly available for building development when the opportune time may arrive, but there are some 15 acres of bacteria beds, where excavation has taken place, and there may be some difficulty for the moment in disposing of these, at any rate by sale of freehold. The suggestion now made by the council was that powers should be given them to deal with the whole area of land by rental or short lease until the stigma of treatment of sewage is lost sight of or forgotten, or when a more advantageous time may arrive for disposal of the land. A portion of the land, representing the frontage to Harrow-road, would probably be the first section advisable to part with, but the hinterland itself it is considered by the council it would be advisable to retain for some few years, pending a suitable time for sale occurring. The land it was proposed to purchase would cost £500 an acre.

APPLICATIONS FOR LOANS.

Barrow-in-Furness T.C.—£3,750 for road improvement purposes.

Birmingham T.C.—£31,057 for the enlargement of sanatoria.

Brierley Hill U.D.C.—£6,600 for the purchase of land for a cemetery.

Canterbury T.C.—£25,000 for the extension of the lunatic asylum.

Carnarvon T.C.—£800 for the site of a new cemetery.

Cleckheaton U.D.C.—£33,780 for the completion of the new gasworks.

Coalville U.D.C.—£1,900 for sewerage works.

Dewsbury T.C.—£1,200 for paving work.

Easington R.D.C.—£24,700 for the erection of 101 houses at Murton.

Eye R.D.C.—£430 for works of sewerage.

Halifax T.C.—£7,839 for paving with granite setts.

Hammersmith B.C.—£9,426 for the electricity undertaking, and £7,783 for paving works.

Haywards Heath U.D.C.—£1,500 for the purchase of a site for a cemetery.

Hebden U.D.C.—£150 for the widening of Princess Bridge.

Lancaster T.C.—£1,075 for the erection of public conveniences.

Loughborough T.C.—£500 for paving works.

Oldham T.C.—£5,000 for machinery for the sewage works.

Southwark B.C.—£29,464 for additional plant and extension of the electric lighting station.

Swindon T.C.—£9,200 for the extension of the electricity plant.

Torquay T.C.—£15,000 for medical and swimming baths.

Wakefield T.C.—£12,806 for the electricity undertaking.

Watford U.D.C.—£2,600 for private street works.

LOANS SANCTIONED.

Brighton T.C.—£9,400 for the extension of the grammar school.

Colchester T.C.—£1,000 for storm-water drainage.

Colne T.C.—£2,000 for electricity mains extensions.

Hexham U.D.C.—£125 for a new shelter on the Seal.

Hornsea U.D.C.—£500 for the purposes of the promenade.

Poole T.C.—£460 for sewerage and surface-water drainage.

South Shields T.C.—£3,560 for sewerage works in Sea-road, Pier-parade, John Clay-street, Statinton-street, and Laygate, and £1,217 for the erection of a shelter and conveniences.

Stratford-on-Avon R.D.C.—£968 for the Wellesbourne sewerage scheme.

Yeovil R.D.C.—£430 for sewerage works.

FORTHCOMING INQUIRIES.

JUNE.	£
16.—**Dorchester.** For surface-water drainage and the provision of a convenience (Mr. R. H. Bicknell)	750
17.—**Aldershot.** For sewage disposal works (Major C. E. Norton)	11,358
17.—**Bexhill.** For the purchase of land for electricity purposes (Major J. Stewart)	400
17.—**Blandford.** For burial ground extension (Mr. R. H. Bicknell)	500
17.—**Chester.** For the electricity undertaking (Mr. H. R. Hooper)	7,550
17.—**Eastbourne.** For the provision of a hospital (Dr. Miles B. Arnold)	4,510
17.—**Halifax.** For the provision of a sanatorium (Dr. E. P. Manby)	—
17.—**Norton.** For works of water supply (Mr. A. W. Brightmore)	600
17.—**Radcliffe.** For new council offices (Mr. W. H. Collin)	1,000
17.—**Wath-upon-Dearne.** For water supply purposes (Mr. F. O. Stanford)	12,000
18.—**Bedford.** For electricity purposes (Mr. T. C. Ekin)	11,590
18.—**Chadderton.** For the erection of boundary walls (Mr. W. H. Collin) ...	5,620
18. **Denton.** For street and municipal offices purposes (Mr. H. R. Hooper) ...	9,720
18.—**Farnham.** For works of sewage disposal (Major C. E. Norton)	748
18.—**Newbiggin-by-the-Sea.** For street and outfall sewer works (Mr. A. W. Brightmore)	2,600
18.—**Oldham.** For the provision of aërating plant and a dust destructor (Mr. F. O. Stanford)	4,400
18.—**Tenby.** For works of sewerage (Mr. P. M. Crosthwaite)	9,699
18.—**Titchfield.** For the provision of a burial ground (Mr. R. H. Bicknell)	800
19.—**Alsager.** For works of water supply (Mr. F. O. Stanford)	6,926
19.—**Bridgend.** For road improvement purposes (Mr. P. M. Crosthwaite)	—
19.—**Broadstairs.** For laying out a recreation ground (Major J. Stewart)	3,500
19.—**Hexham.** For sewage disposal works (Mr. A. W. Brightmore)	850
19.—**Maidenhead.** For the extension of the Guildhall (Mr. Edgar Dudley)	1,325
20.—**Morley.** For the provision of mechanical water filters (Mr. H. R. Hooper) ...	10,000
20.—**Wellington.** For sewage disposal works (Mr. F. O. Stanford)	4,700
20.—**Workington.** For the purpose of the gas undertaking (Mr. A. W. Brightmore)...	7,500

Municipal Work in Progress and Projected.

The Editor invites the co-operation of Surveyor readers with a view to making information given under this head as complete and accurate as possible.

The following are among the more important projected works of which particulars appear below: Buildings — Ilford £20,000, Montgomery £57,000; housing and town planning—Alnwick £6,500, Falmouth £9,000, Shrewsbury £11,127; parks and open spaces—Bridlington; roads and materials—Burnley £13,850, Darlington; sewerage and sewage disposal—Swindon, Westhoughton £2,776; water, gas and electricity—Darlington £48,500.—Particulars of other works projected will be found in our "Local Government Board Inquiries" pages.

BUILDINGS.

Barrow T.C.—The borough surveyor, Mr. Arthur Race, has received instructions to prepare plans for a secondary school.

Bridlington T.C.—The borough surveyor, Mr. E. R. Matthews, has been instructed to revise the plans for the extension of the sanatorium.

Clackmannan C.C.—The Road Board having intimated their intention of giving a grant of £2,500 towards the cost of erecting a new bridge across the river Devon, near Tullibody, the Clackmannan District Committee have resolved to proceed at once with the preliminary work of erection. The total estimated cost is £5,152.

Ilford U.D.C.—The surveyor, Mr. H. Shaw, has been instructed to prepare plans and estimates of a proposed new swimming bath to be erected on the south side of the High-road, adjoining the county council depot. The probable cost of the scheme is stated to be about £20,000.

Maldens and Coombe U.D.C.—Last week it was agreed to approve the scheme for building, on land at the rear of the present offices, a new council chamber and more accommodation for the surveyor, Mr. R. H. Jeffes. The Local Government Board will be asked to sanction a loan for the cost, estimated at £2,000.

Middlesex C.C.—The council have accepted a tender of £5,474 for widening the Brent county bridge in Golder's Green-road, Hendon, this step having been found necessary owing to the largely increased motor traffic on the road.

Montgomery C.C.—A new asylum is to be built at an estimated cost of £57,000.

Newcastle (Ireland) U.D.C.—It has been agreed to raise the sea wall along the southern promenade.

Norton (Yorks) R.D.C.—It has been agreed to consider the question of building six new bridges, subject to a loan for the cost being obtained. Appeals are also to be made to the county council and the Road Board for financial support.

Salford T.C.—A sum of £2,090 is to be paid for 52 acres of land at Marple for the purpose of a sanatorium.

Stoke-on-Trent T.C.—Alterations are to be carried out at the police station at a cost of £1,059.

Wellingborough U.D.C.—A bandstand is to be erected in Castle Field at a cost of £300.

Worthing T.C.—The question of the acquisition of the pier by the corporation is to be submitted to the next meeting of the council.

HOUSING AND TOWN PLANNING.

Alnwick U.D.C.—A housing scheme is to be carried out, at an estimated cost of £6,500.

Carlisle T.C.—The sanitary condition of the property in Shoddengate district has been referred to the Health Committee, with instructions that the city officials produce plans and estimates for its improvement.

Eastdean R.D.C.—A scheme is under consideration for the erection of at least 100 cottages in Dean Forest and 100 in Westdean.

Ellesmere Port U.D.C.—The result of the town planning competition is as follows: First prize (£10), Mr. J. M. S. Bogle; second prize (£5), Mr. S. Barnish. Both first and second are students in the Department of Civic Design of the School of Architecture of the Liverpool University.

Falmouth T.C.—A housing scheme, to consist of forty-four dwellings, is to be carried out at an estimated cost of £9,000.

Hinckley U.D.C.—The surveyor, Mr. F. Tuckey, has received instructions to proceed with the specification in connection with the erection of working-men's dwellings in the new road off Coventry-road, and to advertise for tenders, in order that there might be no delay in getting the houses built when the Local Government Board have sanctioned the loan.

Horncastle R.D.C.—A scheme has been prepared for the building of fifty cottages in eighteen parishes.

Ramsgate T.C.—A committee of the council is considering the question of adopting a town-planning scheme.

Rushden U.D.C.—The erection of thirty workmen's houses has been approved by the council. The surveyor, Mr. W. B. Madin, stated that he had made a calculation of the cost of erecting the cottages in accordance with model plans annexed to the revised memorandum recently issued by the Local Government Board; for type B, a two-storey cottage, four rooms and scullery, having contents of 8,448 cub. ft., exclusive of coals and water-closet, £158; for type E, a semi-detached cottage, two-storey, contents of 9,860 cub. ft., £195 3s.

Shrewsbury T.C.—The tender of Mr. G. E. Probert, of Bilston, at £11,127, has been accepted for the erection of sixty-three model dwelling-houses.

Spalding U.D.C.—Five acres of land are to be purchased for the erection of thirty houses, at a total cost of £5,400.

PARKS AND OPEN SPACES.

Aberavon T.C.—The plans of the borough surveyor, Mr. J. Roderick, for laying out the 8 acres presented to the town by Lord Jersey have been approved by the council. The estimated cost of the work is £7,230.

Bridlington T.C.—Consideration is being given to the purchase, for the purpose of a recreation ground, of about 36 acres of land on the north side of the town, for the sum of £14,000.

Clydebank T.C.—The Parks and Open Spaces Committee have referred to the master of works to submit an estimate of the cost of laying out a bowling green at the upper and lower portions of the public park at Dalmuir, and the cost of a bowling house and equipment, and also to ascertain the cost of a piece of ground in Radnor Park.

Dalkey (Co. Dublin) U.D.C.—Dalkey Island has been purchased by the council from the War Office for £525, of which sum the council pays £300, and the remainder is contributed by Mr. R. W. Booth, J.P. The island will be maintained as an open space for the use of the public.

Oldham T.C.—It is proposed to construct a bowling green at Higginshaw, at an estimated cost of £650.

Rushden U.D.C.—A sum of £300 is to be expended on a bridge, conveniences, fencing, and the provision of swings and parallel bars for the recreation ground.

REFUSE COLLECTION AND DISPOSAL.

Lambeth B.C.—The Wharf and Cleansing Committee at the recent council meeting submitted a scheme for establishing a depot to deal with the refuse of the borough, at the proposed initial outlay of £18,270. The scheme included the purchase of freehold premises in Stockwell Green for £6,150; the fifty-seven years' lease of property lately occupied by a brewery company, for £2,750; and the provision of stabling for fifty-two horses, fodder stores, a committee-room and a foreman's cottage, at a cost of £9,370. If the council agreed to the scheme, the committee stated that they would be able to carry out the cartage work of the inner district of the borough by direct employment of labour—"which would undoubtedly make for efficiency in such work." After considerable discussion the report was referred back to the committee pending an inquiry into the efficiency of motor vehicles for the purpose of dust collection.

ROADS AND MATERIALS.

Aberdare U.D.C.—Wood paving works are to be carried out at a cost of £850.

Amesbury R.D.C.—The surveyor, Mr. J. T. Huxham, has reported to the council that it is the intention of the War Office to make a new road at Bulford to connect the main road near the church with the War Department road to Bulford Camp, at an estimated cost of £1,200.

Barking U.D.C.—The council have adopted a scheme of making up which is estimated to cost £13,126, towards which the Road Board have sanctioned a grant of £1,788.

Burnley T.C.—Repaving works and road repairs are to be carried out at an estimated cost of £13,850.

Darlington T.C.—A sub-committee has been appointed to consider the question of introducing motor traction for street works.

Dundee T.C.—The West-end street widening scheme has been adopted by the council. It was stated that it is not proposed to pay compensation to owners of property.

Enniskillen (Co. Fermanagh) U.D.C.—It has been decided to purchase a steam road roller.

Harwich T.C.—Akonia is being used on the roads where tar is considered to be unsuitable.

Hemsworth (Yorks) R.D.C.—The council are making use of Akonia for dust prevention on some of the roads.

Highbridge U.D.C.—The Somerset County Council is to be approached, urging the necessity of improving Burnham-road at its junction with the Bristol main road at Highbridge, and asking that the Road Board should make a grant towards an improvement of urgent necessity.

Lincoln T.C.—The Road Board have sanctioned a grant of £2,200 towards the cost of surfacing certain roads with tarred slag, at an estimated cost of £8,120, and have also agreed to advance a loan of £4,500. The council have applied to the Local Government Board for a loan for the latter sum.

Northampton T.C.—The Houghton-road improvement is to be carried out at an estimated cost of £7,000, towards which the Road Board have promised a grant of £3,000.

Perthshire C.C.—At the recent meeting of the Highland District Committee it was intimated that the Road Board had arranged to give a free grant of £1,050, with a loan of £350 without interest, repayable in five years, for the further improvement of the main Highland road north of Struan. The committee granted the request of the Institution of Municipal and County Engineers, Scottish District Roads Committee, to lay small experimental lengths of road surfacing on one of the district thoroughfares, which, it was stated, would yield useful results, not only in themselves, but in comparison with others, on the understanding that the committee were not involved in additional expense.

Portslade U.D.C.—A proposal is being considered for the construction of a new road in continuation of New Church-road, towards Southwick.

Rushden U.D.C.—The county surveyor, Mr. C. S. Morris, has intimated that the Road Board have approved of the expenditure of a sum not exceeding £237 on the main roads in respect of the following works—viz., £157 for Tarvia grouting and £80 for surface tarring. The Road Board would contribute three-fourths of the cost, amounting to £178, the county council would contribute half of the balance, leaving about £30 to be provided by the council.—It has been agreed to make up Allen-road, part of Rectory-road, and a side street, under the provisions of the Private Street Works Act, 1892.

Settle R.D.C.—It has been agreed to provide the roadmen with oilskins, sou'-westers, hats, and leggings.

Teddington U.D.C.—Plans, estimate, &c., for making up Broom Water West under the Private Street Works Act, 1892, having been prepared by Mr. M. Hainsworth, the surveyor, it was on Monday resolved to take the necessary steps to proceed with the making up of the road.

Wolverhampton T.C.—A plot of land has been purchased on the Penn-road for £1,770, for the purpose of affecting direct communication with Blakenhall from the Penn-road district. A purchase of land has also been made in Dudley-road for widening purposes.

SEWERAGE AND SEWAGE DISPOSAL.

Aberdeen T.C.—It has been agreed by the Sewerage Committee to enlarge the sewers in Union-street, and also in part of Holborn-street, at an estimated cost of £2,800.

Bowland (Yorks) R.D.C.—A scheme of sewage disposal has been prepared, the cost of which is estimated at £500.

Burnham (Essex) U.D.C.—A new centrifugal pump, capable of delivering about 300 gallons a minute, is to be purchased from Messrs. Tangye, at a cost of £50, for the sewage disposal works.

Fleet (Hants) U.D.C.—At the council meeting held on June 5th the agreement with Mr. T. J. Moss-Flower (Westminster, S.W., and Bristol), the consulting engineer for the new sewerage and sewage disposal works, was duly signed and sealed.

Kidderminster T.C.—Messrs. Willcox & Rajkes, the engineers, have been requested to report as to an alternative scheme for the most efficient and economical disposal of the sewage, having regard to the altered conditions since their report of November, 1911.

St. Ives (Cornwall) T.C.—The work in connection with a sewerage scheme and the culverting of the river is to be carried out by the council under the direction of the borough surveyor, Mr. S. Palmer.

South Shields T.C.—The Local Government Board have written stating that, having regard to the nuisance inevitably associated with conservancy methods of disposal, and to the other considerations mentioned, they would urge upon the council the importance of securing, as rapidly as possible, the total abolition of all existing privies in the borough, and the substitution, wherever practicable, of the water-carriage system. For the same reasons the provision of closets other than water closets in new houses should be prohibited in future.

Swindon T.C. The Local Government Board have written, with reference to the proposed extensions to the plant at the Rodbourne sewage works, that they had considered their inspector's report and the council's application to borrow £24,000, but were advised that the provision now proposed was considerably in excess of what was usually found necessary, and that it would be advisable for the council to consult an engineer as to whether the proposals generally were the best, and, if so, whether it was necessary to carry out the whole of the works in the first instance; also, that the board were advised the proposed plant and details of the scheme required further consideration. It has been agreed to engage the services of an expert.

Warwick T.C.—The mayor, at the meeting on Tuesday, stated that the General Purposes Committee had received an outline of extensive works at the sewage outfall and the sewage farm. They would have a conference with the engineers to see how far their scheme could be modified.

Westhoughton U.D.C.—It is proposed to extend the sewage disposal works at an estimated cost of £2,776.

Wolverhampton T.C.—A satisfactory year's trading is reported in connection with the Barnhurst sewage farm, the profit having been £2,900. During the year the products sold off the farm were valued at £9,359.

WATER, GAS, AND ELECTRICITY.

Arbroath T.C.—It has been agreed that the intake channel at Glenogil reservoir should be widened; that the retaining walls on either side should be re-erected in concrete; and that the bed of the stream be pitched for a distance of about 12 yds.

Ballymena U.D.C.—The council have sanctioned the installation of sixty-two new lamps fitted with inverted burners and automatic controllers.

Birkenhead T.C.—The gas undertaking yielded a nett balance of £39,949 upon last year's working.

Brighton T.C.—The nett balance from the working of the electricity undertaking last year was £1,406.

Carlisle T.C.—The automatic gas-lighting equipment is to be extended at a cost of £500.

Chippenham (Wilts) R.D.C.—The council has appointed Mr. T. J. Moss-Flower, of 28 Victoria-street, Westminster, S.W., and Carlton Chambers, Bristol, to prepare, in conjunction with their surveyor, Mr. A. H.

Lapham, a scheme of water supply for Chippenham Without and certain other districts.

Darlington T.C.—A new retort house is to be built at the gasworks, and a vertical system of retorts installed, at an estimated cost of £48,500.

Fulham B.C.—The nett surplus from the working of the electricity undertaking last year was £4,666.

Kirkcaldy T.C.—The chairman of the Gas Committee reports that the gas undertaking has turned out more successful than was anticipated. This is the third year the undertaking has been in the hands of the corporation, and they have been able to meet all its demands, provide for the interest and sinking fund, and leave a balance of £153.

Maldon R.D.C.—An elevated water tank and reservoir are to be constructed for Althorne, at an estimated cost of £800.

Rhyl U.D.C.—Application is to be made to the Local Government Board to sanction a loan for additional lighting mains, the demand by places of amusement for current having greatly increased the output. It has also been decided to lay additional water mains.

Seaton Delaval U.D.C.—The council have approved a scheme, prepared by the surveyor, Mr. A. Dorin, for the lighting by gas of the whole of the district, at a cost of £700.

Strabane (Co. Tyrone) No. 2 R.D.C.—A committee has been appointed to go into the question of providing a water supply for Castlefin.

Upton-on-Severn R.D.C.—The boring operations for water, which have been persisted in since the end of 1905, have at last been successful, an adequate supply having been found. The cost, which has been considerable, falls upon the town and not upon the rural area.

Wallasey T.C.—Electricity extensions, estimated to cost £65,000, are recommended by the Electricity Committee.—Gasworks extensions, estimated to cost £42,000, are also recommended by the Gas Committee.

Wolverhampton T.C.—Tenders have been accepted for the supply of four converters for the electricity works, at £2,950, two switchboards at £408 and £203 respectively, and an extra tension switchboard at £2,000.

MISCELLANEOUS.

Aberdeen T.C.—Application is to be made for a Provisional Order for tramway extensions, and to provide trolley vehicles and motor omnibuses, at an estimated cost of £50,000.

Darlington T.C.—It has been decided to establish the cattle markets on Feetham Field, which was purchased by the corporation two years ago for £8,000.

Newcastle-on-Tyne T.C.—An extension of the tramway system, by which the Jesmond route is carried out towards Benton, and then runs down to Chillingham-road to join the Byher route, was inaugurated on Friday last. It was stated in the course of the proceedings that the municipal tramway system had been running eleven years. In that time the corporation had paid £384,701 off the debt, which now stood at £939,120, and they had a reserve of £119,000. The new 'bus system to Westerhope, it was added, had been paid for out of revenue, and was free from debt.

Wolverhampton T.C.—The covered and outside market earned a nett profit last year of £4,146.

Cement Binding for Roads.—In his latest annual report Mr. Ralph Oakden, junr., highway and sanitary surveyor to the Newark Rural District Council, mentions that an experimental length of 230 yds. on the Lincoln road was rolled with cement as a binding material. The cost of the cement used was 1½d. per square yard of road repaired. "What the ultimate effect on the wear will be," Mr. Oakden observes, "it would be premature to say, but undoubtedly this portion of the road has shown less tendency to wear into potholes during the past winter than adjoining stretches repaired in the ordinary way. I hope to use cement more extensively during the ensuing year, as I am convinced that it is a mistake to put good material on a road having a heavy motor traffic without a more effective binding material than soil or road scrapings. I also find that it is a great advantage to far over each stretch of road in the year subsequent to its being repaired, and if this coating be renewed every alternate year, it will add considerably to the life of the road metalling without making a surface unduly smooth and dangerous to horses."

PERSONAL.

Mr. A. Dorin, surveyor to the Seaton Delaval Urban District Council, has been granted an increase of salary.

Mr. C. Spearman has been appointed assistant to Mr. C. O. Rawstron, surveyor to the Lichfield Rural District Council.

Mr. D. Robinson, of Bolton Abbey, has been appointed assistant highways surveyor to the Settle Rural District Council.

Mr. W. A. Sturt, surveyor to the Settle Rural District Council, will represent the council at the International Road Congress.

Mr. T. T. Strongman, surveyor to the St. Columb Rural District Council, was on Friday welcomed to the council meeting by members after his illness.

Mr. Wilfred J. Goode has been appointed surveyor, sanitary inspector, collector, and assistant overseer to the Buckfastleigh Urban District Council.

Mr. A. R. Bolwell, road surveyor to the Bath Rural District Council, has been voted an increased salary of £30 for one year, provided he keeps a motor car.

Mr. H. D. Woodcock, surveyor and inspector to the Guisborough Rural District Council, has had his salary increased by £15 a year in order that he may provide a motor cycle and maintain it.

Mr. Edwin Chart, who is shortly retiring under the age limit from the post of resident surveyor of Hampton Court Palace, has been presented by the palace residents with a cheque for 150 guineas and an illuminated address.

Mr. Francis G. Taylor, building surveyor, has been appointed deputy borough engineer to the Sunderland Corporation at a salary of £250 a year, and Mr. G. H. Whitaker, inspector of sewers, has been appointed chief assistant in the borough engineer's department at £200 a year, increasing to £225.

Stephen Dudley Field, known as the "father of the trolley," who died at his home in Massachusetts last month, was the nephew of Cyrus W. Field, who laid the first Atlantic cable. His first work with the electric car was in 1880, when he built an experimental line on his own grounds in Stockbridge, his car taking current from a central third rail. He also took out patents for conduit and trolley systems.

Mr. Alfred Brittain, who died last month in Montreal, was a member of the Montreal city engineering staff for thirty-five years, and as the assistant city surveyor was responsible for the city sewerage system. He retired about ten years ago owing to ill-health. Mr. Brittain was English by birth, and was a life member of the Canadian Society of Civil Engineers, and a member of the American Society of Civil Engineers.

Mr. E. R. Matthews, ASSOC.M.INST.C.E., F.R.S.(ED.), borough engineer of Bridlington, has consented to read before the British Association at their congress at Birmingham in September next a paper on the important subject of "Harbour Projections and their Effect upon the Travel of Sand and Shingle." Mr. Matthews is the author of a treatise on "Coast Erosion and Protection," recently published by Griffin. He has just been called in to advise the Troon Town Council, Ayrshire, regarding a scheme for the prevention of the flooding of the town by the sea. Other local authorities have also recently been consulting him, and he is preparing plans for a further huge sea front improvement scheme at Bridlington, which he estimates will cost £58,000, and which consists of the extension seaward of the Royal Princes-parade.

Mr. Archibald Currie, city engineer of Westmount, Canada, who will, on the 20th inst., take up the similar position to which he has been appointed at Ottawa, at a commencing salary of £1,000 per annum, to be increased to £1,200 at the end of the first year, was born in Glasgow, and was educated there and at the West of Scotland Technical College, graduating in 1890. For three years he was assistant engineer for Sir John Aird & Sons, later being engaged as resident engineer in charge of important works in the North of China. He was in that country during the Boxer riots, and for his services in connection with the attempt to relieve the European legations in Pekin received a medal and clasps. From China he went

to South Africa, where he remained for nine years, six of which he spent in Johannesburg, where he was in charge of electric railway, drainage and road construction. He then returned to Great Britain, and as consulting engineer was engaged in water-supply work and similar enterprises in Ireland, Scotland and Wales. Early in 1911 he was appointed to the post he is now leaving for Ottawa. Mr. Currie is a member of the Institution of Civil Engineers and of the Canadian Society of Civil Engineers.

Direction Posts and Plates.—Prizes to the value of £35, it will be recollected, were offered some time ago by the London Organising Council of the International Road Congress for the best designs and models for highway direction posts and plates. Competitors are reminded that Thursday, the 19th inst., is the latest date on which designs can be received, and that all material should be delivered at the offices of the congress, Queen Anne's Chambers, S.W.

Electricity Supply at Poplar.—The extensions which have been made to the Poplar borough electricity works in Glaucus-street, Bromley, were formally inaugurated on Friday last. The undertaking now comprises four sub-stations, in addition to the main generating station. In the new extensions the boiler house is designed to accommodate four boilers, and the engine room is built to take two 3,000-kilowatt turbo-alternators, two 1,000-kilowatt converters, with switchboard and condensers.

FOR OTHER ADVERTISEMENTS

See End of Paper.

RURAL DISTRICT COUNCIL OF CLUTTON.

INSPECTOR OF NUISANCES.

The Rural District Council of Clutton invite applications from persons under 40 years of age for the Appointment of Inspector of Nuisances and Surveyor for Sanitary Purposes.

The Officer appointed will be required to perform the duties of an Inspector and Surveyor under the Public Health Acts, Factory and Workshop Acts, Dairies, Cowsheds and Milkshops Orders, Petroleum Acts, and the Council's By-laws, to act as the designated Officer for the purpose of the Housing (Inspection of District) Regulations, 1910, and to carry out such other duties as the Council may from time to time direct. He must also strictly devote his whole time to the said duties (doing other work will terminate the appointment), and must reside at such place in the district as the Council may fix.

The District comprises 24 parishes, and about 40,000 acres, with a population of about 15,000.

Candidates must possess a certificate of competency from the Sanitary Inspectors' Examination Board or other similar body. Possession of a Meat and Food Inspector's certificate of the Sanitary Institute will be a recommendation, and they must have a thorough knowledge of building and drainage plans.

The salary will be £130 per annum, rising by annual increments of £5 to £150, subject to the duties being performed to the satisfaction of the Council.

The appointment will be terminable by a month's notice, but will be subject to the sanction of the Local Government Board as regards salary, tenure of appointment and otherwise.

The successful candidate will have to provide his own means of locomotion.

Applications, in candidate's own handwriting, stating age and experience, and enclosing copies of three recent testimonials, must be received by me not later than 4 p.m. on the 8th proximo.

Canvassing, directly or indirectly, will disqualify the applicant.

(By order)
J. SUMNER DURY,
Clerk to the said Council

Temple Cloud, Bristol.
June 11, 1913. (536)

JUNIOR ASSISTANT (21), served articles and experienced in schemes of Water Supply, Sewerage, and Sewage Disposal, good Draughtsman, Surveyor and Leveller, desires berth in public or private office.—Box 1,240, office of THE SURVEYOR, 24 Bride-lane, Fleet-street, E.C.

ASSISTANT SURVEYOR, BLEAN.

JUNE 23RD.

The Blean Rural District Council invite applications for the appointment of Temporary Assistant to their Surveyor and Engineer for a period of about six months, at a salary of 30s. per week.

Candidates must be good draughtsmen, accurate levellers, capable of assisting in the inspection of plans and new buildings, and generally experienced in the work of a surveyor's and engineer's department; they must also be good cyclists and provide their own bicycle.

Applications, in candidate's own writing, endorsed "Assistant," accompanied by copies of three recent testimonials, should reach Mr. J. E. Burch, Clerk, 39 Castle-street, Canterbury, by the 23rd June.

Canvassing will be a disqualification.

(539)

PUPIL.—The City Engineer and Surveyor of Lichfield has a vacancy in his office for a pupil. Particulars of work being executed and salary paid can be had upon application. (540)

LYTHAM URBAN DISTRICT COUNCIL.

TENDERS FOR PUMPING MACHINERY.

The Lytham Urban District Council invite Tenders for the Provision and Erection of a 12-in. Compound Centrifugal Pumping Engine at the Council's Sewage Works.

Plans may be seen, and Specification and Form of Tender obtained, at the Office of the Engineer to the Council, Mr. A. J. Price.

Sealed Tenders, endorsed "Pumps," must be delivered to the undersigned on or before Tuesday, the 24th June, 1913.

The Council do not bind themselves to accept the lowest or any Tender.

(Signed) CHAS. A. MYERS,
Clerk to the Council.

Council Offices, Lytham.
June 11, 1913. (537)

CANNOCK URBAN DISTRICT COUNCIL.

The above Council invites Tenders for a New 10-ton Steam Road Roller, particulars of which can be obtained from the Surveyor to the Council.

Tenders to be delivered at my Office not later than Friday, 27th inst., endorsed "Steam Roller."

C. A. LOXTON,
Clerk to the Council.

Council Offices,
Cannock.
June 12, 1913. (541)

TWICKENHAM URBAN DISTRICT COUNCIL.

ORLEANS COUNCIL SCHOOL (BOYS' AND GIRLS' DEPARTMENTS).

The above Council hereby invite Tenders for the Erection and Completion of the first portion of the Boys' and Girls' Departments of the Orleans Council School Building, Latimer Play Shed, Boundary Walls, and other Works in connection therewith on land situate in Napoleon-road, Twickenham.

The Drawings and Specification may be seen, and Bills of Quantities and Form of Tender obtained, on application at the Office of Mr. Fred. W. Pearce, F.S.I., Surveyor to the Council, Town Hall, Twickenham, and the payment at my Office of a deposit of Three Guineas, which deposit will be returned on receipt by the Council of a *bonâ-fide* Tender.

Sealed Tenders, endorsed "Tender for Orleans Council School (Boys' and Girls' Departments)," are to be delivered to me not later than noon on Wednesday, the 25th day of June, 1913.

The Council do not bind themselves to accept the lowest or any Tender.

(By order)
H. JASON SAUNDERS,
Clerk to the Council.

Town Hall, Twickenham.
June 11, 1913. (542)

FOR SALE OR PART EXCHANGE.—12-in. Halden "Excelsior" Level, with Tripod and Mahogany Case; condition as new. Wanted, Theodolite, in part exchange for above.—Offers to Mr. R. H. Jenkins, Surveyor, Council Offices, Skegness. (538)

Institution of Water Engineers.

SUMMER GENERAL MEETING AT WAKEFIELD.

The eighteenth summer general meeting of the Institution of Water Engineers, as already reported in our columns, opened on Thursday of last week at the Town Hall, Wakefield, the chair at the commencement of the proceedings being taken by Councillor J. Marriott, the deputy mayor, in the unavoidable absence of the mayor. The attendance included: Messrs. A. Andrews (Oldham), G. F. Andrassy (Chelmsford), R. Askwith (Bishop Auckland), J. C. Barrowclough (Batley), A. G. Beaumont (Masham), W. J. E. Binnie (London), A. B. C. Blackburn (Sunderland), R. E. Blakiston (Liverpool), T. Booth (Stamford), T. H. Brunt (Rochdale), W. T. Burgess (London), C. H. Chapman (Salford), S. C. Chapman (Torquay), A. Chisholm (Airdrie), C. G. Cotton (Chili), G. A. Christie (Kilwinning), J. H. Crowther (Wallasey), F. W. Davies (Nottingham), F. J. Dixon (Ashton-under-Lyne), A. Fowler (Rodley), P. Griffith (London), H. L. Groves (London), R. J. Hartley (Halifax), J. F. Hedgford (Colne), C. P. Hogg (Glasgow), F. E. Howard (London), A. H. Jameson (London), A. Jenkins (Jersey), W. R. Jenkins (Wakefield), D. Kirk (Coatbridge), D. Kitchingman (Southampton), G. O. H. Klopp (London), J. J. Lackland (St. Helens), H. Lapworth (London), E. C. Lemon (Wakefield), F. W. Lilicrap (Devonport), F. W. McCullough (Belfast), T. Molyneux (Stockport), C. B. Newton (Hull), H. Nicholson (Manchester), C. Oldham (Ipswich), J. S. Pickering (Cheltenham), H. Preston (Grantham), C. H. Priestley (Cardiff), A. B. Rigby (Bury), R. H. Roberts (Aberdeen), E. J. Silcock (London and Leeds), S. Simmelkfaer (London), C. Clemesha Smith (Wakefield), L. Molyneux (Stockport), F. Waddington (Hebden Bridge), A. H. Walker (Loughborough), W. Wells (Chili), F. Williams (London), and G. Winter (Darlington), members; W. G. Ardley (London), Alderman E. Blackall (Devonport), J. Cartwright (Loughborough), A. J. Clark (Manchester), A. E. Drown (Westminster), G. Foster (Wakefield), T. Gibson (Wakefield), T. M. Gray (London), J. Greaves (Oldham), J. W. H. Johnson (Wakefield), Dr. Kaye (Wakefield), P. F. Rendall (Leeds), W. S. Lackland (Beverley), J. Marriott (Wakefield), J. N. Swales (Leeds), and J. P. Wakeford (Wakefield), visitors.

Councillor Marriott, in expressing the mayor's regret at his absence, said his worship had asked him to convey his compliments to the members and to give them a very cordial welcome on that their first official visit to Wakefield. He (the deputy mayor) could do that with great pleasure and with much confidence, because he felt that in Wakefield they would find something of interest. They had a water scheme of which they were justly proud. When he told them that twenty-five years ago they drew their chief sources of supply from the Calder, those of them who knew the valley from Todmorden down to Wakefield, studded as it was on both sides with innumerable sewage works, would have some idea of the sort of material upon which they had to work. He did not wish to boast too much about their waterworks, but he would like to say one word about their engineer, Mr. Clemesha Smith: even if they had not got the best supply of water in the world, they had got the best engineer—and he was sure they would agree with him. They in Wakefield were proud of the distinction which the institution proposed to confer upon Mr. Smith, and which they believed was fully merited, for he was a most capable, painstaking, courteous and conscientious gentleman. He was sure Mr. Smith would look well after them during their visit, and that they would be not only entertained but instructed, and he hoped on leaving they would have very pleasant recollections of their visit to Wakefield. In conclusion, he begged to offer the members a cordial welcome.

Mr. J. S. Pickering, the retiring president, then took the chair. He said that on behalf of the members he wished to thank the deputy mayor for the cordial reception he had been good enough to offer them. Councillor Marriott, in his position as deputy mayor of an important municipality, would appreciate the great advantages to water engineers of being able to attend meetings of that character, and he was sure he would also agree that the benefit to be derived from such meetings did not only extend to the water engineers but to the authorities they represented, and through those authorities to the community at large. It was an essential education of the water engineer that he should not only make himself familiar with the works under his immediate control, but that he should obtain a knowledge of the various schemes of water supply throughout the country. By that means he was able to take advantage of the experience of others, and to advise his authority in a proper manner on those questions of the improvement of the water supply which from time to time occurred in his daily work. In placing that hall at their disposal, and in affording them facilities for visiting the water supply works of Wakefield, the corporation had conferred a privilege upon them as water engineers which they greatly appreciated, and the pleasure they had in visiting that ancient town was enhanced by the very warm reception they had received. Judging from the admirable programme which had been arranged, and from the way everything had been thought out for their comfort and convenience, he was quite sure that their visit to Wakefield would be both pleasurable and profitable.

Mr. Pickering announced that the following premiums had been awarded by the council for papers read at meetings during the past twelve months: The president's premium, value £10, to Dr. A. D. Kemna for his paper on "Recent Advances in the Science of Water Purification"; an institution premium, value £5, to Mr. Donald Dinwiddy, F.S.I., for his paper on "Rates and Taxes on Water Undertakings"; and an institution premium, value £5, to Mr. Arthur Valon for his paper on "The Rating of Water Undertakings."

Mr. Pickering said it was now his pleasing duty formally to introduce the president of the institution for the ensuing twelve months. In electing Mr. Clemesha Smith to that position he (the speaker) was sure they would confer upon him an honour which he would greatly appreciate, and he was quite certain that he would carry out the duties with every satisfaction to the members and with the greatest credit to himself. It was the highest honour which the institution could offer to any of its members, and in this case he knew it was an honour that was thoroughly deserved. Mr. Clemesha Smith had taken a very active part in everything appertaining to the welfare of the institution. He had given to the council the best of his judgment and advice for many years past, and he was greatly esteemed, not only by his colleagues on the council, but by every member of the institution who had the pleasure of his personal acquaintance. In electing Mr. Clemesha Smith to that office he was sure they would be reflecting credit upon the institution itself.

Mr. Clemesha Smith assumed the presidential chair amid loud applause. He wished to thank Mr. Pickering for the kind terms in which he had referred to him, and the members for the manner in which they had received his election. He was not aware that he was endowed with the many qualities with which Mr. Pickering had credited him, but he would do his best to endeavour to deserve credit for them, and if he were lacking he would endeavour to make up in good will what he lacked in other directions. He trusted that their visit to Wakefield would be a very pleasant one, and that they might be able to gather something which would be of use to them in the future. His first duty as president was an extremely pleasant one, and it was to propose a vote of thanks to the retiring president, Mr. Pickering. Mr. Pickering had displayed all the qualities which made an admirable president—courtesy and tact coupled with a genial disposition and business capacity. Nothing could be better than the way in which he had conducted their proceedings; he had spared himself neither in time nor trouble to make everything go off smoothly, and to advance the interests of the institution.

Mr. H. Ashton Hill (South Staffordshire) seconded the motion, which was carried with enthusiasm.

Mr. Pickering, in reply, said that in relinquishing

the position which through their indulgence he had held for the past twelve months he felt he had been able to do very little personally to promote the objects of the institution. At the same time he could look back with considerable pleasure to the fact that thanks to the efforts of the council the period had been one of great prosperity and activity in the institution and continued usefulness. There was one sorrowful matter he had to refer to, and that was the loss which the institution had sustained in the death of their colleague and friend, Mr. Easton Devonshire. Mr. Devonshire was a man of sterling qualities, and his wide experience and great ability enabled him to do a great deal in promoting the interests of the institution. Those who were familiar with his activity and his devotion in every way to the institution would feel that his loss was practically irreparable, and it was with very great regret they had to mourn his untimely loss.

The President then delivered his presidential address—reproduced in last week's issue of The Surveyor.

Mr. C. H. Priestly (Cardiff) proposed a vote of thanks to the president, and it was carried unanimously.

The first of the papers submitted for discussion was the following:—

THE VALUATION OF WATERWORKS UNDERTAKINGS ON TRANSFER TO MUNICIPAL AUTHORITIES.

By E. J. Silcock, M.Inst.C.E., F.S.I.

[*From Photo by Gearing & Sons, London, W.*]

[Mr. Silcock is a native of Norfolk. After a public school education, followed by a course in the engineering department of Yorkshire College (now the University of Leeds), he was articled to the city and waterworks engineer of Leeds. He remained in Leeds for eight years, and was engaged on heavy works of sewerage, water supply, bridges, refuse destruction, electric lighting and other municipal engineering work. In 1887 he was appointed borough engineer of King's Lynn, where he had under his charge all the departments of the corporation work, including the waterworks and the port and harbour work. He designed and carried out a new water supply for the town from wells and galleries sunk in the chalk about 8 miles from the town, and he also put down a modern system of sewerage for the town involving work in very bad ground in the narrow streets of an old town. In connection with these works was effected the conversion of a number of privies to the water carriage system, and the result in the matter of the death-rate of the town has been most satisfactory, this having been reduced from about 20 to 13 per 1,000. Mr. Silcock introduced a system of lighting the ship channel to Lynn by compressed-gas buoys, and carried out a marine survey of the estuary of the Ouse. In 1897 he resigned his appointments in Lynn, except that of engineer to the Port Authority, which he still retains, and established himself in Leeds as a consulting engineer and surveyor, specialising in waterworks, sewerage, and sewage disposal. About that time the Leeds Corporation were carrying out the experiments in bacterial sewage treatment on which so much subsequent work has been based. Mr. Silcock, being connected with the municipality in all its undertakings, was in close touch with this experimental work throughout, this enabling him to advise on the bacterial systems of purification at a period when less was known about it than at the present time. Thus he accumulated a large practice in this branch of work. In the session of 1901 he was employed by the Leeds Corporation to prepare the Parliamentary plans and estimates and do all the preliminary work for the new water scheme, estimated to cost over two millions sterling, and he thus became well known as a waterworks engineer. In addition to engineering work he has been largely engaged in arbitrations in connection with the acquisition of property for public services, such as waterworks, sewerage works, railways, and so forth, and in particular with the purchase of waterworks undertakings and the valuation of waterworks for rating purposes—hence the present paper. After some years in Leeds Mr. Silcock found that the growing demand for his services in London and the Southern counties made it desirable that he should have offices at Westminster as well as at Leeds. He is well known as a witness before Parliamentary committees at Local Government Board inquiries and arbitrations, and has been engaged on many borough extension schemes. He has advised in one capacity or another more than a hundred municipal authorities, including many of the largest towns in England, and he has probably been found in opposition to almost an equal number. He has written numerous papers for various engineering societies, and frequently takes part in discussions. He is the author of the last edition of "Sanitary Engineering" (Moore and Silcock). Mr. Silcock is a member of the Institution of Civil Engineers, a Fellow of the Surveyors' Institution and of the Geological Society, a past president of the Society of Engineers, a member of the Association of Consulting Engineers, a Fellow of the Royal Sanitary Institute, and a member of the Institution of Municipal and County Engineers and of the Institution of Water Engineers.]

It is the recognised practice of Parliament to favour the ownership and complete control of the public water supplies by local sanitary authorities, and cases are constantly occurring in which Acts of Parliament are obtained by municipal corporations and urban district councils enabling them to purchase by compulsion the undertakings of established waterworks companies.

There are, doubtless, cases where a public supply is required over a large area embracing the whole or parts of several local authorities, and in which, owing to the difficulty of reconciling conflicting interests, a water company can be more easily organised than a joint water board. In such cases the Legislature still passes Acts of Parliament or confirms Board of Trade Provisional Orders constituting waterworks companies; but if there is any competing suggestion of a joint water board, or other form of municipal control, the Parliamentary Committees almost invariably favour the latter in preference to a company.

Even where existing waterworks companies were carrying out their obligations to their consumers in a proper manner, municipal authorities have, in many cases, obtained compulsory powers to purchase; many instances of this could be quoted, but it will, perhaps, be sufficient to mention Sheffield, Harrogate, Filey, Kettering, Southport and Fylde as typical cases.

In "Transfer Acts," as these compulsory purchase enactments are called, it is customary to incorporate the Lands Clauses Acts, and to provide that the word "lands" contained therein shall be taken to cover the undertaking of the water company. The purchase price is then settled by arbitration under the provisions of the Lands Clauses Acts in exactly the same manner as when lands are compulsorily taken for public purposes. The company are required to carry on the undertaking until the appointed day of transfer, which is usually the quarter-day next ensuing after the umpire has made his award; the income accruing to the appointed day belongs to the company, and they are required to pay all outgoings up to the same date, after which the income belongs to the purchasing authority, and they are liable for all expenditure.

The procedure under the Lands Clauses Acts is too well known to need a detailed description, but may be briefly outlined. The purchasing authority serves a "Notice to Treat" upon the owners requiring them to state the sum of money for which they will part with their property, and a claim is then prepared. Failing acceptance of the claim, each party appoints an arbitrator, the two arbitrators select their umpire, and a tribunal is thus created to settle the sum to be paid.

Strictly speaking this sum is not the value of the undertaking, but the amount of compensation awarded to the vendors for being compulsorily dispossessed of their property. In order to ascertain the amount of compensation it is frequently necessary to value the whole undertaking, but it by no means follows that this coincides with the award, as will be seen later. Structural value has only an indirect bearing upon the value of a waterworks. The broad principle of valuation almost always adopted is to ascertain the nett maintainable annual income, and to capitalise this by multiplying by a number of "years purchase," which is determined by the consideration of the various circumstances affecting the security of the income. It is in fixing the "years purchase" that

the greatest differences of opinion occur, and in which the skill and judgment of the tribunal are most needed.

The determination of the nett maintainable income is largely a matter of accountancy, and it is customary to employ a chartered accountant to prepare financial statements showing the capital accounts from the formation of the company, and revenue accounts extending over a period of five years. The last completed year of the revenue account is taken as the basis, and this is carefully analysed and compared with the accounts for the previous four years to ascertain whether the income and expenditure are in any way abnormal. It is here that the engineer and the accountant must collaborate to bring their special knowledge to bear upon the problem of reconciling differences, and adjusting, where necessary, various items of the final year's accounts so that they fairly represent the normal income and expenditure of the company. When competent professional men are engaged upon the task there is not usually any very wide difference between the figures put forward by the two sides, and the umpire has very little difficulty in determining a just amount for the nett income to be used for capitalisation. The chief differences arise on the question of maintenance, and the amount to be set aside annually as a sinking fund to replace the perishable or obsolete parts of the undertaking. These are matters which involve engineering knowledge and skill, combined with sound judgment in the application of principles.

Turning now to the most important factor—namely, the number of "years purchase" to be used in the capitalisation of the nett income—this is obtained by dividing 100 by the rate of interest which should be obtained by an investor, the latter being determined by the consideration of a large number of factors, which may be grouped under the following three heads—viz.:—

(1) The state of the money market as indicated by the value of gilt-edged securities.

(2) The demand for the particular class of security.

(3) The security of the income.

Considering these in turn—(1) The condition of the money market can be ascertained by an examination of the Stock Exchange quotations in Trustee Securities, and is a matter of no difficulty. Obviously the "years purchase" would be greater because the rate of interest was less in, say, the year 1900 than it is to-day.

(2) The demand for the particular class of security depends to some extent upon local considerations, such as whether the district is a flourishing one or the reverse, and also upon the size of the undertaking, and whether it is a statutory or non-statutory company. If the company's capital is big enough to secure for it a Stock Exchange quotation, the investors are not entirely confined to the immediate district, and the shares find a ready market if the owner wishes to realise; therefore the demand for such shares is greater than for those of a small undertaking held entirely by local people. Apart from this, the bigger a concern is, the less likelihood is there of great fluctuations taking place in its income and expenditure. It will be readily conceded that the rate of interest expected by an investor in Metropolitan Water Board Stock would be less than the return he would demand from a small non-statutory undertaking, whose shares might not be easily realised when required.

(3) The third group of the factors above-mentioned, includes the considerations which appeal most to the members of the institution. The principal points to be considered are as follows:—

(1) Quality of water. (2) Quantity of water. (3) Age and condition of works. (4) Whether it is a pumping scheme or a gravitation scheme. (5) Whether the works are capable of supplying the consumers. (6) Whether the scale of charges is high or low. (7) Whether the district of supply is a growing one or a declining one.

In dealing with the question of the upkeep of the company's undertaking and the number of "years purchase," it must not be overlooked that there are certain parts of a waterworks which are either perishable or become obsolete, and which require to be replaced after varying terms of years. This element of value can be dealt with in one of two ways, either (*a*) by decreasing the number of years purchase on the maintainable revenue, or (*b*) by deducting from the maintainable revenue an annual sum to form a sinking fund which will provide the amount required to replace those parts of the undertaking which become worn out or obsolete, as may be necessary from time to time.

The same principle is also applied in certain cases where supplementary works are required in order to improve either the quality or the quantity of water, but in such cases the deduction is made from the capital sum and not from the "years purchase." Thus, supposing it is necessary to cover a service reservoir, it may be more advantageous to the company to keep the number of "years purchase" high, to capitalise the whole available revenue, and then to deduct from the capital sum so obtained the cost of covering the reservoir. The same remarks, of course, apply to any other similar work required in order to make the undertaking more perfect.

It is unnecessary further to elaborate these various heads; they can be sub-divided and enlarged upon by engineers engaged (as members of this institution are) in the practical construction and maintenance of waterworks; the above list is not by any means complete, but is given in order to indicate the main points for consideration.

The tribunal, after having heard the evidence (often very conflicting) upon these and kindred matters, must weigh the opinions expressed by those representing the various interests, and arrive at a figure for the number of "years purchase." When it is stated that, within the experience of the author, this number may vary from 14 to 40, it is obvious that there is a wide field for the exercise of judgment.

Having done this, the nett maintainable revenue is multiplied by the "years purchase," and the main factor in the valuation of the undertaking is obtained. In an ordinary normal case an allowance of 10 per cent for compulsory purchase would be added, and the sum of the two would give the value of the undertaking.

The above represents the normal case, but, as can be easily imagined, there are not a few instances where other considerations will arise. One of the most common cases is that in which the water company is paying its maximum dividends upon all classes of shares, and has, in addition, a surplus revenue. In such a case the principle above indicated does not hold good because the shareholders in the water company are not entitled to participate in the surplus revenue beyond the maximum dividends divisible among the shareholders. It is true that there may be back-dividends owing to the shareholders, and that the surplus revenue can be applied for this purpose, but when all back dividends have been paid off the company are bound under the Waterworks Clauses Acts to reduce their charges to the consumers, and are not therefore entitled to be compensated on the basis of the total revenue derived from the undertaking. In such a case the principle applied is to capitalise a sum representing the total maximum dividends possible for all classes of stock. It would appear on the face of it that a company in such a favourable position should have its maximum share dividends capitalised upon the highest possible number of years purchase. This view, however, when closely examined, by no means follows.

One well-known principle of compensation in cases under the Lands Clauses Acts is the principle which can be summed up in one word—viz., "reinstatement,"—and this principle is often applied to cases where the present shareholders are receiving their maximum dividends, and it is applied in this way—namely, that a sum of money is given to the shareholders which will enable them to reinvest their capital in shares of a similar value as a security—in other words, in waterworks stock of a similar company. . . .

Another reason why it does not follow that the number of "years purchase" on a maximum dividend company should be excessively high is the consideration of the resources of the company in relation to its obligations to a future increase in population. It not infrequently happens that a waterworks undertaking is purchased by the local authority at the precise time when the company goes to Parliament to obtain powers to raise additional capital, and to carry out further works to cope with the increasing consumption. In such cases, although a company may be paying a high rate of interest on its shares at the moment, it may be that when the additional capital necessary to carry out the new works has been expended, the additional revenue immediately available

will be insufficient to enable the company to continue the payment of maximum dividends.

When a water company's works are first established the capital expenditure is usually out of proportion to the number of consumers, and the nett revenue is insufficient to provide full dividends. As the population consuming water increases, this disparity of capital to revenue disappears, and the company becomes a prosperous concern. This arises from the fact that when the works are first constructed a margin of capacity is provided over and above existing requirements. If the population is an increasing one this means that from the time when the company can pay maximum dividends until this margin of supplying power is exhausted, the finances of the company show a large surplus, and the original shareholders can be recouped by payment of back dividends for their losses during the early life of the concern. The time comes, however, when the company must inevitably seek new sources of supply, and to do this, must expend a large sum on capital account. When this occurs there is no sudden increase in nett revenue to pay the dividends on the new share capital, and consequently, for a period more or less lengthy, the shareholders do not receive their maximum dividends, and all question of further payment of back dividends to the original shareholders is indefinitely postponed. . . .

Hitherto nothing has been said about the increased revenue derivable from the progressive increase of population, and this is a point which raises much controversy. In a case of a company paying maximum dividends, the shareholders clearly have no interest in future increase of population, except in so far as it may provide for the payment of back dividends.

This, however, is not so in the case of a company which has not reached its maximum dividends, and in whose district the population is increasing, and whose works are capable of supplying large quantities of water beyond present needs. In such a case, it is argued that the shareholders are entitled to some payment for prospective increase in revenue, and this item is usually dealt with in one of two ways—either (*a*) by increasing the number of "years purchase" of the present revenue, or (*b*) by making an estimate of the probable future increase in revenue, and multiplying this by some smaller number of "years purchase"; smaller, because obviously the security of a prospective revenue cannot be the same as that of revenue actually derived from an existing population.

A further question sometimes arises in the case of a maximum-dividend company where that company has not issued its full share capital, but has issued some form of mortgage or debenture shares at a small fixed rate of interest, usually 4½ per cent or 5 per cent. It is sometimes argued that the shareholders could, if they had been so minded, have issued further ordinary stock instead of debentures, and that, as such stock would have been entitled to the same rate of dividend as the ordinary shares, the company are entitled to be compensated on the basis that all share capital, whether debentures or otherwise, should be treated as capital bearing the maximum rate of dividend.

Payment of back dividends is a subject upon which there is, as a rule, not much controversy. Assuming that a company is paying maximum dividends and has a large surplus, there is nothing to prevent it from paying off back dividends, and it is merely a matter of calculation to ascertain the rate at which such dividends would be paid off, and what the present value of them may be.

In some cases water companies obtain an overdraft at their bankers instead of issuing additional shares or debentures. Not infrequently works of considerable magnitude are carried out in this way, the intention being that the company should pay off the overdraft with the surplus income, and so avoid increasing the share capital. This method of conducting the business of a water company often raises considerable difficulty in a case of arbitration, as the additional works are usually producing an exceedingly small revenue, sometimes none, and consequently if dealt with by themselves as part of the undertaking, the revenue derived would not justify the capital expenditure. On the other hand, if the company had created additional share capital, the total revenue might be sufficient to pay the dividends, and hence the sum to be capitalised would be much larger than that representing the existing share capital. Under such circumstances the usual course adopted is to treat the overdraft simply as a loan, and to provide a sum of money to repay the loan; in other words, no profit is made on the overdraft. This is, of course, assuming that the capital expenditure has been properly applied to works useful to the company.

One of the features of the purchase of an undertaking is the fact that the local authority often step in to purchase at the time when the company are in Parliament for additional powers, and under such circumstances it is usual for the local authority to apply for what is known as a sterilising clause to be inserted in the Bill. The effect of this sterilising clause is that nothing in the Act shall authorise the company for the purpose of determination of the purchase price to be paid for the undertaking to bring into account or make any claim in respect of any powers, rights, or advantages conferred on them by or resulting from the passing of the Act. The contention in favour of such provision being included in the Act is, that as the company have not actually undertaken the construction of the additional works, they should not be entitled to any profit on the concession granted them by Parliament, which in many cases undoubtedly does convey to the company an element of value.

In addition to the actual value of the undertaking itself, it is usual to include in the purchasing Act a clause which requires the purchasing authority to take over any stock or materials such as coals, oil, spare pipes, &c., and these are usually valued by some independent person between the two parties, and are not brought into the main arbitration. This is more convenient because the quantities of stock cannot be ascertained until the day of transfer, and because the value is usually easily determined by vouchers which can be produced, and about which no controversy is likely to arise. The compensation of directors and the servants of the company, and the costs of obtaining or opposing Acts of Parliament are usually provided for in the Act, and the method of dealing with them is usually there prescribed. These matters are highly important, but from an engineering point of view are subsidiary subjects, and hardly come within the scope of the present communication, which is more particularly confined to the engineering features of waterworks arbitrations.

In bringing this subject before the institution, the author has necessarily treated it in general terms, and has endeavoured to indicate the principles on which compensation should be determined rather than to deal with details which must of necessity vary with every case. The application of the principles to a particular undertaking must depend upon the attendant circumstances, and it is the duty of the valuer to present a case as favourable as possible to his clients, but at the same time his valuation must be sound in principle, if it is to successfully withstand the searching explanation to which it is sure to be subjected.

DISCUSSION OF MR. SILCOCK'S PAPER.

Mr. T. MOLYNEUX (Stockport) said there was one point which Mr. Silcock touched upon very shortly, and in regard to which he would like to say a few words, as it was a matter which touched them as water engineers—he referred to the question of compensation to directors and servants. He knew of a case where the servants of a company were protected in this way—the corporation, which was the purchasing authority, was to pay the sum of £5,000 as compensation to the secretary, engineer, and the other servants. The corporation paid the £5,000 for that specific purpose, but at the meeting of the company a shareholder objected to the money being distributed, and the servants got nothing except what they got from the goodwill of the directors. The shareholder in question was a solicitor, and the position he took up was that this £5,000 was an undisclosed sum, although it had been paid for a specific purpose, and legally he was right. The engineer took counsel's opinion on the point, and he was told that he had no case. Ultimately the engineer got £100 and the secretary and the collector £1,000. Although Mr. Silcock dismissed that matter very briefly, it was one of great interest to them as likely to affect them very much in case of a transfer.

Mr. H. ASHTON HILL (South Staffordshire) observed that Mr. Silcock had said it was the recognised practice of Parliament to favour the ownership and complete control of the public water supplies by local sanitary authorities. That might be all right, but, of course, there was a little bit of jealousy between

members who represented companies and those who represented corporations as to which supplied the best water and the best engineers, and some of them thought that companies could manage waterworks much better than corporations. He supposed they were entitled to their opinions, but he was not so strong on that aspect of the question as he was formerly. With a large experience he was inclined to go with the author of the paper and to say that the transfer of a small local undertaking was a move in the right direction. He believed that the direction in which this question of the water supply would move would be that in the end it would probably become a Government matter. The question of watershed areas would have to be taken up, and large sections of the country should be administered by one body, and he thought that body should be a public one. It should be a board representative of all interests. Nowadays everything seemed to tend in that direction, as was seen in the case of town planning, where the jealousies existing between adjacent small local authorities interfered with the proper laying out of the country. Then, again, there was the case of tramways. At present the local boundaries were very small, and often, when a municipality desired to construct a tramway, they came against another authority which possibly refused to allow them to go through their district. That sort of thing, at all events as regarded the water supply, ought to be eliminated.

Mr. C. H. Priestley (Cardiff) said he would like to give them a little information regarding the state of things as regarded Cardiff. Mr. Silcock seemed to assume that in every case of the acquisition of an undertaking it was a question of arbitration, but in their case they acquired the company without arbitration. It was in the year 1878-9 that the Cardiff Waterworks Company was bought out by agreement between the corporation and the company. In that case the purchase price was twenty-five years of the nett annual value, and at the time—and Mr. Silcock had drawn attention to the point very forcibly in his paper—sufficient care was not given to the point to the value of the works as they were then. When he told them that at the time the corporation bought the company the capital expenditure involved was only a matter of £100,000, whereas at the present time it was £1,500,000, they could imagine the difference in the works now and then. It must have been patent to everyone who saw the probable growth of Cardiff that the company at the time would have to expend very large sums of money in order to keep pace with the growing requirements of the place. He came on the scene very shortly after the purchase, and found that nearly everything had been neglected for years before; there was no provision whatever made by the company for the future, and a very large expenditure was immediately necessary. That expenditure had been such that the revenue, although it had increased from £12,000 per annum to over £75,000 per annum, had not kept pace with the requirements. They had at the present time, and he was afraid would have for a considerable number of years, a rate in aid of the works. That was his own experience, and he gave it as an example which might prove useful. There was just one other point he would like to refer to. Mr. Silcock had drawn attention to the question of outside districts. They in Cardiff were in a peculiar position in that respect. In certain of their outside districts which had been supplied since the undertaking had been in the hands of the corporation they charged, and they were able to charge under their Act of Parliament, 25 per cent extra above the charges within the city. That fairly represented the average rate in aid which they had been paying within the city; but there was one town, with a population of about 17,000 or 18,000, where they could only charge the same rate as they could within the city. That meant that in that town the inhabitants were paying considerably less for their water than the inhabitants of the city, although the city had the whole of the responsibility for the water supply. That appeared to him to be a very unjust thing, and it had been suggested that they might have to amend the Act of Parliament to alter that condition of things, but nothing yet had been done in connection with it.

Mr. R. Askwith (Weardale) said that Mr. Silcock had omitted to take into consideration the risk that shareholders had run in investing in a water company when originally formed, and he held that those people should be compensated in some way for the risk they had taken. Generally speaking, the companies that were bought up by local authorities were those that had been successful. Why should he have the benefit of the successful company taken out of his hands by the local authority purchasing it, and not in the other case? The risk in the company that had not succeeded remained with him—he had lost upon it—and the good speculation was taken from him.

Mr. J. F. Hedgford (Colne) said that, in the course of his paper dealing with the point as to the number of years of purchase to be taken into account, the author said: "This element of value can be dealt with in one of two ways—either (*a*) by decreasing the number of years purchase on the maintainable revenue, or (*b*) by deducting from the maintainable revenue an annual sum to form a sinking fund," &c. Further on he said: "The same principle is applied in certain cases where supplementary works are required in order to improve either the quality or the quantity of the water, but in such cases the deduction is made from the capital sum and not from the 'years purchase.'" That implied to his (the speaker's) mind that the deduction could be made in either way. Further on the author said: "Supposing it is necessary to cover a service reservoir, it may be more advantageous to the company to keep the number of 'years purchase' high," thereby again seeming to imply that either way would do. It was conceivable to his mind that in different circumstances the two methods might make a difference, and he would like to ask Mr. Silcock whether he did not consider it advisable to work according to a definite rule as between capital and revenue expenditure.

Mr. Silcock, replying on the discussion, said that, with regard to the point raised by Mr. Molyneux, the compensation to officials was, undoubtedly, a very important matter for the consideration of members of the institution who happened to be in the fortunate or unfortunate position of being bought out. He said fortunate, in some cases, because he knew of one or two instances where the officials of water companies had been very glad to take a sum of money as compensation for their prospective income, and had afterwards embarked upon a different line of business altogether. In other cases, of course, they would much prefer to have been included in the staff taken over by the purchasing authority; but he confessed that he thought that course was open to certain objections, because there was not quite the same security of tenure under a corporation as under a company. At all events there had been cases where men had been taken over by local authorities, and after having been kept in their employment a short time their services had been dispensed with. He quite agreed with Mr. Ashton Hill that there were many cases undoubtedly where water boards did present a difficulty. There was often a good deal of jealousy between local authorities, and sometimes there was great difficulty in arranging those local prejudices which arose in the formation of water boards to deal with the supply of a district which covered a good deal of ground, and in those cases, undoubtedly, a company could deal with the subject with a freer hand, and therefore more efficiently, than a municipal undertaking. But, speaking broadly, he thought he was in favour of the water supply being in the hands of the local authority. That was a matter of pious opinion perhaps. He quite recognised the point referred to by Mr. Priestley that there was no necessity for an arbitration in the case of a transfer, and there were many instances of water undertakings being purchased by agreement. There was the case of Stockport. The figures quoted by Mr. Priestley would lead one to suspect that the number of years' purchase—twenty-five—which was used for capitalising at Cardiff was rather on the high side. With regard to the question of the risk run by the shareholder who originally invested in a water company, and who was or was not bought out, he did not think there was any injustice. If a man invested in a company which did not pay and he was bought out, he was bought out on the terms that his company did not pay, and if he continued to hold it would probably not pay him any more in the future than it had in the past, and therefore he did not suffer. On the other hand, if a man was fortunate enough to invest in a company which paid a good dividend, or possibly its maximum dividend, then he was compensated upon that basis, and there again he did not suffer any injustice, and that point, therefore, was met by the arbitration procedure.

Mr. Askwith said his point was that the man who was unfortunate in his investment was not bought out; he was left with his bad bargain. He lost on the one investment, and was not bought out on equal terms.

Mr. SILCOCK said he was afraid that that was the fortune of war. When one invested in a commercial speculation they had to take the risk, and whether they were fortunate or unfortunate did not govern the question as to whether a municipality should be entitled to purchase on equitable terms. As to Mr. Hedgford's criticism, that was one of words more than anything else. If he (Mr. Silcock) had said that the deduction was "usually" made from the capital sum, and not from the years' purchase, Mr. Hedgford's difficulty would have disappeared. The point was that, if they knew definitely what sum was required in order to make the works more perfect, they were entitled, if representing a company, to say that by the expenditure of, say, £10,000, they could make the undertaking perfect, and therefore they were entitled to be compensated on the basis of a perfect undertaking less £10,000, which might lead to a better financial result than if they were compensated as a second-rate undertaking. It depended upon the side one was engaged upon as to which view one would put forward.

(To be continued.)

ANNUAL DINNER.

The eighteenth annual dinner of the institution was held on Friday last in the Town Hall, Wakefield, the president, Mr. C. Clemesha Smith, in the chair.

Following the usual loyal toasts,

Mr. ROBERT ASKWITH proposed "The Mayor and Corporation of Wakefield." Wakefield was a very ancient borough with great traditions, and the present mayor and corporation were carrying on those traditions. They were told by the deputy mayor that Wakefield had the best water supply in the world—he must have meant by that that it was because the committee that managed the waterworks were a committee of Yorkshiremen, and the engineer was also a Yorkshireman.

The MAYOR (Councillor E. Lodge Hirst, J.P.), replying to the toast, said he could assure them that it had given the corporation great pleasure to receive the institution in their city. It was a great pleasure to them to feel that the institution were holding their annual meeting in Wakefield, and that they had chosen their water engineer as president. They in Wakefield felt very proud that the institution had conferred that honour upon Mr. Clemesha Smith.

Councillor GEORGE FOSTER, in proposing "The Institution of Water Engineers," said he realised that the institution was an important body, and that the work its members undertook was essential to the life and well-being of the millions of inhabitants of this country. The members of that institution were engaged in solving the important problem of procuring and maintaining a plentiful water supply. They knew how such a supply of water could be obtained, and how it could be maintained, and they congratulated them upon the work they had already done. He was reminded that the institution was now in the eighteenth year of its existence, and from the progress it had already made he felt sure that a matured and wise future was in front of it, which gave promise of a ripe and robust manhood, and they all hoped that when the institution attained its majority it would be even more powerful for good than it was to-day.

The PRESIDENT, in responding, after thanking Councillor Foster for the kind terms in which he had proposed the toast, said they were often told that this was a day of institutions and associations, and it was sometimes said in a somewhat supercilious manner, as though those institutions and associations were simply foam or froth upon the path of progress. He would ask such people to consider whether they were not wrong in taking that view, and whether it was not a fact that associations and institutions did not form the bed-rock upon which modern civilisation was founded. Progress in civilisation was in direct proportion to the possibilities of rapid interchange of thought and ideas, and the present condition of things had only been made possible by the fact that we had been able to tap the accumulated fountains of information which had come down to us from other times, and other peoples and other minds than our own. If it were not so we should be in a very difficult position, for isolated individual effort could take them only a very short way in any given direction. If it was necessary for that institution to have a motto, they could not do better than take the words of Bacon: "Reading makes a full man, writing an exact man, but conference a ready man."

WILTSHIRE ROADS.

THE INCREASED COST OF UPKEEP.

The estimate of the county surveyor, Mr. J. G. Powell, of the cost of maintaining the main roads throughout the county of Wiltshire for the year ending March next was £78,368, compared with £77,831 in the previous twelve months. The county surveyor adds that the estimate had been based on the strictest economy. He emphasised the grave injury which is being done to the roads by mechanical traffic, and said it was pleasing to note that the County Councils' Association had at last decided to represent to the Government that no further powers should be given to the railway companies and corporations to run heavy motor cars over country roads until the highway law has been amended. The increase in the cost of the upkeep of roads in consequence of mechanical traffic had become a most serious matter for the ratepayers, and it was to be hoped that in the near future the Legislature would take steps to remedy the gross unfairness that exists between those who pay for the upkeep of the roads and those who abuse them. The basis on which grants were made was undoubtedly an incentive to expenditure, and in no single instance was it possible to obtain a grant from the Road Board without increasing expenditure. The Roads and Bridges Committee have received from the Road Board a letter with reference to the proposed reconstruction of the London-Bath main road, together with the draft statement of the proposed grant from the Road Improvement Fund, and a draft of the undertaking which the board require the county council to give in respect of the sum of £35,600 to be advanced by the board to the county council. The county surveyor is engaged upon the preparation of the further particulars required by the Road Board, and of the maps and particulars required by the Local Government Board in support of the county council's application for their consent to the borrowing of the said sum of £35,600.

Public Health Law.—This concise little work* has been prepared mainly for the use of all concerned in local government work who may find the larger books too elaborate. In twenty chapters it covers the ground sufficiently for its purpose, including such matters as highways, but omitting rating, elections, &c. For students it should be of assistance in preparing for examinations in Public Health Law, while the practitioner will find its arrangements well suited for easy reference.—*The Law Times.*

Horse Shoe Competition.—The Roads Improvement Association have issued the details concerning its Horse Shoe Competition, in which £100 is offered for a new or improved type of horse shoe that will provide horses with a satisfactory foothold upon the modern smooth, waterproof road surfaces, and minimise the damage now caused to such surfaces by certain types of shoes now in use. The Judges' Committee comprises Mr. Robert Todd (chairman of the association), who is acting as chairman; Mr. H. Percy Boulnois and Colonel R. E. Crompton, C.B., representative road engineers; Mr. G. E. Fairholme, who has been appointed to represent the Royal Society for the Prevention of Cruelty to Animals, of which body he is chief secretary; Prof. W. Hunting, Mr. F. W. Stanley and Mr. Thomas Wolsey as the veterinary surgeons on the committee; and Mr. Henry J. Selby and Mr. Richard S. Tilling, who are watching over the horse-owner interests. The War Office have nominated Colonel C. E. Nuthall as their representative. Mr. J. H. Horton and Mr. Alan Lupton, well known in coaching circles, are also included in the Judges' Committee. Mr. Wallace E. Riche (general secretary to the Roads Improvement Association) is acting as secretary, and will be glad to supply copies of the rules upon request. Communications should be addressed to him at 15 Dartmouth-street, Westminster, London, S.W., and as no entrance fee is being charged, all applications should be accompanied by 1d. stamp to cover postage.

* A Manual for Municipal and County Engineers and Surveyors, Town Clerks, Clerks to District Councils, and other officers and members of local authorities. By S. G. Turner, of the Middle Temple, Barrister-at-Law, A.M.I.C.E., &c. London: St. Bride's Press, Ltd. Price 10s. 6d.

Institution of Municipal Engineers.

MEETING AT SALFORD.

We now give an abstract of the lecture which was delivered on Saturday, May 31st, at the Town Hall, Salford, by Dr. Grossmann before a meeting of the North-Western District of the Institution of Municipal Engineers. The remainder of the business at the meeting was fully reported in our last issue.

THE SEWAGE SLUDGE PROBLEM AND ITS SOLUTION.

By Dr. J. Grossmann, M.A., F.I.C.

The hygienic disposal of the refuse from domestic sources which is now carried away in the sewers was (said Dr. Grossmann) only of comparatively recent date. When one read of the indescribably filthy manner in which that refuse was dealt with down to almost the middle of last century, and compared it with the present state and the enormous improvements in the health of the community and comfort of their surroundings which had been wrought by the modern methods of sewage disposal, one was struck with admiration of the enterprise of public authorities and the skill and knowledge of their engineers and chemists. There was still one weak spot in the treatment of sewage, and that was the disposal of the solid matter it contained, which had to be removed before the liquid part could be purified. This part of the sewage was called "sewage sludge," and was, up to the present, in nearly every instance a source of nuisance and probable danger to the community, and it was of the greatest importance that this problem should be solved. At present the sludge was disposed of either by dumping in the sea or on land, or by digging it into land, or similar ways. London, Glasgow, Manchester, and Salford shipped their sludge out to sea, at costs varying from 3s. 8d. to 5s. 7d. per ton of actual solids—that is, of dried sludge. Sludge contained usually from 88 to 92 per cent of water. After drying, the solids contained about 55 per cent of inorganic and 45 per cent of organic matter. In domestic sewage sludge there was, owing to the use of soap, a certain proportion of fats present in the dried or pressed sludge, and it was well to remember that the amount of soap used per head was an index of the civilisation of a country. Pressing was expensive. Too, lime had to be added, and the amount of lime, though small in proportion to the weight of wet sludge, was a much larger amount when compared with the actual weight of the dried solids, the only fair comparison. Pressed cake could only be sold in the winter months, when it was least objectionable and there was the least urgency for its sale. Septic tank treatment only reduced the weight of the dried solids 20 per cent. As a fuel, sludge was no good, being worth perhaps one-third or one-fourth as much as coal. Attempts had been made to recover the nitrogen from the sludge in the form of sulphate of ammonia, but the process was too costly, and it was impossible to get out all the ammonia. A ton of sludge might produce ¼ cwt. of sulphate.

None of these methods offered a complete hygienic solution of the question, and every one of them was liable to cause a nuisance. The only way to obviate the nuisance was not to allow this filthy material to accumulate, and consequently it should be either destroyed in an innocuous way, almost as soon as it was formed, or it should be converted into an inodorous and completely sterilised material. As, however, sludge contained very valuable constituents, it would be against all economic principles to destroy it if some means could be found to convert it into marketable commodities which could be handled and stored without creating a nuisance. Sludge contained nitrogen, phosphates, potash, all good for plant food, yet sludge was not a good manure. Grease was the objectionable ingredient, preventing the access of air and water, and rendering impossible the solution of the valuable ingredients by rain.

Dr. Grossmann then gave a description of his patented process as carried on at the Oldham sewage works, and by which an inodorous and sterilised manure of the highest value and grease (which found its way into the sewers chiefly from soap) were recovered, and although he did not claim that there was any large profit to be obtained by adopting his process, there was this great advantage that it did away with the nuisance of smells, flies and danger to health, wherever it existed now, without adding in the least to the expenses incurred at present. He removed the grease and solids, and recovered valuable manurial constituents in the shape of a dry powder, portable and easily handled. The system had been working at Oldham some time, and Oldham was a town of some 147,000 inhabitants. The sludge was taken direct from the settling tanks, and was settled in special tanks until the percentage of solids was raised from about 10 to about 20. The next step was to dry the sludge, and for this it was taken by an automatic conveyer to the top of the building, and thence led by shoots to six horizontal heated drying cylinders. In these were revolving screw conveyers, pushing the sludge along until it dropped into hoppers in the form of a powder. Each machine would produce 1½ tons of dried sludge in twenty-four hours, which was equal to 15 tons of the original sludge. In the evaporation of the surplus water there was no smell. To extract the grease which still remained in the dried sludge, the latter was passed through another cylinder into which superheated steam was admitted, along with a continual supply of sulphuric acid in the form of a slender stream no thicker than a knitting needle. The rotating paddles and shaft which carried them were perforated in such a way that the steam penetrated the whole mass of dried sludge and absorbed the grease and fat. The presence of acid was necessary for this action. The steam was finally led to condensers, where the grease separated out and floated on the surface of the condensed water. The grease contained 80 per cent of saponifiable matter, and was sold.

The dried powder had no smell, and was sold as manure, and the best proof of its value lay in the fact that repeat orders were received from farmers. He did not claim that large profits could be made, but if the sludge could be got rid of for nothing it would be a boon to the community at large. Also, in designing sewage treatment works the production of sludge would not have the same terrors if one knew that it could be disposed of without cost.

In conclusion, Dr. Grossmann referred to the Report of the Royal Commission on Sewage, and welcomed the recommendation they were making that the water supply and sewage treatment should be controlled by a central board. Both water and sewage were national assets; as regards sewage, we were only at the beginning of new developments. It was pointed out by Liebig, as far back as the middle of last century, that the water carriage system was the most wasteful one that could be designed, as all the most valuable constituents which came from the soil were lost to it, but the danger to health and the interference with the comfort of the people caused by the old system were such as to render it imperative that a hygienic method of sewage purification should be adopted regardless of expense. The advances which had been made in science and engineering were such that we were now in a position to consider whether it was not possible to deal with sewage on more economic principles than had been done in the past. It had been proved at Oldham that, so far as sewage sludge was concerned, it could be done, and that the valuable constituents contained in it might be profitably returned to the soil as manure. Several millions of pounds per annum could thus be saved to the country by being used again in the shape of manure in producing crops, and millions of acres near towns which were at present unfit for cultivation owing to the want of cheap manure would be rendered available for agricultural purposes and find employment for many thousands of people. It was in this direction that the central board would probably be of the greatest assistance, and it was to be hoped that it would have sufficient powers and sufficient funds to encourage and support work which was likely to lead to results of national importance and benefit to the community at large, and which, at present, had had to be carried out by individuals at great risk and ruinous expense.

DISCUSSION.

Mr. ARTHUR BOWES (Newton-in-Makerfield), in proposing a vote of thanks to Dr. Grossmann, said that no town in the country had devoted more attention to this difficult and expensive problem of getting rid of sewage than Salford. Dr. Grossmann had explained in a remarkably lucid manner the theories on which he had worked. Salford established its sewage works with a great blowing of trumpets in 1881, but in a few years they found themselves busy with all sorts of systems. Goodness knew what it would be five, six, or ten years hence. Dr. Grossmann had thrown a new light on the problem with his theory that sewage sludge did not allow of its valuable constituents—potash, soda, and phosphorus—being utilised in the ordinary way—namely, by being dissolved by rain, and that the reason for this was because these constituents were locked up in grease, which must first be got rid of. Theoretically his process was perfect, and practically it had evidently worked out all right. The only remaining point was the financial aspect. If the result of a year or two's working at Oldham showed that the sludge could be disposed of, even at a slight cost, he had not the slightest doubt that Dr. Grossmann's process would be adopted by many communities where at present it was tremendously expensive to get rid of the sludge satisfactorily. One of its chief advantages was that there was no need to be particular in limiting the amount of the sludge. There was no need to build expensive settling tanks. And at the same time each community would be producing something of value outside.

Mr. J. T. PEGGE (Durham) seconded the resolution. After referring to the ingenious nature of the machinery adopted by Dr. Grossmann for his process, and to the value of the manure produced, he said that to his mind the whole question of the treatment of the sludge, as explained by Dr. Grossmann, depended on whether by his process he had got rid of that dreadful filth which choked up the surface of the land and gave it a leather-like covering. Was the fatty matter changed in its chemical nature so as to avoid that? Then, although the provision of a valuable manure was extremely important, a greater question was whether, after its final treatment, the effluent was in such a condition as to be delivered directly into rivers of pure water, and so comply with the various requirements of the Local Government Board and the various River Boards.

Councillor E. MATHER, chairman of the River Irwell Conservancy Committee of the Salford Corporation, said he had seen the plant at Oldham in operation, and there were many things in connection with it that had merit in themselves. In purifying the sewage Dr. Grossman had done something that would be useful to all sewage managers. In connection with the tank in which the solidification took place, he had a method of taking the sludge out by means of a screw continuously working. Moreover, it appeared to work without disturbing the sludge, so that there was no necessity to run the tanks off or to clean them. This arrangement extended to the apparatus which did the drying and automatically extracted the fat. In these processes he had shown managers of ordinary sewage works that there were methods in connection with his treatment which would be beneficial to them.

Mr. JOSEPH CORBETT, borough engineer of Salford, in supporting the resolution, gave an interesting and amusing account of how when he was a boy in 1851 his father and a few others experimented on the same lines as Dr. Grossmann, and carried on a successful business for some years until a tailor who had advanced them money came to the conclusion that it was too good an investment to share with others, got rid of his expert partners, and in a short time ruined the whole concern and came to grief. Mr. Corbett mentioned that, in all, Salford had tried about thirty-four systems of sewage treatment; and referred to Colonel Scott's process of making cement from sludge, and Mr. Jones's process at Ealing of producing clinker out of it. He believed that eventually something definitely valuable would result from Dr. Grossmann's process, especially in the recovery of grease. At present the trouble was what was to be done with the grease. Dr. Grossmann had mentioned making candles of it. In a conversation upon the process the other day, a suggestion was made that it would make very good margarine. He was sure, however, that Dr. Grossmann would see that nothing harmful went out that way.,

Dr. MELLIN, borough analyst of Wigan and county analyst of Cheshire, added his congratulations to those of the other speakers. Over two years ago the Oldham Corporation called him in to report upon Dr. Grossmann's scheme generally. It was hardly fair to go into the figures given by Dr. Grossmann, because they had been stated by him on the minimum side. When his own investigation took place the process was not perfected to the extent that it was to-day, but he could fully confirm Dr. Grossmann's analysis in regard to the grease, which to his (Dr. Mellin's) mind was of equal if not of greater value than the manure. His experience of sewage disposal in certain towns convinced him of the enormous difficulties there were in the disposal of sludge. He was thinking especially of one town where the authorities had been using for years chemical precipitants for the removal of sludge from tanks. They had worked that sludge into the surrounding land to such an extent that they could not get any more into it without creating an intolerable nuisance within a radius of 3 or 4 miles. This was an abominable state of things and should not be allowed. Dr. Grossmann's process stood to-day as a record of what could be done. Other authorities, when placed as Oldham was placed, and having no more land on which to put their sludge, and no Ship Canal to take it to the sea, would have to adopt that or some similar system. Dr. Grossmann had shown them that it was possible to dispose of the sludge, not only to the advantage of the town that produced it, but also to the advantage of the community in general; and he hoped soon to hear of other communities of still greater populations having adopted it.

At this point the CHAIRMAN intimated that he had to withdraw in order to attend a committee meeting, and the chair was taken by Mr. F. W. Platt, building surveyor of Salford.

Councillor MATHER explained that they could take it on trust that the benefits derived from obtaining the grease and the manure from the dry sludge were such as to satisfy the Oldham Corporation on the one hand and Dr. Grossmann on the other; for under the arrangement between them Dr. Grossmann bought the grease and manure and resold to the users of them. It was interesting to know that already Dr. Grossmann had had to reject orders for thousands of tons of the manure.

Mr. A. HERRING-SHAW, lecturer in sanitary engineering at the Manchester Municipal School of Technology, said there could be no doubt that the results of Dr. Grossmann's work represented many years of patient toil and research and experiment. One disadvantage of dumping sludge into the sea was that the pathogenic organisms in it were liable to affect shell-fish in the vicinity, and so become dangerous to the community. That being so, he thought it a still greater disadvantage to turn sewage effluents, without sterilisation, into rivers, which eventually reached the sea. The absence of pathogenic organisms in sludge, as determined by experiments, was largely due to the presence of other and beneficent organisms, or organisms the life processes of which were opposed to those of the pathogenic organisms. The same conditions did not obtain in sewage itself, and therefore he could not see where the disadvantage came in in dumping sludge into the open sea and still allowing many million gallons of sewage, which undoubtedly contained pathogenic organisms, to pass into the sea without sterilisation. One question he would like to ask regarding the statement of the calorific value of dry sludge as being 3s. a ton. Was there any comparable standard, such as a certain type of coal?

Mr. J. HOWARD (Worsley) stated that at his works the sludge was merely treated and spread on the land. In time to come they might become short of land, and then they would have to consider what to do.

The CHAIRMAN said it had struck him that the manure produced by Dr. Grossmann's process was perhaps lacking in nitrogen, and contained somewhat of an excess of phosphate. Would he say what were the proportions of nitrogen, phosphate, and potash, and how much of the potash was soluble and insoluble, and what the effect was when combined with the essence of clay?

Mr. R. J. MCKENN (Heywood) asked at what temperature the furnace into which the sludge was deposited was heated. At the Heywood sewage works they had a set of destructors, and as the commercial

point of view was the one first inquired into by corporations when new schemes were brought forward, he would be glad to know whether the temperature generated by the burning of the refuse could be used in any way to evaporate the sludge. If so, such an element of economy would be greatly in favour of Dr. Grossmann's scheme. Further, it would be interesting to know the relative cost of Dr. Grossmann's plant with a plant of sludge presses—quite apart from the after-disposal of the sludge; and also the cost of maintenance as compared with that of presses. Unfortunately, to-day men of the type of Dr. Grossmann were generally regarded as iconoclasts. We were too conservative, and inclined to think that what was good enough for our fathers was good enough for ourselves. Rates were advancing, and so was the cost of materials. If, in such circumstances, corporations could not see their way clear to adopt experimental methods, would it not be wise for the Government to make grants for the purpose? After all, the country was made up of a combination of communities, and what was good for one might be good for others.

Dr. Grossmann, replying to the discussion, said that, in his opinion, the particular trouble experienced by Mr. Pegge in getting rid of the humus was partly due to the fact that there was not sufficient "settled out" to start with. Sewage managers were often afraid of adding more precipitants to the sewage because it meant that they would have a larger amount of sludge to deal with, and thus incur more expense and trouble. What was called humus, and went by the fancy name of "colloidal substances," was nothing else but an amount of soap in solution which went away with the effluent. If this could be got rid of by suitable precipitation there would be far less trouble in dealing afterwards with the effluent, and the purification of the sewage would become more perfect and much easier to deal with than at present. One of the great advantages of the method he had introduced in Oldham was that it would enable them ultimately to use precipitants of a suitable nature more freely, because these precipitants would precipitate nitrogenous matter at present lost, and also an amount of soap which was now lost. And as the fatty matter was very valuable it would easily pay for the extra amount of precipitant which had to be used. The process would thus not only be beneficial in the hygienic and rational disposal of the sludge, but ultimately, too, it would help in the purification of the sewage itself. There was so great a demand for fats of the hard nature of that produced at the Oldham works that there was no fear of their being used for any purpose which anyone could object to. Such enormous quantities were now used for special lubricating purposes that the demand for hard grease was much greater than the supply. If every town in this country were to adopt his process he could still easily sell the whole of the grease recovered without going outside his office. For the manure, also, the demand was so great that, although work had gone on night and day for five months without a stoppage, he had not yet been able to stock. In fact, he had had to stop his agents from taking more orders. The shipping inquiries were such that he could easily dispose of 10,000 to 20,000 tons a year where he could only produce 3,000 tons. Mr. Herring-Shaw had raised some questions which were difficult to answer. The danger of pathogenic germs going into the sea from sewage was being especially closely studied in America, and probably we should hear something as a result. The calorific value of the sludge could be easily ascertained by experiment. It was about one-third the value of coal, so that if coal were 9s. or 10s. a ton, the value of the sludge would be 3s. or a little more per ton. Mr. Howard was in a very fortunate position regarding sewage, and all he could hope was that he would soon be short of land. Mr. Platt wished to know how much nitrogen and phosphates and potash there was. The nitrogen was equal to 2 per cent of ammonia as it came out of the machinery, there was about 3 to 5 per cent of phosphates of lime, and about 1½ per cent of potash salts. Of course, the best manure was that which supplied to the plants all the food they required in the proper proportion. This manure was somewhat short in potash and phosphates, and therefore in bringing out a concentrated manure one had to mix these ingredients in it in such proportions as were necessary for the particular crop for which the manure was intended. One great advantage of such manure was the quantity of organic matter it contained, and which was itself beneficial to the soil, and helped to spread the ingredients mentioned over a large surface, so that they became more accessible to the plants. Mr. McKenn wished to know the temperature of the dryer. It could never be much more than 212 deg. No decomposition took place. Part of the merit of the dryer was that it was so constructed that, although he had a very high temperature outside, there was no decomposition inside the dryer. Of course, the cost of pressing plant as compared with the cost of his was much in favour of the pressing plant; but when it was remembered that pressed sludge was only the beginning of the nuisance, whereas the working of it up into manure and grease was the end of the nuisance, the two could hardly be compared, With regard to the maintenance or working expenses of the plant, that also could not be compared, because in the one case the sludge was still left, whereas in the other it was done with. But if it cost £1,000 a year to produce the pressed sludge, he undertook, in a general way, that it should not cost more than £1,000 a year to get rid of it altogether by turning it into manure. At Oldham he was really working under unfavourable conditions. A pretty stiff price had to be paid for coal, and that was a serious item in the drying of the sludge. Wherever there was a destructor, the destructor could be used, and the work would be done at a considerably reduced price. During the last twenty or thirty years there had been many wonderful inventions. The question of haulage had altogether changed since motor haulage had come to the front. One matter for future consideration was whether it would not be cheaper, by using motor haulage, to raise destructors on sewage works. If that were done there would be a saving in fuel and a profit to the sewage works. Another invention which might greatly affect and benefit sewage works was the new manner of pumping, as exemplified in the Humphreys pump; for, if the cost of pumping became much reduced, the work of the sewage engineer would be rendered far easier in the future.

The resolution was adopted with hearty acclamation.

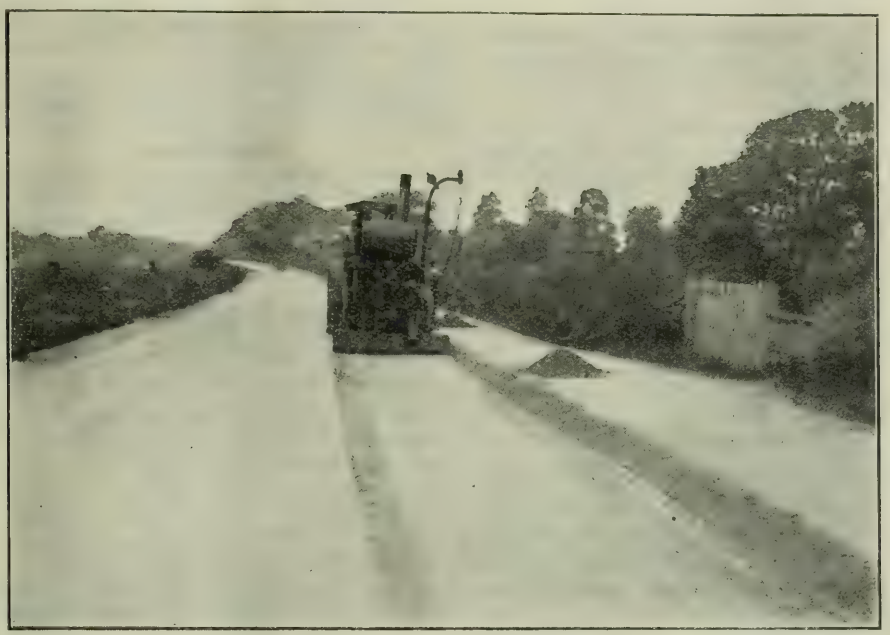
Bridge Building.—Students, young engineers, and surveyors will find much useful information in "Preliminary Studies in Bridge Building," by Reginald Ryves, Assoc.M.Inst.C.E. (London: St. Bride's Press, Limited, 24 Bride-lane, E.C. Price 2s. nett.) The book is described as the "first of a series of small volumes, each complete in itself, dealing with the design of ordinary highway bridges of moderate span." Though highway bridges alone are referred to, the matter contained in this volume is largely applicable to railway bridges, aqueducts, and similar engineering undertakings. The five primary types of bridges are described, and the conditions determining the best site for each of the three types of streams are discussed in detail; while in connection with wandering streams various modes of designing abutments or approach spans are dealt with. Improvements of fords and the effect of eccentric loading of vehicles on the girder loads are among the numerous other items touched on.—*Scotsman.*

Tarring Operations: Practical Hints to Roadmen.—A leaflet entitled "Notes upon Tar Treatment of Road Surfaces," giving the elementary principles in road-tarring work, has been issued by the Roads Improvement Association. It has been prepared for the information and guidance of men actually engaged in tarring work on the road, who do not usually have access to the various comprehensive technical publications upon this subject. The unsatisfactory results from the tar treatment of roads often complained of by road users have been traced in many cases to be due to the non-observance of the elementary principles in this work. The leaflet deals with (1) the suitability of a road for tar treatment, (2) the preparation of the surface, (3) the type of tar to be used, and (4) the application of tar to the road, and its subsequent gritting. Notes upon the removal of tar splashes from clothing, paintwork, animals, &c., complete the leaflet. The secretary to the Roads Improvement Association (Mr. Wallace E. Riche, 15 Dartmouth-street, Westminster, London, S.W.) will be glad to supply copies on request at the price of 2d. each, post free.

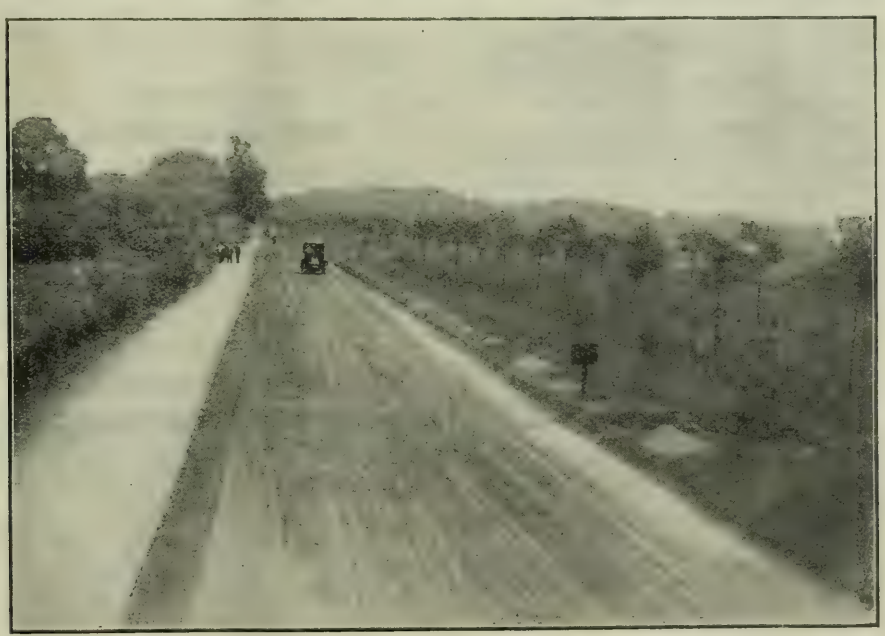
"FLUXPHALTE" ON ESSEX ROADS.

The road illustrated herewith is a 2-mile stretch on the London side of Epping Town, which has been sprayed with "Fluxphalte" under the supervision of Mr. Percy J. Sheldon, county surveyor of Essex. The road, which was treated during the last week in May, was first swept by a horse-machine broom, and a spraying machine drawn by a small traction engine rapidly laid the "Fluxphalte" on the road. This was followed by a liberal sprinkling of gravel, after which the completed portion was thrown open to traffic. The resultant road is not only dustless, but has a durable, wear-resisting surface, non-slippery and silent.

"Fluxphalte" is being used on several miles of roads in other parts of Mr. Sheldon's territory, ano at Romford, Essex; 5,000 super. yds. on the main road from Romford to the Chelmsford road have also been treated with "Fluxphalte." This road was in a very bad state and greatly in need of repair, and on inspection it will be acknowledged that "Fluxphalte" has practically made it a new road. It was laid 4 yds. to the gallon, and heavily coated with ¼-in. granite chippings.



Laying "Fluxphalte" at Epping.



The Completed Road.

London Park Gardens.—An Old English garden which has just been completed at Battersea Park is now open to the public. There are already Old English gardens at four other parks maintained by the London County Council—namely, Brockwell Park, Golder's Hill, Peckham Rye Park, and Ravenscourt Park.

INSTITUTION OF MUNICIPAL AND COUNTY ENGINEERS.

President—Mr. R. J. Thomas, M.Inst.C.E., County Surveyor, Buckinghamshire.

ROCHDALE MEETING.

A meeting of the institution is to be held in the North-Western District at the Town Hall, Rochdale, to-morrow (Saturday).

Programme.

11 a.m.—Reception in the council chamber (main entrance of town hall) by his Worship the Mayor, Alderman W. Cunliffe, J.P.

Paper by Mr. S. S. Platt, M.Inst.C.E., borough surveyor, "On Some of the More Recent Municipal Works of Rochdale," which will be taken as read.

Drawings and progress photographs will be exhibited in adjoining rooms, showing the works described and intended to be inspected.

Inspect the town hall (described fully in Vol. xxiii. of "Proceedings" of institution).

Inspect tramway centre, formed by covering the river in ferro-concrete.

12.30 p.m.—Luncheon (tickets 3s. each).

1.30 p.m.—Proceed in brakes (1s. 6d. each) to inspect the following works—viz., Falinge Park, branch police station, tramway depot and offices, ferro-concrete bridges, Mellor-street, sewage disposal works extension at Roch Mills (including new screening and raking arrangements, electrical pumping plant, percolating filters, &c.).

4 p.m. (about).—Afternoon tea at Roch Mills House, kindly provided by the Paving and Sewering Committee.

Arrangements will be made for a brake, if required, to leave Roch Mills for the Rochdale Station about 4.30 p.m.

A. W. Bradley, M.Inst.C.E.,
Hon. District Secretary.

Borough Surveyor,
St. Helens, Lancs.

ANNUAL GENERAL MEETING AND TOWN PLANNING CONFERENCE, GREAT YARMOUTH.

(July 16th—19th.)

Wednesday, July 16th. Morning: General business of the institution; presidential address and presentation of premiums; adjournment for lunch. Afternoon: Conference on Housing and Town Planning Act.

Thursday, July 17th.—Morning: (*a*) Papers on road matters; (*b*) conference (continued); adjournment for lunch, given by mayor and corporation to members of the institution and delegates to the conference. Afternoon: (*a*) Papers on road matters (continued); (*b*) conference continued and concluded. Evening: Annual Dinner.

Friday, July 18th.—Morning: Papers on road matters and subjects of general interest. Afternoon: Trip to waterworks at Ormesby Broad.

Saturday, July 19th. Morning and afternoon: Trip by rail and steam launches over some of the rivers and broads of Norfolk.

The following is a preliminary list of the papers to be read and discussed at the Town Planning Conference:—

"Town Design in Practice," by J. E. Wilkes, town planning engineer, Dunfermline.

"Legal Aspects of Town Planning," by J. L. Jack, town clerk, Dunfermline.

"Description of Birmingham Schemes," by H. E. Stilgoe, city engineer, Birmingham.

"Early Examples of Town Planning in the City of Edinburgh," by A. H. Campbell, city engineer, Edinburgh.

"Cities Beautiful by the Sea," by J. S. Brodie borough engineer, Blackpool.

"The Small Dwellings Acquisition Act, 1899," by J. L. Redfern, borough engineer, Gillingham.

"The Housing Question and its Solution," by Reg. Brown, surveyor to the urban district council, Southall.

"Factors Causing Bad Housing," by G. B. Hartfree, surveyor to the urban district council, Alton.

"Description of Town Planning Schemes and Housing in Sheffield," by C. F. Wike, city surveyor, Sheffield.

"A Description of the Ruislip-Northwood Town Planning Scheme," by W. Louis Carr, surveyor to the urban district council, Ruislip-Northwood.

The delegates to the conference will be welcomed by the mayor and corporation of Great Yarmouth, and entertained to luncheon by kind invitation of the mayor and corporation.

An important exhibition of plans of town planning schemes, kindly lent by authorities in various parts of the kingdom, will be available during the meeting.

LEEK MEETING.

A meeting of the institution in the West-Midland District will be held at Leek on July 5th (Saturday).

Thomas Cole,
92 Victoria-street, S.W. *Secretary.*

INSTITUTION OF MUNICIPAL ENGINEERS.

President—Mr. Frank Latham, M.Inst.C.E.I., F.S.E., Borough Engineer and Surveyor, Penzance.

A meeting of the North-Western District of the institution will be held at Wellington (Salop) on Saturday, June 21st.

Programme.

1.30 p.m.—Meet at Council Chamber, Walker-street, Wellington.

2 p.m.—Inspect fire station, public baths, library, market, gasworks, water pumping station, Cottage Hospital and recreation ground.

3 p.m.—Drive to sewage disposal works, impounding reservoir and water filtration works at the famous Wrekin. Brake tickets, 2s. 6d. per head.

6 p.m.—Members and friends will be entertained to tea by John Bayley, Esq., C.C., principal of Wellington College, at the college.

J. W. Gleave,
Hon. District Secretary.

COUNCIL MEETINGS.

The following council meetings have been arranged: June 25th, London; July 30th, London.

B. Wyand,
Secretary.

39 Victoria-street, S.W.
May 1, 1913.

ROYAL SANITARY INSTITUTE.

ANNUAL CONGRESS AND EXHIBITION, EXETER.

The annual congress of the Royal Sanitary Institute will be held at Exeter from July 7th—12th next, under the presidency of Earl Fortescue, K.C.B., Lord-Lieutenant of Devonshire. The order of proceedings will be found set out in our issue of May 23rd.

E. White Wallis,
Secretary.

APPOINTMENTS VACANT.

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SURVEYOR. June 14th.—South Crosland Urban District Council. 30s. per week as surveyor, and £30 per annum as inspector of nuisances.—Mr. A. J. Slocombe, clerk, Town Hall, Huddersfield.

ASSISTANT INSPECTOR OF NUISANCES.—June 14th.—Shipley Urban District Council. £80 per annum.—Mr. I. Lindon, clerk.

BUILDING INSPECTOR.—June 14th.—Corporation of Stafford. 45s. a week.—Mr. W. Plant, borough engineer.

SANITARY INSPECTOR.—June 16th.—Gellygaer Urban District Council. £120 per annum.—Mr. Frank T. James, clerk, Council Offices, Hengoed.

SEWAGE WORKS ATTENDANT.—June 16th.—Billericay Rural District Council. £1 5s. per week.—Mr. C. E. Lewis, clerk, New-road, Brentwood.

QUANTITY SURVEYOR.—June 17th.—To act in the Swansea borough architect's department. £250 per annum.—Mr. H. Lang Coath, town clerk.

CLERK OF WORKS.—June 18th.—Corporation of Bradford. £2 5s. per week.—City Architect.

BOROUGH SURVEYOR.—June 21st.—Banbury Town Council. £250—£350.—Mr. A. Stockton, town clerk.

SURVEYOR.—June 21st.—Barrowford Urban District Council. £145 £175.—Mr. A. T. Chandler, clerk.

TEMPORARY ASSISTANT.—June 23rd.—Horbury Urban District Council. 30s. per week.—Mr. W. Sugars, engineer and surveyor.

ACCOUNTANT CLERKS (Engineer's and Surveyor's Department).—June 23rd.—Beckenham Urban District Council. First-class clerk, £165—£200; third-class clerk, £75—£115.—Mr. F. Stevens, clerk.

CLERK OF WORKS.—June 23rd.—Carnarvonshire Joint Standing Committee. £2 10s. per week.—Mr. A. Bodvel-Roberts, clerk of the peace, Carnarvon.

SANITARY INSPECTOR.—June 26th.—Islington Borough Council. £148 per annum.—Mr. W. F. Dewey, town clerk.

SEWAGE OUTFALL WORKS MANAGER. June 28th.—Willenhall Urban District Council. £100 per annum with house and light.—Mr. Rowland Tildesley, clerk.

ASSISTANT ENGINEER AND SURVEYOR.—June 30th.—Corporation of Chelmsford. £150—£180.—Mr. P. T. Harrison, borough engineer and surveyor.

ASSISTANT VALUER AND SURVEYOR. June 30th.—Calcutta Improvement Trust. 600—800 rupees per month.—Mr. C. H. Bompas, chairman, 5 Clive-street, Calcutta.

CITY SURVEYOR'S DEPUTY (ENGINEERING DEPARTMENT).—June 30th.—Corporation of Manchester. £750 per annum.—City Surveyor, Town Hall.

CITY SURVEYOR'S DEPUTY (SURVEYING DEPARTMENT).—June 30th.—Corporation of Manchester. £750 per annum.—City Surveyor, Town Hall.

TECHNICAL (SANITARY) INSPECTOR.—October 1st.—Municipality of Alexandria.—The Director-General of the Municipality.

ASSISTANT SECRETARY.—For the Road Board. £500 a year. The Road Board, 28 Broadway, Westminster.

ASSISTANT ENGINEERS.—Ceylon Public Works Department. £300—£350.—Messrs. Gregory, Eyles & Waring, 12 Dean's-yard, Westminster, S.W. Quote M/6,106 on letter of application.

ASSISTANT ENGINEERS.—Gold Coast Government railway extension. £350, and field allowance £90.—Crown Agents for the Colonies, Whitehall-gardens, London, S.W. Quote M/6,090 on left-hand top corner of application.

SURVEYOR'S TEMPORARY CLERK.—Grimsby Rural District Council.—Mr. A. Hobson, surveyor, Council Offices, Grimsby.

MUNICIPAL COMPETITIONS OPEN.

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NEWCASTLE-UPON-TYNE.—June 19th.—Designs for laying out a portion of the Walker estate, for the corporation. Premiums, £50, £30 and £20.—The Town Clerk.

LIVERPOOL.—July 24th.—Designs for a sanatorium of 250 beds. Premiums, 150, 100 and 50 guineas.—Mr. Edward R. Pickmere, town clerk.

CHEPPING WYCOMBE.—September 1st.—Designs for town-planning the borough and an area immediately adjoining. Premiums, £25, £10 and £5.—Mr. T. J. Rushbrooke, borough surveyor, High Wycombe.

MUNICIPAL CONTRACTS OPEN.

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Buildings.

NEWTON ABBOT.—June 14th.—For the reconstruction of Penn Inn Bridge, for the urban district council.—Mr. Coleridge D. White, surveyor.

WALLASEY.—June 14th.—For the erection of a pavilion, for the corporation. Mr. W. H. Travers, borough engineer and surveyor.

NORTH RIDING.—June 14th.—For the erection of a police station, for the Standing Joint Committee. Mr. W. C. Trevor, clerk, County Hall, Northallerton.

HOLLAND (Lincs).—June 14th.—For the erection of a school, for the county council.—Mr. E. J. A. Christie, county architect, Market-place, Boston.

WEDNESBURY.—June 14th.—For works and renovations at town hall, for the corporation.—Mr. E. M. Scott, borough surveyor.

MILFORD (Co. Donegal). June 14th.—For the erection of forty-nine labourers' cottages, for the rural district council. Mr. S. Watters, clerk.

EDINBURGH.—June 16th.—For alterations at public schools, for the School Board.—Mr. J. A. Carfrae, architect, 3 Queen-street.

STOURBRIDGE.—June 16th.—For the erection of a ferro-concrete bridge, for the urban district council.—Mr. F. Woodward, surveyor.

DOVER. June 16th. For the erection of a public convenience, for the corporation. Mr. W. C. Hawke, borough engineer.

SHEFFIELD.—June 16th.—For the building of an infants' school, for the Education Committee.—City Architect.

WEST RIDING.—June 16th.—For erecting new constabulary headquarters, for the Standing Committee.—Mr. Percy O. Platts, acting West Riding architect, County Hall, Wakefield.

SUTHERLAND.—June 17th.—For the construction of new waterworks for Brora, for the county council.—Mr. A. Argo, county clerk, County Offices, Golspie.

MANCHESTER.—June 18th.—For the extension of the School of Art, for the corporation.—Accountant, Education Offices, Deansgate.

WILTS.—June 18th. For repairs to a school, for the county council.—County Surveyor, Trowbridge.

AGHALEE (Ireland).—June 18th.—For the erection of fifteen labourers' cottages, for the rural district council.—Mr. G. Sands, architect, Court House, Lisburn.

BLACKPOOL. June 18th. For the erection of storerooms, for the corporation.—Mr. J. S. Brodie, borough engineer.

BURNHAM (Essex).—June 19th—July 9th.—For the erection of cookery and handicraft centre, for the Education Committee. Mr. F. Whitmore, county architect, Chelmsford.

CHELMSFORD.—June 19th.—For the erection of an engine-house, steel water towers, tanks, and laying water mains and valves, for the rural district council.—Mr. James Dewhirst, engineer.

HEBDEN BRIDGE.—June 19th.—For the erection of new stables, for the urban district council.—Mr. T. Waddingham, engineer and surveyor.

LANCASHIRE.—June 20th.—For the erection of a school, for the Education Committee.—Mr. H. Littler architect, 16 Ribblesdale-place, Preston.

RHONDDA.—June 20th.—For the erection of a school, for the urban district council.—Mr. J. Rees, architect, Hillside Cottage, Pentre.

HAMPSHIRE.—June 20th—July 17th.—For the building of a new asylum, for the Joint Visiting Committee.—Mr. H. Barber, clerk, The Castle, Winchester.

NORTHUMBERLAND.—June 20th.—For alterations to a council school, for the Education Committee.—Mr. C. Williams, secretary, The Moothall, Newcastle-on-Tyne.

HARROW-ON-THE-HILL.—June 21st.—For the erection of two cottages, stables, and stores, and additions to hospital, for the urban district council. —Mr. J. P. Bennetts, engineer and surveyor.

WEST RIDING.—June 23rd.—For the widening (in masonry) of Cottingley Bridge, for the Highways Committee.—Mr. F. G. Carpenter, West Riding surveyor, County Hall, Wakefield.

TOTTENHAM.—June 23rd.—For redecoration of schools, for the Education Committee.—Mr. W. H. Prescott, surveyor.

CARLISLE. June 23rd. For the extension of electricity buildings, for the corporation.—Mr. H. C. Marks, city engineer.

SWINDON.—June 23rd.—For the erection of a cemetery chapel, for the corporation.—Mr. H. J. Hamp, borough surveyor.

WEST RIDING.—June 23rd.—For the widening, in masonry, of a bridge, for the Highways Committee. Mr. F. G. Carpenter, West Riding surveyor, County Hall, Wakefield.

READING.—June 23rd.—For the building of a lairage shed and construction of roadway at the market, for the corporation.—Borough Engineer.

SOUTHAMPTON.—June 23rd.—For reconstructing a warehouse, for the Harbour Board. Mr. J. E. Pailthorpe, clerk, Town Quay.

CARDIGAN.—June 23rd.—For the construction and extension of waterworks, consisting of mains, valves, hydrants, and supplemental reservoir, for the corporation. Mr. D. Morgan Jones, town clerk

HINCKLEY. June 23rd. For building twelve workmen's dwellings, for the urban district council. Mr. E. H. Crump, engineer and surveyor.

HORNSEY. June 23rd. For the erection of a fire station, for the corporation. Mr. E. J. Lovegrove, borough engineer.

WEST SUSSEX.—June 23rd.—For the erection of an infants' school, for the Joint Education Committee.—Mr. H. P. Roberts, county education architect, Thurlow House, High-street, Worthing.

LEWISHAM.—June 24th.—For covering the floors of the council chamber and committee rooms with parquetry flooring, for the borough council. The Surveyor.

ABERDARE.—June 24th.—For the erection of a domestic subjects centre, for the Education Committee. Mr. J. L. Smith, architect, 7 Victoria-square.

FARNHAM.—June 24th.—For the erection of five cottages, for the urban district council. The Surveyor.

WALTHAMSTOW. June 25th. For the erection of a tuberculosis pavilion, for the urban district council. Mr. G. W. Holmes, engineer.

LEWES. June 25th. For building municipal offices, for the corporation.—Mr. Rowland H. Halls, architect, Sewers Buildings, Lewes.

FARNWORTH. June 25th. For the erection of a fire station, for the urban district council. Mr. W. Tyldesley, clerk.

SOUTHWARK. June 25th.—For the extension of the electricity station, for the borough council. Borough Engineer.

HERTS. June 27th. For the construction of a bridge, for the county council. Mr. Urban A. Smith, Hatfield.

HERTFORDSHIRE. June 27th. For the construction of a new bridge over the Stort Navigation at Bishops Stortford, for the county council. — Mr. Urban A. Smith, county surveyor, Hatfield.

HERTFORDSHIRE. June 27th. For the construction of a new bridge over the Stort Navigation at Sawbridgeworth, for the county council.—Mr. Urban A. Smith, county surveyor, Hatfield.

SOUTHAMPTON. June 30th. For the construction of Great Town Bridge, Whitchurch, consisting of four small brick arches with concrete abutments and piers, the construction of 1 mile of surface-water drains, and the construction of short lengths of surface-water drains, for the county council.—Mr. H. Barber, clerk, The Castle, Winchester.

Iron and Steel.

MERTHYR.—June 14th.—For laying and jointing water mains, for the corporation.—Mr. T. A. Rees, town clerk.

TEDDINGTON. June 16th.—For the supply and erection of pumping machinery, auxiliary plant, and pipework, at the sewage disposal works, for the urban district council.—Mr. Marshall Hainsworth, surveyor.

WALTON-LE-DALE.—June 16th.—For sinking well head and borehole, and supplying borehole pump and shafting, for the urban district council. Mr. G. J. Gibbs, 7 Lune-street, Preston.

LEISTON-CUM-SIZEWELL.—June 17th. For the supply of water mains, for the urban district council. —Mr. H. A. Mullens, clerk.

MARGATE. June 18th. For the supply of fencing, for the corporation.—Borough Surveyor.

SUTTON (Surrey).—June 18th.—For the supply of a new double vertical fire engine, for the urban district council.—Mr. Hedley Grieves, surveyor, Municipal Offices.

SALFORD. June 25th. For the supply of steel tie-bars, for the corporation. Tramways General Manager.

EAST GRINSTEAD.—June 28th.—For the supply of fencing and gates, for the urban district council. Mr. W. E. Woollam, engineer.

NORTHAMPTON.—No date.—For the supply of No. 1 385 lin. yds. of 6ft. high unclimbable fencing, for the corporation. Mr. Alfred Fidler, borough engineer.

Roads.

MACCLESFIELD.—June 14th.—Tenders invited for the purchase of tar.—Mr. F. R. Oldfield, town clerk.

STAINES.—June 14th.—For making up, paving, and surface draining, for the urban district council. Mr. E. J. Barrett, engineer and surveyor.

CROYDON. June 14th.—For tar paving and tar dressing playgrounds, for the Education Committee. —Mr. James Smyth, clerk, Education Offices, Katherine-street.

WILLITON.—June 14th.—For the hire of steam roller, for the rural district council.—Mr. F. Risdon, clerk.

HARROW-ON-THE-HILL. June 14th.—For the supply of broken granite, granite chippings, and limestone tar-paving, for the urban district council. —Mr. J. P. Bennetts, surveyor.

WAKEFIELD. June 14th.—For the supply of broken granite, broken whinstone, broken furnace slag, and team labour, for the rural district council. —Mr. Frank Massie, Tetley House, 47 Kirkgate, Wakefield.

HASTINGS.—June 14th.—For work of road rolling, for the rural district council.—Mr. A. R. Inskipp, clerk.

HALIFAX.—June 14th.—For private street works, for the corporation.—Mr. J. Lord, borough engineer.

MERTHYR. June 16th. For the supply of limestone, macadam, gravel, limestone chippings, granite or basalt, macadam and chippings, tar-macadam and chippings, for the corporation. Mr. A. J. Marshall, borough surveyor.

DOVER. June 16th.—For forming a roadway and building boundary wall, for the corporation.—Mr. W. C. Hawke, borough engineer.

BRISTOL.—June 16th.—For tar-paving playgrounds, for the Education Committee.—Mr. P. Addie, Exchange, Corn-street, Bristol.

HEBDEN BRIDGE.—June 16th.—For the reconstruction of footpaths, for the urban district council. Mr. T. Waddingham, engineer and surveyor.

REIGATE. June 16th.—For the construction of new streets and walks and surface-water culvert with other works, for the corporation. Borough Surveyor.

BARROW.—June 16th.—For making up streets, for the corporation. Borough Engineer.

SHEFFIELD.—June 16th.—For asphalting at schools, for the Education Committee.—City Architect.

TEDDINGTON.—June 16th.—For road works in several streets, for the urban district council.—Mr. M. Hainsworth, surveyor.

CHESTER-LE-STREET.—June 17th.—For making up sixteen private streets, for the rural district council.—Mr. G. W. Ayton, highway surveyor.

ESTON (Yorks).—June 17th.—For work of making up, for the urban district council.—Mr. Thomas Belk, clerk.

ALDERSHOT.—June 17th.—For making up a terrace, for the urban district council.—Mr. Fred. C. Uren, surveyor.

ILKLEY.—June 17th. For making up two streets, for the urban district council.—The Surveyor.

ELLAND.—June 18th.—For the repair of a street, for the urban district council.—Mr. J. Clarkson, clerk.

DALTON-IN-FURNESS.—June 18th. For making up several streets, for the urban district council.—Mr. W. Richardson, surveyor.

LEWES.—June 20th.—For scarifying and steam rolling, for the corporation.—Mr. Montague S. Blaker, town clerk.

WORCESTER.—June 21st.—For work of piling for a river promenade, for the corporation.—Mr. T. Caink, city engineer.

WEST ASHFORD.—June 23rd.—For the supply of granite, for the rural district council.—Mr. A. Sims, surveyor.

BATTERSEA. June 23rd.—For laying down Norwegian granite kerbing, for the borough council.—Town Clerk.

WANDSWORTH.—June 23rd.—For repairs in part of Moyser-road, Streatham, for the borough council.—Mr. P. Dodd, borough engineer.

YIEWSLEY.—June 23rd.—For kerbing and paving with concrete slabs, for the urban district council.—The Surveyor.

WOKINGHAM.—June 25th.—For fixing Norwegian kerb and channel, concrete slab paving and paved crossings, for the corporation.—Mr. C. W. Marks, borough surveyor and engineer.

HORNSEY.—June 25th.—For making-up work, for the corporation.—Mr. E. J. Lovegrove, borough engineer.

EAST SUSSEX.—June 26th.—For hiring steam rollers and scarifiers, for the county council.—Mr. Fred. J. Wood, county surveyor.

LAMBETH. June 26th.—For the supply of 40,000 ft. of paving flags, for the borough council.—Mr. H. Edwards, borough engineer.

BECKENHAM.—June 30th.—For the supply of 300 cub. yds. of tarred road material, for the urban district council.—Mr. John A. Angell, surveyor.

BECKENHAM.—June 30th.—For the supply of about 600 super. yds. of artificial stone paving, 2 in. thick, for the urban district council.—Mr. John A. Angell, surveyor.

Sanitary.

BERWICK.—June 16th—24th.—For constructing sewerage, cast-iron outfalls, manholes, and settling chambers, for the corporation.—Mr. R. Dickinson, borough surveyor.

DOVER.—June 16th.—For the erection of a public convenience, for the corporation.—Mr. W. C. Hawke, borough engineer.

SOUTH SHIELDS.—June 19th.—For the construction of a public convenience and shelter, for the corporation.—Mr. L. Roseveare, borough engineer.

LISTOWEL (co. Kerry).—June 19th.—For constructing main sewer, for the rural district council.—Mr. M. O'Connell, clerk, Union Offices.

CHELMSFORD. — June 19th. — For taking out, washing, screening, and replacing the coke in the bacteria beds, for the rural district council. — Mr. James Dewhirst, engineer.

SOUTH SHIELDS. June 19th.—For the erection of a public convenience and shelter, for the corporation. Mr. Leslie Roseveare, borough engineer and surveyor.

KIDDERMINSTER.—June 20th.—For the erection of a public convenience, for the corporation.—Mr. A. James, borough surveyor.

BEDWELLTY.—June 21st.—For laying sewers and surface-water drains, for the urban district council.—Mr. D. H. Price, surveyor.

ASHTON-UNDER-LYNE.—June 21st.—For the supply of 4,000 yds. of sludge press cloth, 41 in. wide, for the corporation. — Mr. Edward Stamp, manager, Sewage Disposal Works, Dukinfield.

BROMSGROVE.—June 23rd.—For the construction of sewers and sewage disposal works, for the rural district council.—Mr. W. Fiddian, engineer, Old Bank Offices, Stourbridge.

CHIPPENHAM.—June 27th.—For laying sewer and making connections, for the rural district council.—Mr. M. Awdry, clerk.

WHITTINGTON AND NEWBOLD.—June 30th.—For the construction of 1,600 yds. of 12-in., 15-in. and 18-in. earthenware pipe sewers, with manholes, tanks, filters, engine and pump house, machinery, and other works, for the urban district council.—Mr. Bathgate Comb, surveyor, St. John's-road, Whittington Moor, Chesterfield.

HAMPSHIRE.—June 30th.—For the construction of surface-water drains, for the county council.—Mr. W. J. Taylor, county surveyor, The Castle, Winchester.

TENDRING.—June 30th.—For laying sewer with manholes and ventilators, for the rural district council.—Mr. A. J. Martin, 7 Victoria-street, Westminster.

NORTH BROMSGROVE.—June 30th.—For the construction of 1,000 yds. of 6-in., 7-in. and 9-in. diameter stoneware pipe sewers, manholes, overflow chamber, ventilating columns, and other works, for the urban district council.—Mr. Francis T. Leven, clerk.

HOUGHTON-LE-SPRING.—July 1st.—For scavenging work, for the rural district council.—Mr. R. B. Marley, clerk.

ROWLEY REGIS.—July 1st.—For works of sewerage, for the urban district council.—Mr. D. Wright, clerk, Old Hill, Staffs.

MADRAS.—September 9th.—For the supply and delivery of English stoneware pipes and specials, varying from 4 in. to 21 in. internal diameter, and aggregating a total length of about 143 miles, for the corporation.—Messrs. James Mansergh & Sons, agents, 5 Victoria-street, Westminster, S.W.

Stores.

ATHERTON.—June 19th.—For the supply of materials, for the surveyor's, and gas and water departments, for the urban district council.—Mr. William Garnett, clerk.

LEEDS.—June 21st. For the supply of iron, steel, gas and pipe hooks, bolts, nuts, tin plates, tin ingots, shovels, coke forks, files, brushes, brackets, lead, lead tube, and Portland cement, for the Gas Committee.—Mr. R. H. Townsley, general manager, Market Hall, Leeds.

BIRMINGHAM.—June 23rd.—For the supply of general and engineering stores, for the electricity department.—Mr. R. A. Chattock, city electrical engineer, 14 Dale-end, Birmingham.

WEYMOUTH.—June 26th.—For the supply of brooms, brushes, ironmongery, iron castings, bricks, cement, stoneware goods, and timber, for the corporation.—Mr. K. J. S. Harris, borough surveyor.

KEIGHLEY.—June 30th.—For the supply of ironmongery, iron castings, pitch, oil, broken limestone, granite, earthenware pipes, and cement, for the corporation.—Borough Engineer.

Miscellaneous.

KING'S LYNN.—June 24th.—For the supply of 500 tons of coal (best hand-picked hards), for the corporation.—Mr. Alfred J. Smith, borough surveyor and waterworks engineer.

CHEPPING WYCOMBE.—July 8th. For a supply of best anthracite coal, for the corporation.—Mr. T. J. Rushbrooke, water engineer.

GAINSBOROUGH.—Offers wanted for two horse scrapers.—Mr. S. W. Parker, engineer and surveyor to the rural district council.

Drainage Works and Sanitary Fittings.—A third edition, revised and brought up to date, particularly as regards the questions of concrete sewers, sewer ventilation and flushing, and the Public Health Acts Amendment Act of 1907, still further evidences the success of this little manual,* which manifestly deserves the attention and confidence of all concerned in the important subject with which it deals.—*The Bookseller.*

* "Drainage Work and Sanitary Fittings." By Wm. H. Maxwell, Price 2s. nett. London: St. Bride's Press, Ltd., 21 Bride-lane, E.C.

TENDERS FOR MUNICIPAL WORKS OR SUPPLIES.

The Editor invites the co-operation of SURVEYOR *readers with a view to making the information given under this head as complete and accurate as possible.*

* Accepted. † Recommended for acceptance.

ABBEY MILLS.—For the renewal of steam piping at the pumping station, for the London County Council:—

Stewarts & Lloyds, Limited, Birmingham	£675
Stewarts & Lloyds, Limited, Birmingham (alternative tender)	636
J. Spencer, Limited, Wednesbury	232
British Mannesmann Tube Company, Limited, London *	189

ALFRETON.—For the supply of cast-iron pipes, and specials, and pig lead, for the urban district council.—Mr. R. F. Ward, water engineer:—

7-IN. CAST-IRON PIPES DELIVERED AT WINGFIELD STATION.

	Per ton. £ s. d.
Clay Cross Company, Limited, Clay Cross	6 17 6
Staveley Coal and Iron Company, Limited, Chesterfield	6 16 9
Stanton Ironworks Company, Limited, Nottingham	6 16 8
Sheepbridge Coal and Iron Company, Limited, Chesterfield	6 16 0
J. Oakes & Co., Alfreton *	6 13 6

TRENCHES.

Lane Brothers, Mansfield	£342
H. Bennett, Mansfield	331
W. W. Bateman, Chesterfield *	290
H. Ashley, Mansfield (withdrawn)	234

BARNOLDSWICK.—For making good certain streets, for the urban district council.—Mr. W. Ellis, engineer and surveyor:—

J. W. Hopkins, Earby	£326
W. J. J. MacDonald, Barnoldswick	309
Muff & Randell, Barnoldswick	303
J. Bradley & Co., Barnoldswick	293
J. R. Miles, Burnley	292

CHELTENHAM.—For cement rendering at No. 1 Hewletts reservoir, for the corporation:—

P. P. Gallagher & Son, Northampton	£3,000
A. & S. Hyslop, Bettws-y-Coed	2,911
J. J. Shardlow, Leicester	2,052
W. Higgins, Northampton	2,000
W. Drew, Cheltenham	1,811
M. Williams & Co., Cheltenham	1,651
T. Farley, Stourbridge	1,488
Williams & Co., Kidderminster	1,455
S. B. Dix, Cheltenham	1,354
J. C. Pearce, Cheltenham	1,327
W. Cresswell, Cheltenham	1,108
Collins & Godfrey, Cheltenham	1,078
Emery & Co., Aston	921

COVENTRY. For the erection of 104 workmen's dwellings, for the corporation.—Mr. J. E. Swindlehurst, borough engineer:—

Teanby & Son, Sheffield	£29,353
Kelley & Son, Foleshill	27,773
T. Higgs, Northampton	26,400
Bosworth & Lowe, Nottingham	25,435
— Garlicks, Coventry	25,205
Thomas & Sons, Oswestry	24,698
W. Crane, Limited, Nottingham	24,623
T. Elvins & Sons, Birmingham	24,570
Clarke & Sons, Coventry	24,173
B. Whitehouse & Sons, Birmingham	24,165
Shaw & Nicholas, Coventry	23,691
Orr Brothers, Coventry	23,182
H. Goode & Son, Coventry *	23,036

DORKING.—For the supply of broken granite and hire of steam roller, for the urban district council. Mr W. A. Clegg, surveyor:—

GRANITE.

	Per ton. s. d.
A. & F. Manuelle, Gracechurch-street, E.C.	15 11
Mowlem & Co., Grosvenor Wharf, Westminster	15 6
Rowe & Mitchell, Denman-street, London Bridge	15 6
Penlee and St. Ives Stone Company, Queen-square, Bristol	15 —
London Granite Company, Water-lane, Great Tower-street, E.C.	15 4
British Macadams, Limited, Cannon-street, E.C.	15 1
Road Maintenance Company, Cannon-street, E.C.	15 1
Enderby and Stoney Stanton, Narborough, near Leicester	14 6
Croft Granite Company, Croft, near Leicester	14 6
Croft Granite Company, Croft, near Leicester	14 6
Mountsorrel Granite Company, Mountsorrel, near Leicester	14 6
St. Keverne Stone Company, Church-street, Helston, Cornwall	13 6

STEAM ROLLING.

	Per day. £ s. d.
W. G. Smoothy & Son, Engineering Works, Rochford	1 8 0
Eddison Steam Rolling Company, Dorchester	1 7 5
T. Rowley, junr., Carlingford-road, West Green, London *	1 1 6

HERTS.—For the erection of a new police station at Tring, for the county council.—Mr Urban A. Smith, county engineer:—

Brightman & Son, Watford	£1,150
Fassnidge & Son, Uxbridge	1,106
McCormick & Son, London	1,052
Watts & Co., Finchley	1,040
W. Payne, Leavesden	942
Webster & Cannon, Aylesbury	898
Honour & Son, Tring *	893

BARNSLEY.—Accepted for making up Grove-street, for the corporation.—Mr. J. H. Taylor, borough surveyor:—
F. Taylor, Barnsley, £1,448.

LEICESTER.—For the erection of the Oadby handicraft centre, for the county council.—Mr. E. G. W. Fowler, architect and surveyor:—

J. Chapman & Sons, Limited, Leicester	£899
T. Barker & Sons, Loughborough	885
J. C. Kellett & Son, Leicester	879
Cope & Hales, Oadby, Leicester	873
E. Fox, Leicester	868
W. Potter, Blaby, Leicester	860
H. D. Smith, Wigston, Leicester	859
Haycock Brothers, Great Glenn, Leicester *	853

NORBURY.—For the construction of roads and sewers, for the London County Council:—

J. Ford, Willesden-junction	£9,201
W. H. Wheeler & Co., Limited, Blackfriars	7,481
W. Griffiths & Co., Limited, Bishopsgate, E.C.	6,864
J. Mowlem & Co., Limited, Westminster	6,540
E. Iles, senr., Croydon	6,137
F. J. Coxhead, Leytonstone	5,896
H. Woodham & Sons, Catford	5,791
W. Hall, Thornton Heath	5,698
E. B. Yewen, Croydon	5,626
H. Farrow, Brixton	5,586
G. Wimpey & Co., Hammersmith †	5,355

Architect's estimate, £5,950.

PADDINGTON.—For No. 1 sewers general work, for the borough council.—Mr. E. B. B. Newton, borough surveyor:—

Tenders at a percentage above or below rates fixed in the Schedule.

	One year. Above	Below.	Two years. Above.	Below.	Three years. Above.	Below.
E. Rogers & Co.	—	7½%	—	7½%	—	7½% *
Markham & Markham	Schedule		2½%	—	2½%	—
W. Manders & Co.	15%	—	15%	—	15%	—
H. Sabey & Co.	17½	—	17½%	—	17½%	—
John Abrahams, Ltd	Schedule		Schedule		Schedule	
J. Latter	—	1½%	—	3½%	—	3½%
D. R. Paterson, Ltd.	15%	—	15%		15%	—
W. Boyer & Sons	12½%	—	—	—	—	—
Henry Boyer	15%	—	14%	—	12½%	—
E. T. Blomfield	—	3%	—	1%	—	6%

SHORT HEATH.—For the construction of sewage disposal works, for the urban council.—Mr. J. Lycett, surveyor:—

J. Owens, Wolverhampton	£1,199
G. P. Trentham, Limited, Birmingham	1,194
Hammond Brothers, Darlaston, Staffs	1,137
H. Holloway, Wolverhampton	1,070
Currall, Lewis & Martin, Birmingham	1,048
J. Langley, Birmingham	1,045
H. Dorse, Cradley Heath, Staffs	980
Childs & Withers, Worcester *	964

STOCKPORT.—For making up certain streets, for the corporation.—Mr. J. Atkinson, borough surveyor:—
Gosling & Stafford, London-road, Hazel Grove, £1,331.

STOWMARKET.—For the supply of broken granite, for the urban district council.—Mr. G. W. Lingwood, surveyor:—

GRANITE.

	Per ton. s. d.
British Macadams, Limited	13 4
Ellis & Everard, Limited	13 3
Enderby and Stoney Stanton Granite Company, Limited	13 2
London Granite Company, Limited	12 11
Lavender & Bateman	12 11
Croft Granite Brick and Concrete Company, Limited	12 11
Jee's Hartshill Granite and Brick Company, Limited	12 7
Groby Granite Company, Limited	12 3
E. H. Woodmancy	11 11
Johnston Brothers †	11 6

FLINTS.

C. R. Ayton (4 in.) †	6s. per ton.

STREATHAM AND BALHAM.—The London County Council in 1912 accepted the tender, amounting to £34,319, of Messrs. E. Bentley & Son for the construction of the Streatham and Balham relief sewer. Included in the contract is a sum of £175 for the provision of a penstock, and the undermentioned tenders have been received for this work:—

J. Cochrane, Barrhead	£220
Markham & Co., Limited, Chesterfield	210
G. Waller & Son, Stroud, Glos.	190
Glenfield & Kennedy, Limited, Kilmarnock	145
J. Blakeborough & Sons, Brighouse *	130

TROWBRIDGE.—For the conversion of primary and secondary contact beds to percolating filters, including the erection of sewage distributing machinery, also the construction of humus tanks, sludge-water and sludge drains, manholes, chambers and other work, for the urban district council.—Mr. H. G. Nicholson-Lailey, engineer:—

F. & E. Small, Taunton	£14,937
Wort & Way, Salisbury	14,088
Chivers & Sons, Devizes	13,995
J. Ford, London	13,950
Johnson & Langley, Leicester	13,568
J. Shardlow, Leicester	13,355
G. Pollard & Co., Limited, Taunton	13,120
E. Ireland, Bath	12,868
J. Riley, Cheltenham	12,217
H. Isley & Co., Trowbridge *	12,029

The Surveyor

And Municipal and County Engineer.

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Minutes of Proceedings.

The Control of Water.*

The value of a treatise upon an engineering subject depends on the possibility of its useful application. The opinion held by most engineers with regard to theoretical works of this kind is the result of failure to apply the teachings of the theorist after earnest effort. Elaborate calculations will frequently produce a result which is manifestly absurd simply because the theorist, lacking practical engineering experience, has failed to take the whole facts into account in laying down his rules. Thus every engineer finds sooner or later that experience and conclusions based on the results of well-conducted observations must be relied upon rather than purely theoretical calculations. Again, the theorist generally carries his calculations beyond the point of usefulness simply from his lack of knowledge of practical requirements, the result being that we have a large number of text-books which are supposed to be edifying for students and which are of use in preparation for examinations, but which, to be quite candid, are of comparatively little value to the engineer. The true engineer does not, however, ignore the possibilities of accurate mathematical calculation, and experience alone can teach him its limits of usefulness on any particular work. Thus, the value of a book which, in dealing with an engineering subject, demonstrates the extent of useful calculations, and omits all that is doubtful or which had been found by experience to be useless, giving in its place practical advice, is great.

Mr. Philip à Morley Parker has produced a book on the Control of Water as applied to irrigation, power and town water supply purposes which, as stated in the preface, is the result of actual engineering experience, and is based on a collection of notes and formulae which have been prepared and used in ordinary practice. It is a very remarkable book of a most comprehensive character. It contains over 1,000 pages of clearly written matter, diagrams, examples, tables, formulae and calculations. While at the first glance it appears to be highly theoretical, closer study shows that it deals with the essential points of practical work and theoretical calculation in the most complete manner, but only so far as to be useful to the engineer. The author omits with considerable care an enormous amount of matter which, being quite irrelevant, is generally included in an engineering treatise. Large as the work is, and elaborate as the calculations undoubtedly are, the author's statement that the treatment of the theoretical parts is purposely cursory is quite true. The book treats of practical engineering matters pure and simple. Where necessary, complete specifications are given, and the reader gains confidence in the author from his exact description of practical matters and difficulties, such as the cracks which occur in concrete, the preparation of puddled clay for dams, the construction of culverts, and many other practical details which are ignored in most treatises, but which nevertheless give the engineer great trouble.

It is impossible in brief space to do more than comment generally on so large a work. Probably the most valuable section of the book is that which deals with dams and reservoirs. A very large number of instances are quoted, while special reference is made to various failures, the causes of which are discussed, while the formulae and calculations referring to many types of dam should be most useful owing to the practical way in which they are presented. It is interesting to note that the author speaks very favourably of reinforced concrete dams, drawing attention, however, to the certainties of failure where the material or foundations are defective. On the other hand, the omission of the reinforced concrete pipe from the section which deals exhaustively with cast iron, wrought iron, steel, and wood stove pipes is remarkable, seeing the importance of this economical form of water main. Also the author says very little about wells as sources of supply, although he deals very completely with the collection of water and flood discharge. The section relating to water purification is very complete, with the exception that there is very little information given with regard to sterilisation, the author apparently considering the application of the new methods as being outside the work of the engineer. It seems that there is much which ought to be said with regard to such work, which is frequently done very badly by chemists when the engineering part of the work is left to them. The book is otherwise a very full work of reference for water engineers. It is not a text-book for students, but is to be recommended to all technically trained water engineers, and it will also be of value in the hands of draughtsmen and assistants.

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The Road Congress.

The long period of active preparation for the Road Congress is now drawing to a close. A comprehensive and well-conceived programme has been arranged, combining the prosecution of the immediate aims of the congress with activities which, while they are less obviously directed towards the improvement of roads and road systems, have probably quite as great an effect in the long run as

* "The Control of Water, as Applied to Irrigation, Power, and Town Water Supply Purposes." By Philip à Morley Parker, A.M.I.C.E., A.M.AM.SOC.C.E., M.D.I.V., B.A.(CANTAB), B.C.E.(MELBOURNE). Price 21s. net. London: George Routledge and Sons, Ltd.

have the more formal proceedings of a congress. Full details of the arrangements for meetings and excursions will be found in another part of this issue, and we have also prepared a detailed account of the various exhibits of machinery and plant which will be displayed at the Royal Horticultural Hall. The official programme should, of course, be consulted by all who are taking part in the congress, but we have endeavoured to place before our readers something which may serve to convey distinct impressions of the nature and order of the various proceedings, in a form convenient for study beforehand. Attention may be drawn to the important fact that in addition to the official excursions there are scores of trips which can be made by omnibus. There are runs of eight, twelve, and fifteen miles along important main roads leading out of London, and the transition from roads with trams to roads without trams, from street paving to country road crusts, from dense city traffic to the ordinary traffic of a country main road, cannot fail to be of great interest to visitors from remote country districts and foreign countries. In addition to the study of main routes which is thus afforded, there are in some cases opportunities for studying secondary roads, many of the omnibus services during the summer being specially arranged so as to afford opportunities for visiting districts of great natural beauty or rural charm.

So wide is the range of the Road Congress and so very great the number of subjects to be discussed, that it is quite impossible to regard the more technical of the proceedings as matters which can in any sense be disposed of by the congress itself and the comments of high authorities or technical journals. The series of congresses of which the London Congress is the third should rather be considered as providing the profession of highway engineering and the authorities concerned in highway administration with materials for use, in each case, during the interval between one congress and another. It is hardly to be expected that in any period of less than two years the enormous mass of material dealt with at one of these congresses can be fully considered by those who are responsible for distinguishing between what is important and what is merely interesting, between what is vital and what is accessory, between what is lasting and what is only of temporary importance.

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Resolutions Proposed by the General Reporters.

In another part of the present issue the reader will find the resolutions proposed by the general reporters of the different "questions." Here we have something in comparatively little compass which is indicative of the general tenour, in each case, of the papers submitted and the discussions held. It is unnecessary to consider to what extent the individual reporters are responsible for expressing in a few words the general trend of opinion in their sections, or, on the other hand, to what extent their resolutions convey the sense of majority or unanimous decisions of the committees. These are matters on which the proceedings at the congress itself will throw light; the important fact for present consideration is that these resolutions indicate definitely specific points which will be discussed. As regards the planning of new streets and roads, we find that both technical and administrative matters are considered, and the subject of fresh legislation is introduced. The resolutions on the second question relate entirely to technical matters, and the same applies to the third question, except in so far as the procedure recommended involves the establishment of administrative conditions necessary in order that the tests and records referred to can be duly made. The resolutions on the fourth question, relating to wood paving, are all technical in character, with the exception of No. 3, relating to investigations and laboratory experiments. The fifth question relates to a subject in which administrative and technical considerations are so closely bound up together that they cannot usefully be separated for the purpose of study from the administrative or technical points of view. It may be suggested that there are among these resolutions on the fifth question several which will be very actively debated. The underlying principles of illumination are quite definite, and their application to different conditions is often more a matter of common sense than of engineering. The real difficulty in coming to definite conclusions on the subject of the illumination of roads and streets or the lighting of vehicles is a moral rather than a technical one. This applies particularly to the lighting of vehicles. The sixth question is covered by five resolutions which obviously and necessarily challenge discussion, though in most cases, it may be suggested, the nature of the subject dealt with is such that opinions will differ rather in degree than in principle, while a notable feature of these resolutions is the definite acceptance of the fact that in many cases further observations must be made and further experiments carried out before definite conclusions can be arrived at. As regards the seventh question, regulations for fast and slow traffic on roads, seven of the eight resolutions are such as invite the expression of opinion, for or against, without any considerable amount of discussion. It is obvious that opinion on the whole will be strongly favourable to most of these resolutions, a point requiring further consideration being how they are to be carried out; but resolution No. 3, recommending that in all large cities there should be a traffic authority, is one which seems likely to lead to an interesting discussion. The eighth question relates to a subject which is usually considered as highly controversial, but the introductory paragraph should go some way towards eliminating a good deal of matter which is too often regarded as generally pertinent, though it is really of importance only in particular cases. The resolutions relating to the ninth question seem intended merely to start discussion on the important subjects included in its scope. It may be suggested that it is of great importance that resolution No 3 should be very fully discussed.

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The Question of Canal Development.

It is not surprising, its importance being such as it is, that the subject of road construction and maintenance has of late monopolised the attention of the authorities concerned with it. There is evidence, however, that another matter, that of canal development, is beginning once more to command attention from local bodies. Just how long this question has received consideration more or less serious from the public we hardly like to say. For something like a couple of generations sporadic interest has been bestowed upon it, and those periodical revivals have included an inquiry by a Royal Commission, which recommended among other things the acquisition by the State of four trunk and the subsidiary canal routes. Recently interest in the national waterways has been renewed, especially in the Midlands and the North. The Derby Town Council have passed a resolution urging that legislation should be promoted to give effect to the proposition of State control, and the Dudley Town Council have also advocated the formation of the suggested Waterways Board accompanied by State ownership. It is pointed out that the cheaper facilities of transit in Germany, France, and Belgium are in no small measure due to the fact that in these countries canals compete not unsuccessfully with other means of conveyance, and that this is entirely due to the fact that there the waterways have been maintained in a condition of efficiency and activity. In this country, on the other hand, canals have been neglected, and, to an extent, despised, with the result that as a competitive force their value has become almost negligible. The subject has a closer connection with road adminis-

tration than appears on the surface, and for this reason, as well as many others, we welcome the action of the Dudley and Derby Corporations in seeking to bring it within the range of practical politics.

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Municipal Engineers and Private Practice.

The question of the desirability or otherwise of municipal engineers carrying on private practice in their districts is one which has been debated on many occasions. Indeed, it can hardly be that so many surveyors would of their own free choice desire to add to their already arduous duties as public officials, and the very frequency with which the question arises suggests that the underlying cause is the necessity which many men feel for eking out an inadequate salary by undertaking outside work. There is probably nothing unlawful in a surveyor acting professionally for persons within his district, but we agree with the opinion expressed by the learned authors of Lumley's "Public Health" that such conduct may lead to a mischievous result. We are aware, however, that this is a matter in regard to which it is difficult to lay down any rule, as so much must depend upon the circumstances of each case. Our opinion, however, is decided enough to cause us to note with satisfaction the course adopted by the Lowestoft Town Council in granting to their assistant surveyor an increase of salary on the occasion of their passing a resolution precluding him for the future from taking private practice. We feel that this is a step in the right direction which we trust will not be detrimental in any way to the officer concerned. At the same time, the action of local architects in complaining that the assistant surveyor was doing private work "to their detriment" is to be resented, inasmuch as they were only called upon to meet competition which in the circumstances was perfectly lawful. Further, the methods adopted to get rid of this competition by making against the assistant surveyor charges which investigation showed to be without foundation do not reveal a very fine sense of the courtesy and consideration which one professional man owes to another.

* * *

The Case for Superannuation.

For many years now we have been consistently advocating legislation conferring upon every municipal officer the right to an adequate allowance by way of superannuation after a life spent in the public service. There is a tendency when considering the special circumstances in which municipal engineers are placed to confuse the question of superannuation with that of security of tenure. As we have been at pains to point out hitherto, however, these questions are really quite distinct, and a case which has recently been brought to our notice affords an excellent illustration of the fact that an official who enjoys security in his appointment until he is well past the usual pensionable age may nevertheless suffer grave hardship owing to the circumstance that he is not legally entitled to a pension. The official to whom we refer has held responsible appointments as surveyor to a local board or district council for thirty years, the last twelve of which have been spent in the service of an urban district council. Having now completed the three score years and ten which the Psalmist allots as the normal extent of man's life, he finds that instead of entering into the honourable retirement to which he is so well entitled he has to accept an appointment as assistant-surveyor at a much reduced salary. While we are aware that "hard cases make bad law," we are prepared to contend that a career such as that which we have just outlined affords an excellent illustration of the proposition that in regard to the superannuation of Local Government officers the law as it at present exists is by no means consistent with justice. Every instance of this kind which is brought to light should spur every officer on to do all that lies in his power to assist the efforts which are being made to secure a remedy for a very real grievance.

* * *

The Metropolitan Water Board Bill.

The Metropolitan Water Board (Various Powers) Bill, which is now before Parliament, as originally drafted contained a clause which, had it been allowed to stand unamended, would have inflicted considerable hardship upon the local authorities affected. The clause in question required the immediate substitution of modern hydrants for existing fire-plugs, and the principal objections put forward by the petitioners against the Bill were two. In the first place it was said that the passage of the clause would saddle local authorities with a very heavy expenditure; and second, that in many cases the existing fire-plugs were quite efficient for the purpose for which they were used, and that if they were to be replaced the cost should fall upon the Board and not upon the locality. The clause was materially modified in Committee to meet these objections. As regards the former, it was provided that the work of substitution should be spread over a period of ten years; while the latter point was met by limiting the operation of the section to "obsolete" or unsuitable fire-plugs. In case of dispute the question whether plugs are obsolete is to be determined by arbitration; but the board appear to have admitted in the course of the discussion that a fire-plug fitted with a controlling valve or cock is as efficient as a hydrant. The local authorities concerned are to be congratulated upon their successful opposition to a clause which, had it been passed in its original form, would have inflicted considerable hardship upon the ratepayers of their districts.

* * *

A New Book on Asphalt and Bitumen.

In view of the approaching Road Congress, the attention of highway engineers and surveyors may specially be directed to a review of Mr. Arthur Danby's book on "Natural Rock Asphalts and Bitumens," which appears in another part of this issue. All who intend to take part in the discussion of the subject at the Road Congress should consult this book, a study of which will tend usefully to concentrate discussion on really important points. It is obvious that only a small portion of the time available for discussion can be given to this particular subject, but there will certainly be many private discussions in which engineers from different countries will take part, and no one who wishes to hold his own in such encounters — as some of them will doubtless be—can afford to be without the latest and best information as regards the materials themselves and the views which well-known experts hold as regards their use.

* * *

Surveyors' Institution Examinations.

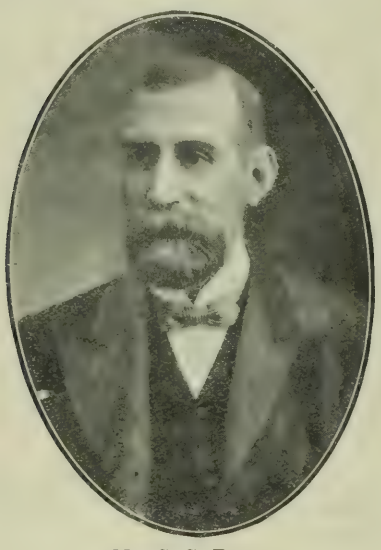
Our attention has been called to a possibly misleading statement which occurred in the course of a "Minute" on this subject in our last issue. The position is that candidates who have been referred back in their "typical" subject will still have the privilege of taking that one subject again at a subsequent examination. The new regulations make no alteration in this respect; but they do provide that, after waiting until next March to be re-examined in only one subject, the candidate (assuming he is then successful) cannot be elected as a professional associate of the institution until he has passed the final examination, for which he must wait until the following March. We may perhaps take this opportunity of renewing the invitation which we gave last week to the candidates affected to communicate with us with a view to the presentation of a memorial to the council of the institution.

Some of the More Recent Municipal Works of Rochdale.*

By S. S. PLATT, M.INST.C.E. Borough Surveyor.

This meeting is intended primarily as a visit to some of the works carried out by the author since the last visit of the institution in 1897, and the following description is offered to explain the principal features of interest to members, rather than that of a paper for discussion.

In vol. xxiii. (1897) of the "Proceedings" was given an account of some of the chief municipal works of Rochdale at that date—viz., the town hall, technical school, free library, new fire station, sewage disposal works, and an interesting sewer crossing under the Rochdale Canal.



Mr. S. S. Platt.

To recapitulate shortly for the benefit of members who do not possess vol. xxiii., or The Surveyor of May 28, 1897, containing the description of the sewage disposal works in 1897. The sewage, then about 1,250,000 gallons per day dry-weather flow, was passed through a detritus catch-pit and screening chamber, after which alumino-ferric was added, and when necessary sulphuric acid to neutralise the excessive alkalinity due to flushes of wool scouring trade refuse. The sewage then passed through one of two roughing tanks, each having a capacity of 105,000 gallons, then through six precipitating tanks each of a capacity of 200,000 gallons; total capacity of tanks equals 1,410,000 gallons. The tank effluent was then passed on to twenty-four land filtration plots having a total area of 60 acres. The final effluent from the land was discharged into the river Roch at six outlets. The precipitated sludge was pressed in four presses, since increased in 1908 to six, and improved by new mechanical arrangements for opening and closing.

The amount of pressed sludge, 1912-13, was 4,050 tons.

Extension of the Sewage Disposal Works, Roch Mills (1913).

Plate I.—Owing to the abnormal foulness of the sewage and the increased volume now delivered to the works caused by the coupling up of districts which were not connected to the main sewers of the borough, the land proved to be inadequate for dealing with the sewage in a satisfactory manner, and the surface of the land filtration plots became coated over with sludge from the tank liquor, causing the water to lie in lakes on the plots, and an unpleasant odour to be given off when any of the plots were "dried off." In 1901 the author presented a report dealing with this matter, and advised a scheme to be carried out, including an installation of percolating filters for the treatment of the major portion of the sewage and to act as a relief to the land. Owing to various causes this portion of the scheme was not carried out, but the whole of the land was rested and relevelled where necessary, deep ploughed and cropped, and the sludge on the surface was disposed of. Also 5¼ acres of contact beds were constructed out of rates, at a cost of about £6,500, and have since been used to supplement the land in dealing with the sewage. This subsequently proved to be only a temporary relief, and as no more suitable land available for the purpose was to be had in the neighbourhood, or even for a considerable distance, the author again advised that it was only possible to look for means of improvement in bacterial beds as a supplement and relief to the existing arrangements.

In regard to the foulness of the sewage previously referred to, the Royal Commission on Sewage Disposal, in the Third Appendix to the Fifth Report, issued in 1909, at p. 450, state that—"The above figures show the Rochdale sewage, as judged by the hourly samples, to be very strong, especially in oxidisable matter," and, after giving further particulars, conclude as follows: "Nothing more requires to be added to emphasise the foul and greasy character of Rochdale sewage." It may be interesting to mention that in September, 1899, two experimental percolating filters, having an area of 400 sq. yds., 9 ft. deep, of gas coke, 1½-in. gauge and upwards, were installed on "Whittaker & Bryant's" principle, and have been worked continuously since that date up to the present with varying quantities of both septic and chemically precipitated sewage effluent, and within that time the Royal Commission paid two official visits to the works, and the officers of the commission paid frequent visits of inspection, and made analyses of many samples of effluents from these beds under varying conditions of working. Ordinarily the filters were worked at a volume of 133 gallons per cubic yard per twenty-four hours, but at the request of the Royal Commission this volume was in the case of chemically precipitated effluent gradually increased up to 250 gallons per cubic yard, when their tests were discontinued, the results of which it is expected will appear in a subsequent report.

As the result of the satisfactory continued working of these experimental filters, and also the successful working of an installation since 1905 of six similar filters at a branch sewage works in the southern part of the borough at Castleton, the author in May, 1910, submitted a complete scheme of extension and alterations which, in his opinion, were necessary for the satisfactory disposal of the sewage tributary to the Roch Mills works.

In order to comply with the requirements of the Local Government Board, it was necessary that provision should be made for three times the dry-weather flow of sewage to be treated as sewage, and that an additional volume of three times the dry-weather flow should be treated as storm water. The recommendations of the Royal Commission having included in their Fifth Report the dealing with the storm water in special settling tanks, the author designed the scheme accordingly.

The sewage tributary to these works was discharged at two outfalls at opposite sides of the farm, and the ordinary dry-weather flow at both outfalls was about 2,250,000 gallons per twenty-four hours, but for the purpose of the scheme the total dry-weather flow was taken at 2,750,000 gallons to allow for anticipated increase at an early date due to extension of the main sewerage system, and for increase expected from conversion of pail closets to the water-carriage system, and this would make a volume of 8,250,000 gallons of sewage to be treated as sewage, and an equal volume of diluted sewage to be treated as storm water. It should be mentioned that heretofore the flow of sewage tributary to the minor outfall (the Sudden Valley)—about 500,000 gallons per day—was treated in a set of three precipitating tanks of a total capacity of 300,000 gallons, and the extension scheme provides for utilising these existing tanks for treatment of the storm water only due to that outfall, and diverting the sewage up to three times the dry-weather flow by a new line of pipes to the main works, so as to enable the whole of the sewage flow from both outfalls to be screened and

* Paper read at the meeting of the Institution of Municipal and County Engineers held at Rochdale on Saturday last.

dealt with at the Roch tanks, and for this purpose the inlet arrangements at main works have been altered and the provision made in duplicate of new entrance channels, detritus catchpits, screens, chemical mixing channels, &c. In order to increase the tank capacity it is proposed to construct an additional tank adjoining the No. 6 of the Roch tanks, with a capacity of 200,000 gallons, which, added to the existing tank capacity of 1,410,000 gallons, will give a total tank capacity of 1,610,000 gallons, or equal to rather more than fourteen hours' flow of the dry-weather sewage.

After having undergone chemical precipitation while passing through the tanks, the tank liquor drawn off at either end of the tanks, to the extent of 450,000 gallons of the daily dry-weather flow, will be dealt with on 45 acres of the land already laid out for filtration, after it has been relevelled where necessary, cropped to take off the sludge, and deep-ploughed and subsoiled; the remainder of the dry-weather flow (2,300,000 gallons) will pass by gravitation through a new pipe line under Roch Mills-lane and over the river Roch to a pump well situated at the westerly side of the farm, on each side of which will be placed the installation of percolating filters to treat the major portion of the tank liquor. As the yard per twenty-four hours during the time that the smallest volume has to be dealt with. The Local Government Board, as a condition of giving their sanction, reduced the volume to be treated on these filters to 65 gallons per cubic yard for dry-weather flow and 195 gallons for three times diluted flow, the result being that the number of filters had to be increased from twenty-three to twenty-six. These are to be in two groups, thirteen being placed on each side of the pump-house, the first half having been constructed and brought into use, and the remainder to be constructed within a short period after this first installation has been brought into operation.

The floor of the filters has been constructed of cement concrete, rendered smooth and made to fall to channels provided for the collection of the effluent. The outside walls of the filters are constructed of pigeonholed brickwork, and a false bottom is formed by means of 15-in. diameter perforated half-pipes, upon which is placed the filtering material, consisting of gas coke (obtained from the corporation gas-works) which has had all smaller than 1½-in. taken out of it. In the centre of each of the filters is a shaft of brickwork, on the top of which rests the body of the sprinkler for distributing the tank liquor, consisting of six revolving arms of iron pipes, perforated

Roch Mills Sewage Works Extensions, Rochdale.
(Plate 1.)

top of the filters is above the level of the tanks, it was necessary to provide for the requisite pumping plant, to house which has been erected a building adjoining the pump well previously mentioned, and in which has been installed centrifugal pumps driven by electric motors. Each pump unit is capable of delivering 3,450,000 gallons per day into an overhead tank adjoining the pump-house. This tank is elevated sufficiently to feed by gravitation the automatic revolving sprinklers for distributing the tank liquor on the surface of the filters.

In order to safeguard against a breakdown, and to comply with the requirements of the Local Government Board, a "stand-by" electrically-driven pumping plant is provided, as continuous pumping will be necessary in order to deal with the sewage flow to the works. As previously mentioned, it is intended to treat the tank liquor so pumped on lines based on the results of the two experimental beds at Roch Mills, continuously worked since September, 1899, and on similar lines to the installation constructed in 1905 at the Castleton sewage disposal works.

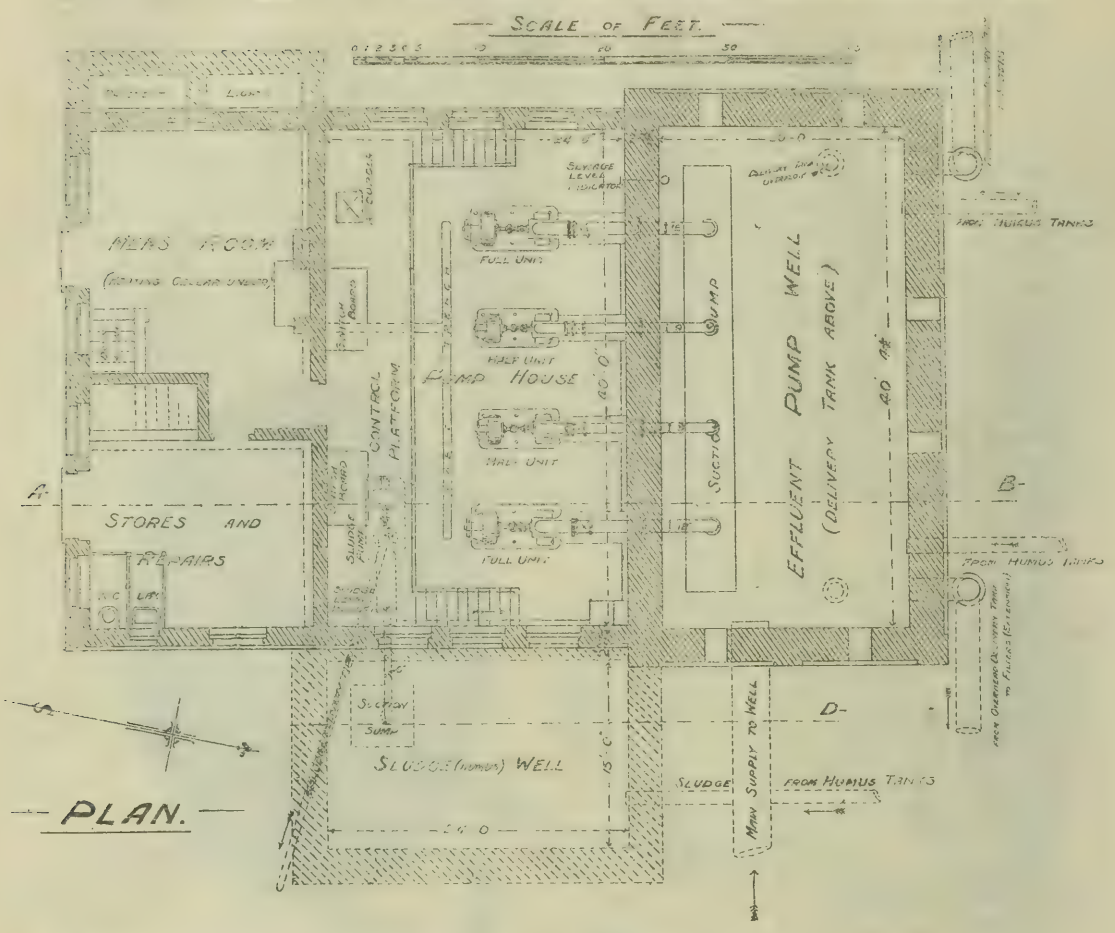
The scheme provided for the laying down of twenty-three percolating filters, each 72 ft. diameter, 9 ft. deep, with a surface area of 452 sq. yds. The quantity of tank liquor treated was proposed to be at the rate of 220 gallons per cubic yard per twenty-four hours during the time that the greatest volume has to be dealt with, and at the rate of 73⅓ gallons per cubic at varying distances so as to ensure a uniform distribution over the whole of the upper surface of the filter.

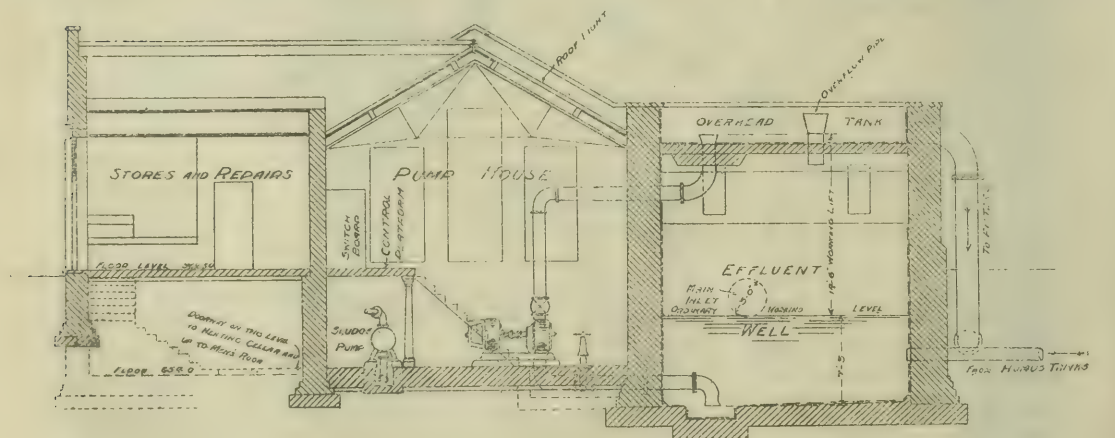
After the tank liquor has passed through the filters it flows by means of channels to the humus tanks, two in number, each of a capacity of 225,000 gallons, through which it is allowed to pass slowly and deposit as much as possible of the heavier portion of the fine solid matters that are in suspension.* These tanks are provided in duplicate so that they can be cleaned out alternately, the top water being run off into the pump well, and then retreated on the filters; the deposited matter, in the form of very thin sludge, gravitating to a sludge well adjoining the pump well, from which it is pumped by a centrifugal pump through a 6-in. sludge main to the new Sudden outfall to mix with the sewage treated at the tanks. Arrangements have been designed that the filter effluent, having passed through the humus tanks, can, if necessary, be dealt with on the adjoining fine ash beds, 2½ acres (now used as secondary contact beds), when they have been converted by a different arrangement of feed into streaming filters.

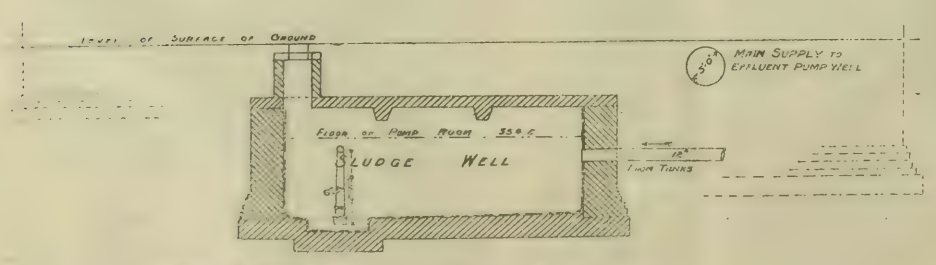
PUMP-HOUSE BUILDINGS AND PLANT.

Plate No. 2.—These are situate midway between the two stacks of percolating filters, the one already constructed and the one included in the full scheme, and

* The final effluent passing to the River Roch.





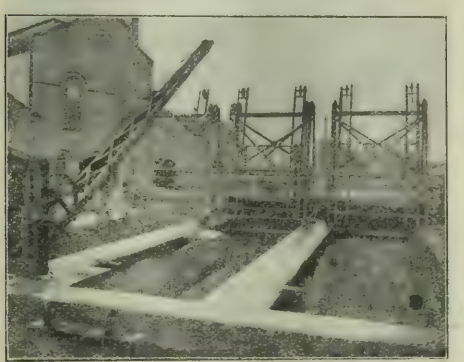


ROCH MILLS SEWAGE DISPOSAL WORKS: ELECTRICALLY DRIVEN CENTRIFUGAL PUMPING PLANT.

(Plate 2.)

opposite the south end of the humus deposition tanks. The buildings are one storey in height above ground, finished in Accrington facing bricks with Yorkshire stone dressings. They comprise a pump-room, 40 ft. by 24 ft.; men's messroom, 19 ft. by 18 ft.; store and repair room, 18 ft. by 15 ft., with lavatory, &c., and heating chamber in cellar; also tank effluent well (pump well), 40 ft. by 20 ft., with overhead delivery tank of the same dimensions, and a sludge well, 24 ft. by 15 ft. The rooms internally are finished in Accrington facing bricks, with glazed brick dado in pump-house. The tank effluent is delivered to the pump well through a 3-ft. diameter cast-iron pipe, which has a larger discharge capacity than required, but acts as additional storage in conjunction with the pump well.

The well is built of brickwork in cement, lined with "Breala" asphalt put on in two coats, and supports the overhead delivery tank, 3 ft. 3 in. deep, the floor of which is in reinforced concrete, 9 in. thick, both



CATCHPITS, SCREEN AND CHEMICAL MIXING PLANT, ROCHDALE.

(Plate 3.)

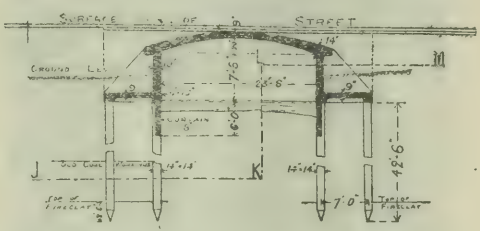
floor and side being lined with asphalt. The floor of this tank gives a head of 1 ft. above the level of the top of the percolating filters. The whole of the plant installed for pumping the tank effluent from this well to the overhead delivery tank, which commands and feeds the percolating filters, has been supplied and erected by the Rees Roturbo Manufacturing Company, Limited, of Wolverhampton. It consists of four electrically driven centrifugal pumps of their Roturbo pressure-chamber type, each directly coupled to a semi-enclosed direct-current motor of their own manufacture. The plant is arranged in two full units and two half-units. Each full unit can lift 3,450,000 gallons in twenty-four hours (or at the rate of 2,400 gallons per minute) to a height of 14 ft. 6 in., which is the ordinary working lift. Any two full units are capable of pumping the maximum flow to be treated on the percolating filters viz., 6,900,000 gallons per twenty-four hours the remaining unit being provided as a stand-by in case of breakdown. The half-units are provided to deal with the reduced night flow, and with the variations of the ordinary flow. It should be noted that the plant is of sufficient capacity for the full scheme, which includes an additional thirteen percolating filters. All the pumps have "drowned" suction pipes, the sizes of the suction and delivery pipes of the full units being 12 in. diameter, and of the half-units 9 in. diameter. The full units have 20-b.h.p. motors, and the half units 10-b.h.p. motors.

For dealing with the humus from the deposition tanks, which flows by gravitation into the sludge well previously mentioned, a pump of similar type to the other pumps has been installed, with 6-in. diameter suction and delivery pipes, driven by a 10-b.h.p. motor. In this case the pump is not "drowned," but is primed from the tank effluent pump well. This pump raises 300 gallons per minute of sludge against a total head of 42 ft. This humus sludge, containing 95 per cent of water, is delivered into the Sudden Valley outfall main, and so passes along to the main works for treatment.

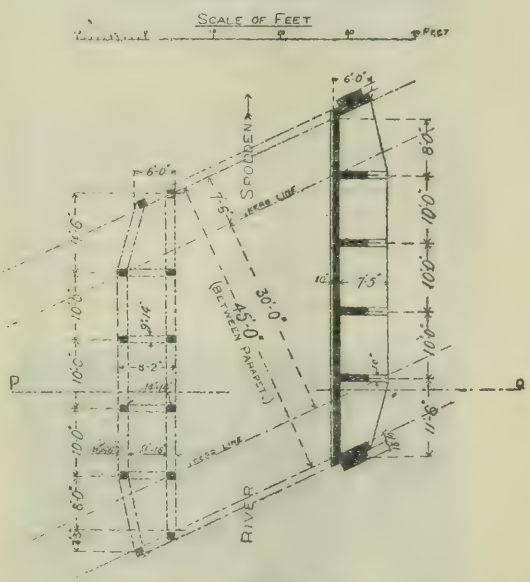
All the arrangements for the starting gear, switches, meters, &c., are on two switchboards fixed on the control platform, 8 ft. above the floor of the pump-house, and on the same level as the floor of the men's room, &c., thus giving easy access for the men in charge.

The switchboards are of slate slabs, mounted on an angle-iron frame, with polished teak casing. There are panels for the incoming main supply, lighting circuits, circuit to the Sudden storm-water screen motor, together with a separate control panel for each pump motor, each panel being fitted with a protected, enclosed, ventilated type of starter, circuit-breakers, fuses, meters, &c.

The electrical work has been executed by Messrs. Whipp & Bourne, Rochdale. The buildings and the percolating filters, &c., are lighted by incandescent electric lamps, work carried out by the Rochdale Electric Company, and the pump-house has an installation of low-pressure hot-water heating on the "Reck" system, supplied by Messrs. Saunders & Taylor, of Manchester. The electrical supply is direct from the corporation power station, and is a three-wire system of 440 volts between the outers and 220 volts between each outer and the middle wire; but the installation has been designed in such a manner as to allow of the overhead lines being supplied at 550 volts from a traction supply, of which the negative will be earthed. The portion up to the old works has been laid underground by the corporation departments to a connection board in the engine-house, about 1,200 yds., and thence overhead forward



SECTION PQ.



SECTIONAL PLAN JK,LM.

MELLOR-STREET BRIDGE, ROCHDALE.

(Plate 4.)

over the settling tanks, supported on steel lattice standards, and over the farm on "A" wooden poles to the switchboard at the pump-house, about 560 yds., and to subsidiary plant at the Sudden screening chamber, &c., about 240 yds.

The supply of cable and all overhead work has been carried out by Messrs. Glover & Co., of Manchester.

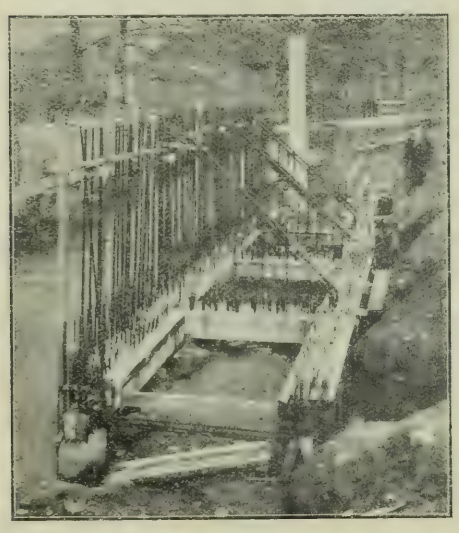
The electrical part of the scheme, including the work at the pump-house, has been designed and supervised by the borough electrical engineer, acting in co-operation with the author.

Weir-gauging recorders and water-level indicators have been provided in different parts of the works

where required, supplied by Messrs. Geo. Kent, Limited.

Having described the plant provided for the disposal of the sewage up to a volume equal to three times the dry-weather flow, as previously mentioned, now follow the particulars of the provision for treating an equal volume of storm water.

Following the recommendations of the Royal Commission in their Fifth Report the scheme provides for two settling tanks having a total capacity of 515,000 gallons = six hours' flow of sewage delivered by the main outfall. This diluted sewage, before reaching the storm overflow weir, has passed through



Ferro-Concrete Work, Mellor-street Bridges, Rochdale.

(Plate 5.)

detritus catchpits and the mechanically operated screens at the entrance to restrain the grosser solids, and the overflow only from the storm-water tanks passes to the river. The contents of the storm-water tanks, after the end of the storm flow and after settlement, are drawn off by floating arms down to the sediment, and flow to an effluent well at the original works, and are pumped up to the channel for treatment in the precipitation tanks, and any sediment is separately drawn to the sludge well for treatment along with the sludge from the precipitation tanks.

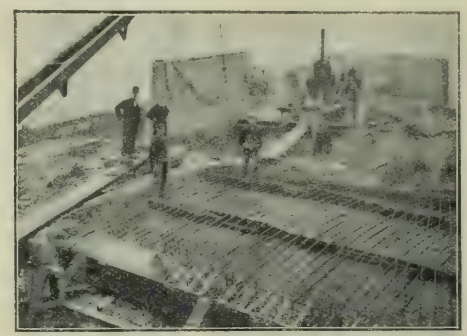
Ferro-Concrete Abutments, Mellor-street Bridges, Rochdale.

(Plate 6.)

The same arrangements are carried out at the Sudden storm-water tanks. Supernatant water left in these tanks is passed over a filtration plot adjoining, and the sediment is forced by a Shone's ejector to the main works for treatment along with the sludge tributary to that works. In this case, however, the storm flow is screened by a motor-operated screen on similar lines to that installed at the main works hereafter described before passing to the storm-water tanks.

CATCHPITS, SCREENING AND CHEMICAL MIXING PLANT.

Plate No. 3. At the entrance to the works there are three catchpits (30 ft. by 8 ft.), after which the sewage passes through two (or if necessary in times of storm through three) screens. As the screening and raking apparatus at these works, supplied by Messrs. S. S. Stott & Co., engineers, Haslingden,



Ferro-Concrete Arch, Mellor-street Bridges, Rochdale.

(Plate 7.)

possesses novel features, the author has thought it advisable to insert here a full description of it.

The three screening and raking apparatus (Law's patent) are fixed in chambers 8 ft. wide by 6 ft. 9½ in. deep at the outlet end of the detritus tanks. Each inclined screen is fitted with taper section steel bars 7 ft. 6 in. long, spaced ½ in. apart, the maximum sewage level being about 5 ft. The raking gear above the coping consists in each apparatus of a built up steel framework with sprocket wheels and bearings, also malleable detachable chains, carrying a travelling cleaning rake fitted with a series of malleable prongs. The rake is suspended by two vertical "T" section arms from a cross-bar on the chains, and is counterbalanced by two weights suspended by wire ropes working over suitable groove pulleys. The ends of the rake are fitted with runner pulleys, working between cast-iron guides in front of the inclined screen. In working the rake descends

Mellor-street Bridge, Rochdale: A Completed Structure.

(Plate 8.)

through the channel guides furthest from the screen, and ascends through the guides nearest to the screen, the prongs engaging in the spaces between the screen bars and removing the refuse therefrom.

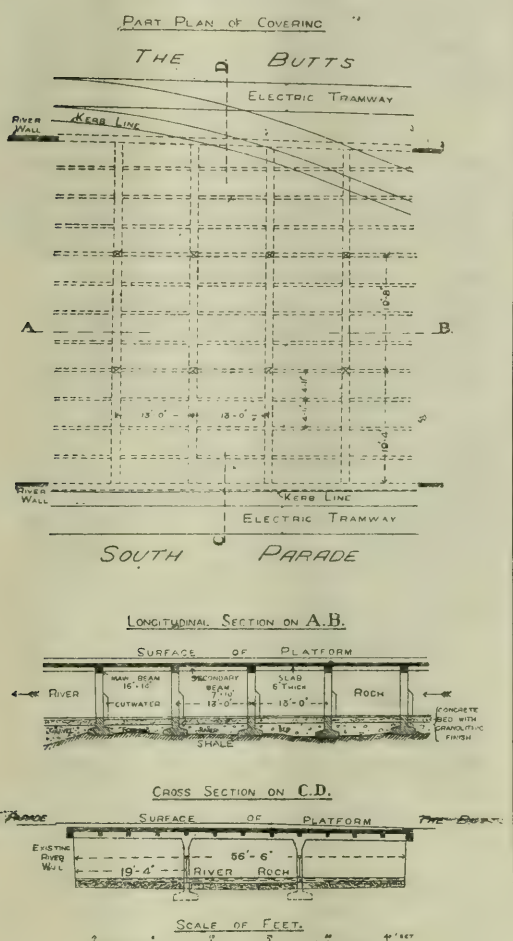
A vertical steel plate is fitted at the top of the screen to prevent the refuse falling from the rake, and on the rake arriving at the highest point of travel the refuse is automatically discharged by a cleaner, consisting of a set of vertical prongs in a cross-bearer, actuated from the detachable chains which carry the rake. At the junction of the "up" and "down" guides a hinged flap is fitted, to ensure the rake descending the guides furthest from the inclined screen.

Conveyor.—A scraper conveyor, consisting of a series of steel scrapers on a double-strand endless chain, working along a steel trough, removes the

screenings and deposits same into a wheelbarrow at the side of the screening chambers. The three screening apparatus and the scraper conveyor are driven independently by means of steel roller chains and sprocket wheels with clutches, from a countershaft across the tanks, the motive power being obtained from a totally enclosed motor, 9 b.h.p., 1,070 r.p.m., direct-coupled to a set of worm reduction gearing to transmit 6 b.h.p. at 40 r.p.m.

Crane.—The jib crane for raising the detritus in a wheelbarrow from the tanks has a radius of 18 ft., and is suitable for lifting loads up to 10 cwt. The crane is operated by hand, but is arranged so that an electric motor can be applied if found desirable.

Chemical Boxes.—Immediately in front of the agitators, in the two sewage channels, are two chemical boxes, each consisting of a perforated steel trough 7 ft. 4 in. long, containing the alumino-ferric, the



RIVER COVERING, ROCHDALE.
(Plate 9.)

troughs being carried by link chains working over suitable winding barrels, with spur and pinion gear for raising and lowering by hand.

Agitators.—The two agitators are of the double type, each having two vertical shafts with horizontal agitator arms, geared to work in opposite directions by means of bevel gear and cross shaft. The lower end of each of the four vertical shafts is supported in a footstep bearing, the top end of each shaft being carried in a cast-iron cross bearer. All the bearings for the vertical shafts are bushed with gun-metal. The cross shaft extends across both channels, and is supported by pedestals with double gun-metal steps. The bevel driving wheels are each fitted with a sliding clutch with hand levers, so that any of the four revolving agitators may be stopped or started independently of the others. The agitators are driven by a totally enclosed motor, 4 b.h.p., 1,000 r.p.m., direct coupled to a set of worm reduction gear, to transmit 3 b.h.p. at 40 r.p.m., with a steel bushed roller drive chain, and sprocket wheels with machine-cut teeth, to transmit power from the worm gear to the cross-shaft of the agitator.

The screening apparatus at the Sudden Valley sewer is of exactly similar type to the three described for the Roch Mills screening chambers, the depth in this instance being 5 ft. 8 in. This apparatus is driven by a 2¾ b.h.p. motor with worm gear to transmit 2 b.h.p.

The whole of the constructional work of the extension has been carried out under contract by Messrs. J. Bentley & Co., of Bradford, the penstocks and other sewerage ironwork being supplied by Messrs. J. Blakeborough & Sons, of Brighouse; cast-iron pipes and specials by the Staveley Coal and Iron Company; Messrs. Rd. Johnson, Clapham, and Morris, of Manchester, have supplied the wire netting for reinforcing brickwork and foundations, and the Expanded Metal Company the reinforcement in concrete. The whole of the rotary sprinkler apparatus (mercury seal), including all piping, valves, &c., connected therewith, has been supplied and erected by Messrs. C. Whitaker & Co., Limited, of Accrington. The total cost of the extension work now carried out is about £32,000.

As the extension works are only just about approaching completion, it is not possible to give any results of sewage treatment in respect to them, but it may be of interest to give the results of the experimental filters previously referred to, upon which the scheme has been based. It should be mentioned that the sewerage tributary to these works is on the combined system with storm overflows, and the average flow to the works during the last three years has exceeded the normal by from 50 per cent to 70 per cent, according to the wetness of the seasons.

AVERAGE RESULTS FOR THE LAST THREE YEARS IN GRAINS OF OXYGEN ABSORBED PER GALLON IN FOUR HOURS, WHEN DEALING WITH 133 GALLONS OF PRECIPITATED SEWAGE PER CUBIC YARD OF FILTER.

Raw Sewage.	Tank effluent going on experimental percolating filters.	Effluent leaving experimental percolating filters.	Effluent leaving small humus deposition tanks.
9·02	3·87	1·22	0·66

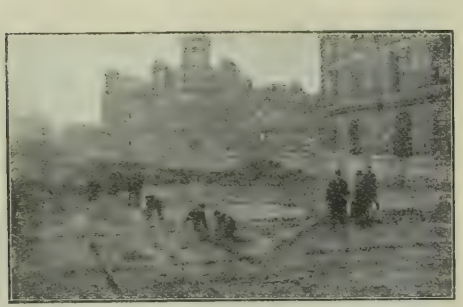
The second part of the installation required to complete the scheme is the duplication of the outfall sewer, as the present 30-in. iron outfall, executed in 1886, is only capable of delivering about 4¼ times the present dry-weather flow, and only about 3¼ times the flow proposed to be provided for, and it will therefore be necessary to construct an additional outfall sewer alongside the existing one for a length of about 870 yds. to the Roch Mills works. There will also require to be constructed an additional tank adjoining the No. 6 tank at the main works, and the second installation of percolating filters on the easterly side of the pump-house. (This work is stipulated by the Local Government Board to be completed by May, 1915.) The estimated cost of the second installation is about £22,000.

WORKS IN FERRO-CONCRETE.

There seems a tendency for the universal reign of steel to be giving way somewhat to a return of masonry construction—not to brick or stone work, but to an artificial stone—*i.e.*, concrete strengthened by steel. This composite material of construction is variously called "ferro-concrete," "concrete steel," "armoured concrete," "fortified concrete," "reinforced concrete," and many others, at the whim of the patentee or advocate using some variety or method of union of the two materials of which it is composed. Concrete itself is not a new constructional material, for the author remembers, when visiting Rome over thirty years ago, noticing ample evidence of its use early in the present era. Concrete alone, however, is comparatively weak when exposed to tensile strains. Its use has been limited to cases where only a low tenacity is called for, but, by the combination with steel, in which the steel is rigidly embedded in the concrete, the concrete stiffens the steel, and the steel reinforces the concrete, thereby producing a constructional material of great value, economic adaptability, and usefulness. An important consideration is that, once properly made, the first cost is the only cost—a great advantage over steel construction, which, if exposed to atmospheric influences, requires a constant outlay

for maintenance. In order to attain successful application of this combined constructional material it is, however, absolutely necessary that the work should be entrusted only to persons properly qualified to settle the proportions and distribution of the reinforcement; and the work must be carried out under qualified supervision by contractors experienced in this class of work. Any departure from or non-observance of the essentials of first-class work considerably reduces the strength of this most valuable constructional material in a manner which cannot be determined by calculation.

The author does not propose to enter into the many matters affecting the design, construction, and



Covering in the River Roch, Rochdale.
(Plate 10.)

stability of reinforced concrete, which can now be more fully studied to advantage in text-books and periodicals devoted specially to this new form of construction, but *en passant* he may refer to special matters of detail which he had to deal with in the work hereafter described, as it is probably known to some of you that he was one of the earliest in this country to adopt ferro-concrete construction, and some of the work presented unique points which he trusts will be of interest to his fellow-members. The four works hereafter described were carried out on the "Hennebique" system of ferro-concrete.

(*a*) Two arch bridges, each 23 ft. 6 in. span, to carry a new street, 15 yds. wide, called Mellor-street, over the river Spodden. (Completed 1905.)

(*b*) Covering the river Roch, in the centre of the town, for a length of 100 yds. by a width of 20 yds., to form a central open space for a distributing centre

River Roch Covering: View from River Bed.
(Plate 11.)

of a system of electric tramways for the borough and surrounding districts. (Completed 1905.)

(*c*) An arch bridge, 83-yds. span and 14 yds. wide between parapets, to carry Milnrow-road over the Rochdale Canal at the borough boundary at Firgrove to replace an old narrow and inconvenient arched bridge, 7 yds. span and 4½ yds. wide between parapets, erected about 1800, when the canal was originally made. (Completed 1906.)

(*d*) A further covering of the river Roch for a distance of 45 yds. below the Rochdale Bridge and below the work (*b*) previously referred to, in connection with the construction of a new street, 16 yds. wide, and to enable an isolated tramway to be connected to the centre. (Completed 1909.)

In connection with these works the author deemed it essential that special precautions should be taken in the use of a new material of construction about which there was then very little experience in this country, and it may be of interest to record the following matters of importance. The aggregate was determined by the author to be of "Lonkey" rock, which is a local hard, fine grit stone forming the hardest and most solid beds of the Haslingden grit of the millstone grit formation, the gauge to be of all sizes from ¾-in. down to ⅛-in., and it was to be broken as cubical as possible. In most stone-breakers there is a liability for such hard grit stones to be broken into a flaky shape as distinguished from the cubical. This depends somewhat upon the make of the breaker and the arrangement of the crushing jaws, which, instead of knapping, have a tendency to shear the stone off in flakes. These would probably pass edgeways through an ordinary wire riddle, and therefore be larger than the prescribed gauge, which should be objected to, otherwise they will cause voids in the concrete (which should be guarded against) by lying flatwise across the steel reinforcement. Another important point is as to the amount of dust, or flour, in the resultant crushed stone, which, if of an earthy character, would considerably deteriorate the strength of the concrete by taking up and so diluting the amount of cement compo in the mixed aggregate. From experiments made for the author with 1 part of G. & T. Earle's cement to 3 parts of various kinds of sand, as follows: (1) The fine riddlings from the crusher of Lonkey or hard flagrock stone; (2) the same with the floury dust washed out; (3) ordinary sharp pit sand, mostly quartz grains; (4) millstone grit sand, ground in a mill; and (5) Standard Leighton Buzzard sand—the following results were obtained:—

Table of Tests of Sand and Cement by Messrs. Henry Faija & Co. In all cases the average of three briquettes, September, 1903.

Briquettes (1" section) and cubes were composed of three parts by weight of each of the sands to one part of G. & T. Earle's cement.	Seven days.	Fourteen days.	Twenty-eight days.
Tensile Strength per Square Inch— Strain applied at the rate of 100 lb. in 15 seconds—			
No. 1.—Crushed Lonkey sandstone (sand used as received)	lb. 262	lb. 279	lb. 373
No. 1A.—Crushed Lonkey sandstone (sand washed before gauging)	318	427	497
No. 2.—Natural sand	302	381	413
No. 3.—Crushed yellow gritstone	290	339	397
No. 4.—Standard Leighton Buzzard sand	251	—	—
Crushing Strength per Square Inch—			
No. 1.—Crushed Lonkey sandstone (sand used as received)	2,405	2,434	3,168
No. 1A.—Crushed Lonkey sandstone (sand washed before gauging)	3,872	3,989	3,578
No. 2.—Natural sand	3,226	3,285	3,490
No. 3.—Crushed yellow gritstone	2,199	2,640	3,285
No. 4. Standard Leighton Buzzard sand	2,963	—	—

Note. Washing the Lonkey (No. 1 to 1A) got rid of about 30 per cent. of fine dusty matter passing through a No. 100 sieve (see following table):—

Table of Tests of Cement and Sand by Messrs. Henry Faija & Co. for Fineness, September, 1903.

Sample described as:	Residue on sieves numbers.				
	100 × 100	76 × 76	50 × 50	25 × 25	10 × 10
	Per cent.	Per cent.	Per cent.	Per cent	Per cent.
Cement	0·6	Trace	Nil	—	—
No. 1.—Crushed Lonkey sand (unwashed)	64·0	60·0	58·0	46·0	24·0
No. 1A.—Crushed Lonkey sand (washed)	98·0	96·0	90·0	78·0	50·0
No. 2. Natural sand	97·0	86·0	66·0	20·0	12·0
No. 3.—Crushed yellow sandstone	70·0	58·0	36·0	12·0	6·6

The author would here draw the attention of members to a series of comparative tests of the effect of "rock flour" in concrete, recorded in *Concrete and Constructional Engineering* of May, 1912, pp. 369-371, in corroboration of the earlier tests made for him.

The proportion of the aggregates specified and used was:—

	Parts by measure.
27 cube feet of broken stone	3½
13½ „ „ of sand	1¾
	5
8½ „ „ (or 6 cwt.) of Portland Cement	1 = 5 to 1.

These quantities, when properly rammed, yield about 31 cub. ft. of concrete. It may also interest you

to have the comparative results of tests of columns, of plain concrete and ferro-concrete, 3 ft. long by about 12 in. by 10 in. rectangular, made at the same time and from the same mixtures of concrete as used in the work.

Test number.	Material.	Age in weeks.	Dimensions.	Cracking stress.	Crushing stress.
				Tons per sq. ft.	Tons per sq. ft.
5950	Concrete 5 to 1	9	12″× 9·9″×36″	60·1	60·1
5951	Ferro-concrete 5 to 1 4 steel bars 1·77″ diameter held in position by wire rods 0·20″ diameter twisted round same in seven places.	9	11·8″×10·3″×36″	210·5	240·9
(Tests made by Messrs. D. Kirkaldy & Son, London, Jan., 1904.)					
542	Concrete 5 to 1	52	10″ ×12″×36″	113·8	113·6
553	,, ,,	53	10″ ×12″×36″	117·3	117·8
21	,, ,,	53	10″ ×12″×36″	141·0	141·0
543	Ferro-concrete 5 to 1	52	10″ ×12″×36″	176·2	220·8
550	,, ,,	54	10·2″×12″×36″	183·2	219·3
551	,, ,,	53	10·2″×12″×36″	183·2	208·9
24	,, ,, (Transverse links twisted)	53	10″ ×12″×36″	211·0	343·0
(Tests made at the Municipal School of Technology, Manchester, November, 1904.)					

The tests Nos. 21 and 24 are referred to in Mr. W. C. Popplewell's paper in the "Proceedings Inst.C.E.," vol. clxi. (1904-5), p. 328.

MELLOR-STREET BRIDGES.

Plates Nos. 4 to 8.—In the case of the two arched bridges carrying this new street over the river Spodden the special reason for the adoption of ferro-concrete construction was the abnormal difficulties due to the presence of colliery workings in the Royley or Arley Mine of the Middle Coal Measures (at least 4 ft. in depth) under their sites, at a shallow depth of 30 ft. to 40 ft. below the river level. These workings contained water which was being pumped out and used for industrial purposes. To rest a bridge on land so badly honeycombed would have been to court disaster. The scheme consisted of boring cylindrical holes, 16 in. in diameter, through the shale overlying the disused coal workings down to the fireclay under the coal; then pitching ferro-concrete piles, 14 in. square with corners bevelled off, 40 ft. to 50 ft. long, in such boreholes, and driving same at least 2 ft. 6 in. into the fireclay, and so that they should have a set, after three blows with a 30-cwt. monkey dropped 5 ft. 2 in. of not more than ¼ in., which would give a resistance equal to a dead load of about 90 tons on each pile. Upon these piles, which are arranged in each abutment in two rows approximately parallel about 10 ft. apart centres (one bridge has twelve and one fourteen on each side of the river), is placed a ferro-concrete slab, 9 in. thick, upon which rests the abutment, 10 in. thick, supported by a buttress 10 in. thick at every back pile, and at the springing the abutments are further strengthened, thickened and reinforced to resist the pressure of the arch and tendency to rupture at that point. The arch is 9 in. thick at the crown and 14 in. at the springing, with a rise of 2 ft. above the springing line. The steel rods in every part are combined into the adjacent portions, and overlapped at every juncture so as to ensure a completely connected and homogeneous structure. Owing to the plan of the bridges being on the skew the upper set of rods for the extrados for a distance of about 10 ft. in one case to 14 ft. in the other from each side were laid diagonally across the rods for the intrados parallel with the parapets. The rods in the slab were disposed as required in ferro-concrete beams in the abutments as in walls. Below the level of the slab, the underside of which was about 5 in. above the ordinary water level in the river, there was arranged, in line with the front of the front row of piles, a curtain wall, 8 in. thick, to prevent scour of the bank below the slab and behind the arch, and this curtain wall was carried low enough to allow for a considerable margin of alteration in the bed of the river, which may arise in the future due to the possible abandonment of adjoining weirs. In six cases the piles did not give the required set, and had been driven so near to water level that it was necessary to lengthen them; this was done by breaking away about 18 in. of the concrete at the top, extending the rods through coupling pieces of iron tube about 2 ft. long, extending the shuttering, say, 10 ft., and so lengthening the pile to that extent of 4 to 1 concrete. After allowing the concrete to set for about a month, these piles were again driven without damage until the required set was obtained, and any superfluous length was then sawn off. In one case, owing to some of the shale dropping into the borehole, a pile could not be driven to the foundation required. After trying to drive it for twenty-four hours, and it could not easily be withdrawn, it was decided to abandon any dependence upon it, and by driving the piles on each side of it until a set of ¼ in. in three blows was obtained, and providing extra steel reinforcement in the abutment so as to cantilever it over the abandoned pile, the work was proceeded with.

These bridges were the first in this country constructed of ferro-concrete from the foundations to the superstructure, and they are also the first which have been built with slab arches—that is, arches without ribs or beams. The parapets were formed of Stanicliffe stone from the quarries near Rowsley, Derbyshire, and were designed with perforations to give a neat and light appearance. These bridges were very carefully and severely tested, the following being the method adopted: The heaviest load likely to pass over the bridge was a Lancashire boiler weighing, say, 25 to 30 tons, and this would be carried on two bogies spread over a long wheel base. The footpaths on each side were loaded with 25 tons of pig-iron, equal to a human load of 140 lb. to the square foot, or 50 tons in all. Standing on the bridge was the corporation steam road roller, weighing 12 tons, attached to

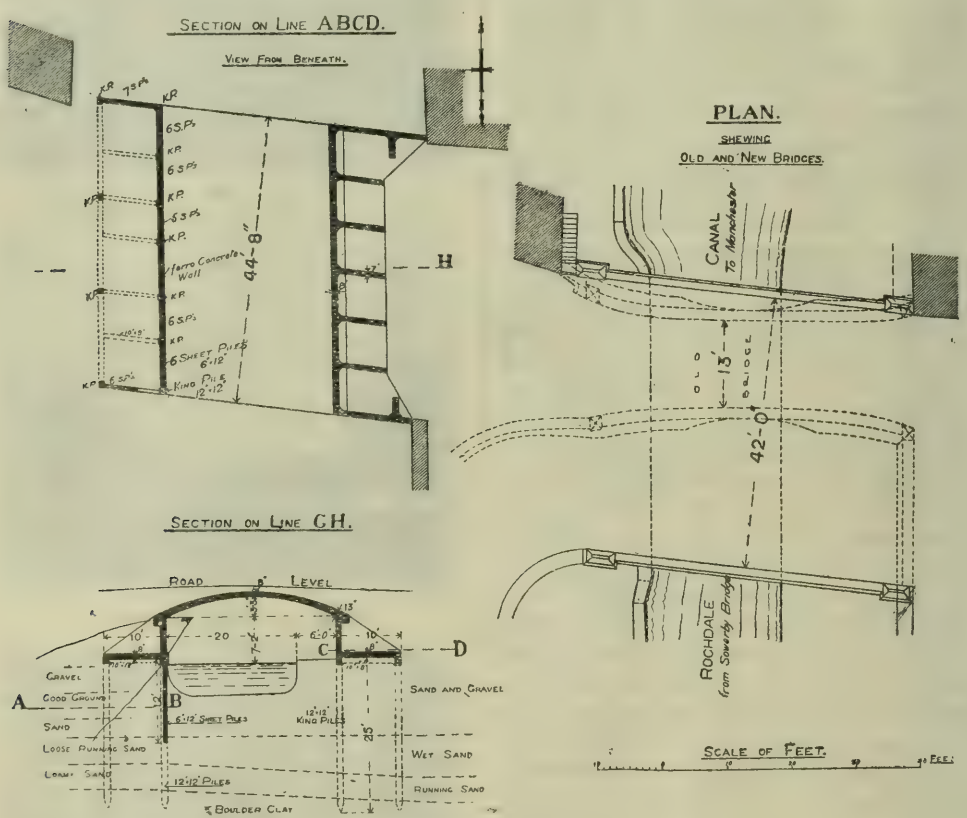
TRAMWAY CENTRE, ROCHDALE.
(Plate 12.)

a small bogie loaded with pig iron to 18 tons. Alongside it was a traction engine weighing 16 tons attached to a bogie, 8½-ft by 6½-ft. wheel base, which, with the pig iron piled thereon, weighed 32 tons. Not only were these weights greater than there was any probability of the bridges being called upon to bear, but the loads were more concentrated than the Lancashire boiler likely to be borne in actual practice. The test, which was witnessed by the chief engineer of the Manchester Ship Canal Company and the engineers of several important railway companies and corporations, was in every way satisfactory. The first bridge having been loaded as described, a further test with a live load was applied, the two sets of moving loads being driven first over the centre of the bridge and then on one side, where, on account of the skew, there was the least reinforcement of steel in the concrete, and where, therefore, the resisting power was assumed to be least. During all these operations observations were being made on a platform below the arch by a company of engineers by means of several steel rods (suspended from plaster-of-Paris moulds attached to the arch) with spring balances underneath. These balances were fitted with indicators to record the deflection, so amplified as to make it visible to the eye. The load of 50 tons on the footpaths remained there throughout the whole of the test. The maximum deflection was about $\frac{1}{15}$ in., although $\frac{3}{8}$ in. was allowed for, and after the removal of the loads the structures resumed their original position. These tests were considered very satisfactory. The second bridge at Mellor-street, and also at a subsequent date the covering of the river Roch, were similarly tested, with equally satisfactory results. The saving in the initial cost was about 20 per cent on the estimates for steel construction in both cases.

COVERING OF THE RIVER ROCH IN THE CENTRE OF THE TOWN.

Plates Nos. 9 to 12.—In this case ferro-concrete appeared to possess such advantages of economy in construction and maintenance—particularly with reference to the avoidance of the requirement of regular painting the underside of a structure exposed to the vapoury emanations from a river largely used for industrial purposes—that it was adopted in place of the ordinary steel decking construction. As the levels of the thoroughfares on each side of the river and the necessary waterway in time of flood would not permit of sufficient depth of beams relative to the span across the river (about 60 ft., which would require similarly as with steel construction a depth of from 4 ft. to 5 ft.), the author determined to divide the width into three spaces, by providing two rows of columns arranged longitudinally down the river, and in order to cause as little interference as possible to the ordinary flow by the arrangement of such columns the two rows were decided upon, and the river bottom being inverted to the centre would allow the normal flow to pass generally centrally between the two rows of columns. The inverting is constructed of ordinary concrete, 12 in. thick, of which the bottom 10 in. is of 6 to 1 concrete, the upper 2 in. being formed with a granolithic finish in the proportion of 2 to 1, laid to transverse falls of 1 in 48. The columns are carried down to the solid shale, which was found at a depth of about 4 ft. below the ordinary river bed, and are constructed of rectangular section 16 in. by 10 in. (with the addition of a cutwater edge upstream), the foundation being extended to a truncated pyramid, 4 ft. 4 in. square by 4 in. to 10 in. thick, all reinforced with steel, as shown in the cartoon drawings now exhibited.

"Hennebique" column footings consist of a layer of concrete a few inches thick, in which are embedded steel rods in the two main directions, and a monolithic truncated pyramid, connected with the column they support. Such a footing may be considered a girder affected by uniformly distributed loads in an upward direction, and a nearly concentrated load acting downward in the centre. These forces tend to bend the pyramid in the two main directions, and this tendency is effectually resisted by the concrete in compression and by the rods in tension; the bottom rods being supported by "U"-shaped hoop-iron stirrups, having the arms bent out slightly at the top. The stirrups (which are employed to resist shearing) are always brought up to just under the surface of the concrete. As the retaining walls abutting on the river were not of too excellent construction to take the additional concentrated load to be put upon them, it was arranged—instead of taking down and rebuilding or strengthening such walls—for the weight to be transmitted more uniformly over the whole length of the wall by the introduction of a ferro-concrete beam, 20 in. deep by 14 in. wide, laid longitudinally on each side on the top of the wall. (See cross-section.) It was also deemed advisable in the case of a large elliptical-shaped sewer, which passes diagonally under the river, to arrange for a special treatment of the foundations of the columns which are located upon or adjacent to such sewer crossing, by the extension of the principle of the reinforced truncated pyramid previously referred to.



FIRGROVE BRIDGE, ROCHDALE.
(Plate 13.)

The columns supporting the ordinary flooring are spaced at 13-ft. centres in the longitudinal direction of the river, and approximately 20-ft. centres transversely, but at the upper portion of the work the river narrows somewhat, and thereby reduces the span on the north side only. The covering is divided up into the main beams, which rest upon the columns and the two side walls; these are 16 in. by 14 in. in section; between them are the secondary beams 7 in. by 10 in. in section, which are connected up to the main beam, and in turn receive a flat beam or slab 6 in. thick, which constitutes the floor, and upon which has been laid in part the tramway track, consisting of rails 7 in. deep, with hard wood paving blocks, 5 in. deep. The other portion of the floor was laid out as island platforms, upon which have been arranged shelters, &c., for the convenience of the tramway travelling public.

(*d*) A further covering of the river Roch for a distance of 45 yds. below the Rochdale Bridge, and below the work (*b*) previously described, carried out in 1909. This was on similar lines to the work (*b*), but in the

case of the river wall on the northerly side it was taken down and substituted by a ferro-concrete retaining wall constructed of a thin slab with ribs at the back, both the slab and the ribs being connected to a foundation slab with rib at the front at the toe. This work was tested on similar lines to that of the other work, and proved equally satisfactory.

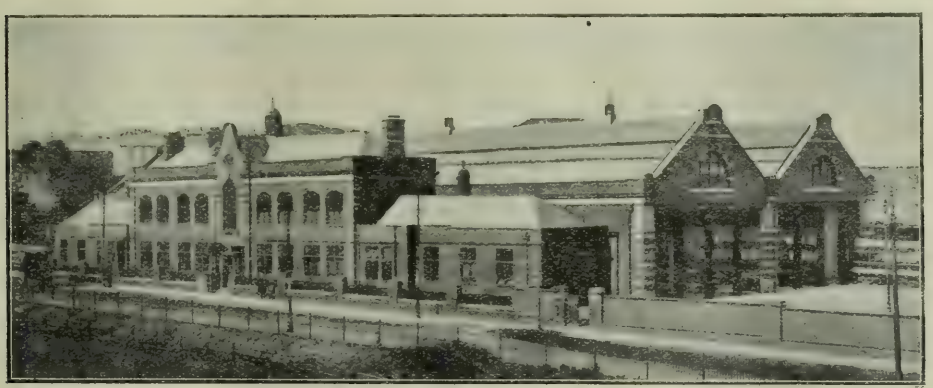
ARCHED BRIDGE OVER THE ROCHDALE CANAL AT FIRGROVE.

Plate 13.—After standing for over 100 years the old bridge was demolished to make way for a wider structure, and the new bridge has been built at a cost of about £3,000, under a joint agreement between the Rochdale Corporation, the Lancashire County Council and the Milnrow Urban District Council (the canal at this point forms the boundary between Rochdale and Milnrow). Rochdale had the letting of the contract and the supervision of the work, and contributed £1,500 (or three-sixths) of the cost, Milnrow paid two-sixths (£1,000), and the remaining sixth (£500) was paid by the county council. The old bridge had a width of only 13 ft. between the parapets, and there was no footpath. The span of the arch was 21 ft., of which 15 ft. was waterway and 6 ft. towing path. The new structure measures 14 yds. between the parapets—more than three times the width of the one it replaces. There is a flagged footpath, 7 ft. 6 in. wide, on either side, and the roadway, which is 27 ft. wide, is paved with non-slippery granite setts. The span of the bridge across the canal has been widened to 26 ft., made up of 20 ft. of waterway and 6 ft. of towing path. The widening involved the widening of the towing path on the northerly side. This and other work was carried out before the demolition of the old bridge and the diversion of the road traffic. On the northerly side, almost touching the structure, were two large gas and water mains. By the new scheme these have been carried under the footpath on the northerly side. Under the southerly footpath space has been reserved for electric lighting and tramway cables when these are required.

The canal company required that the headway under the bridge should not be reduced. As a matter of fact, in addition to a wider waterway, the scheme provides a better headway for the whole width of the bridge. There was only 18 in. between the underside at the arch at the keystone and the top of the road above, and it was this that made ferro-concrete necessary. The depth for a stone bridge with increased span could not be provided without raising the levels of the road, to which there were strong objections. Plans had been prepared of girder and other types of bridges, but on account of the abnormal circumstances the ferro-concrete method was finally regarded as the most suitable. After certain preliminary work had been executed, the road traffic was temporarily diverted over another bridge, crossing the canal about 150 yds. northward, to enable the work of demolition to be proceeded with. The method of demolition, which was carried out while the canal was in use, was first to remove the parapets and the backing over the arch; then the arch stones were removed.

An old, stoutly built, broad-gauge canal boat was placed under the arch to catch the *débris* as it fell, and so prevent it choking the canal. The work, which was risky, was carried through successfully and expeditiously, and without any personal injuries to workmen.

The new bridge is similar in appearance to those in Mellor-street, the chief difference being that the stone parapets are of a plainer type without perforations. The abutments of the new bridge are supported on both sides by ferro-concrete king piles, 25 ft. long by 12 in. square, the length being determined to ensure their being driven down to a satisfactory foundation. Boulder clay was found there by boring at from 20 ft. to 22 ft. below the surface of the water. The intervening strata was not considered satisfactory by the author. Each abutment is supported by eleven of these piles. The east abutment between the king piles on the water face was formed of 12-in. by 6-in. tongued and grooved ferro-concrete sheet piles, 12 ft. long, which reached 6 ft. below the bed of the canal. On the top of the piles there is a ferro-concrete slab, 8 in. thick, supported on the piles by a ferro-concrete beam, 10 in. by 12 in. This forms the base of the abutment, and the side walls of the bridge, which are of the same substance, 8 in. thick, rise off the top of the slab and beams, and are strengthened at the back by ferro-concrete buttresses, 7 in. wide, in a similar manner to the Mellor-street bridge abutments. The ferro-concrete arch, which has a rise of 3 ft. 3 in., is 8 in. thick at the crown and 13 in. at the springing. Arrangements were made to stop the canal traffic during Whit week of 1906 in order to carry out foundation work. Temporary dams were put across the canal on either side of the bridge. By working night and day this stoppage of the traffic sufficed to carry out all necessary work below the water level in the canal.



Tramway Depot, Rochdale.
(Plate 14.)

The test of the strength of the bridge after completion on September 26, 1906, was on the same lines as those of the Mellor-street bridges, and was witnessed by Mr. P. M. Crosthwaite, M.Inst.C.E., Local Government Board inspector, who had previously held the preliminary inquiry for the sanction to the necessary expenditure. Over 130 tons weight was on the bridge at one time. The maximum deflection was only about $\frac{1}{32}$ in., and when the loads were removed the deflector instruments practically returned to zero. This was considered highly satisfactory by those who witnessed the test, including several engineers interested in structural engineering work. The Local Government Board shortly afterwards issued their sanction, but limited the period for repayment on the basis of fifteen years for the ferro-concrete work; whereas, if it had been carried out in steel, stone or brickwork, they would probably have granted the normal period of thirty years.

Reinforced-concrete construction, in the opinion of some engineers, has been under expert observation too short a time in this country to enable anyone to dogmatise upon its life; but, given a recognised satisfactory system of reinforcement, first-class materials throughout, used with first-class labour, under competent supervision, there is no reason to fear satisfactory results under severe tests in the first instance or after the lapse of many years, and the period for repayment might be extended to the same as for other forms of construction without fear of unsatisfactory results.

The whole of the works here described were initiated by and executed under the supervision of the author,

with whom was associated Mr. L. G. Mouchel, C.E.(FRANCE), English agent of the Hennebique patents. The work was satisfactorily carried out under four separate contracts (obtained at different times by the Yorkshire Hennebique Contracting Company, Leeds).

FALINGE PARK.

This park, about 23 acres in extent, situated on the northerly side of the town, and presented by Alderman S. Turner, J.P., will always be associated with the coronation of two kings. The first and larger portion, 18½ acres in area, was presented in commemoration of the coronation of King Edward VII., and opened in 1905, and the addition on the northerly side, 4½ acres in area, in commemoration of the coronation of King George V., and opened on Coronation Day, June 22, 1911.

The general lay-out of the first portion was designed by Mr. T. H. Mawson, of Windermere; the carrying out and supervising of the work, and the design of the gates, boundary walls, railings, building work, &c., was by the author and his staff. The cost to date to the corporation for laying out, &c., has been about £15,000, and in addition the donor has expended for land and certain internal works a somewhat larger amount.

BRIDGEFOLD POLICE STATION.

The new branch police station in Mellor-street is a two-storeyed building. The site, about 400 sq. yds., formed part of the Bridgefold estate, which is corporation property. The accommodation consists of a dwelling-house for the sergeant-in-charge, a general office, 15 ft. 6 in. by 13 ft., two cells, 13 ft. by 7 ft., and an ambulance storage room. The cells are fitted with electric lights, and have separate sanitary accommodation in accordance with Home Office Regulations. The building is of red brick with stone dressings, and is heated throughout by hot water, and was designed and supervised by the author and staff. The total cost of the work, including land and paving work in front, was £1,400.

ELECTRIC TRAMWAYS.

The author was the engineer for the promotion in Parliament in 1900 of an authorising Act, and for the subsequent construction of 24¾ miles of tramway track (measured as single track) and the construction of about 3¾ miles by an adjacent authority, leased by them to the corporation, and the following description of the track, car depot and offices relates to the above work.

TRACK.

The track has been constructed on the 4 ft. 8½ in. gauge of 7-in. by 7-in. girder rails, 102½ lb. weight per yard, with 1⅛-in. by 1⅛-in. groove on straight track, mostly of 60-ft. lengths, with fishplates 27 in. long, weight 53 lb. per pair, supplied mostly by Walter Scott, Limited, of Leeds Steel Works, and a part by P. & W. Maclellan, Limited, of Glasgow, from the Angleur Steel Works, Limited, Liege, Belgium. The rails for curves of 50-ft. radius or under were about 105 lb. per yard, with grooves 1¼ in. by 1¼ in., and were mostly in 45-ft. lengths. The fishplates are secured to the rails by six 1-in. diameter bolts with lock nuts. Each joint is strengthened by a Cooper & Smith's "Anchor" soleplate, 27 in. long, of similar section to the rails, secured to the bottom flange of the rails by six ¾-in. rivets on each side. The points and crossings were supplied by Hadfield's Steel Foundry Company, Limited, of Sheffield, the crossings and the tongues of the points being of "manganese" steel. Some of the special track work at junctions was supplied by the Lorain Steel Company, Limited, of Philadelphia, Penn., U.S.A., and the remainder by Hadfield's Steel Foundry Company, Limited. The track is bonded by two "Neptune" bonds at each joint, with cross bonds every 50 yds., the double track being bonded together every 100 yds.

The whole of the track is laid on 5 in. of 6 to 1 Portland cement concrete, with 1 in. of packing composed of three parts of hard granite chippings to pass through a ¼-in. mesh to one part of Portland cement, with deeper recesses at joints for concreting round the "Anchor" soleplates, the concrete between rails being finished off with about 1½ in. of 4 to 1 concrete. The sides of the rails are plastered with mortar composed of three parts of sand to one part of Portland cement, and the whole paved with granite setts, 6 in. deep, the joints of which are run with asphalt mixture and finished off with cement grouting. Opposite places of worship, &c., the paving is 3-in. by 5-in. creosoted beechwood or Australian hardwood. In some of the later portions of the work cross anchors were introduced under the rails every 30 ft., and in some cases every 20 ft., and the length of the points was increased in the major portion of the work from 8 ft. 6 in. to 12 ft. and 14 ft. Drain rails and boxes have been freely placed on the track to intercept rainfall above points and also at low-lying places.

Wherever the width of road would permit, and the character of the traffic justify it, the lines were laid double track with "crossover" roads every half mile; in other parts the lines are single, with passing-places at frequent intervals, located so as to enable drivers to see the next passing-place in either direction. The steepest gradient on the system is 1 in 11·7, and the sharpest curve is 35ft. central radius. The construction of the whole of the permanent way works was carried out by workmen employed by the corporation, under the direct supervision of the author and his staff, the maximum number of workmen attaining to about 600. The overhead equipment and cable work was designed by Messrs. Lacey, Sillar & Clirehugh, of Westminster, and carried out by various contractors under the supervision of the borough electrical engineer.

CAR SHED.

Plate No. 14.—The car shed stands on the easterly side of Mellor-street, and the whole site covers an area of 11,692 sq. yds. The land belonged to the corporation. The shed is a lofty building, in which good natural light is obtained from the glazed roof, and is 216 ft. long by 100 ft. wide. There are two entrances, one at each end, and, as a double track is laid along Mellor-street, this allows the cars to be moved in and out of the shed expeditiously and without interfering with the ordinary traffic along that street, which is now the principal tram route to Norden. At each entrance from Mellor-street there is a single track, which, after passing through the gateway, forks out in a fan-shaped arrangement into eight sets of lines into the main shed, and two tracks into the repair and painting sheds, which lie on the easterly side. So that in case one entrance happens to be fouled by a car off the line, the other will still be open for the admission or discharge of the cars. Underneath the lines on which the cars rest there are continuous pits running from end to end and from side to side, the tracks being supported on steel stanchions, between which are steel joists carrying the rails to which they are bolted. These steel stanchions are firmly fixed below the level of the pit and surrounded by solid blocks of concrete. The pit arrangement is adopted so that when workmen are engaged on repairs to cars they can pass underneath from one car to another in any part of the shed. All the spaces adjoining and between the tracks are laid with pitch-pine planks, with the exception of the two adjoining the main walls, which are of concrete, with intervening places between the planks so that when the cars are being washed the water will go through to the pits, which are well drained. The planks are arranged in bays so that in case a car is in a bad condition and cannot conveniently be taken to the repair shop, they can be removed to allow an apparatus to be put down in the pit to raise the car which is in need of attention.

The repairing shop, which is 117 ft. long, and the paint shop, 45 ft. long, are on the river side of the erection. Off the repairing shop are the general stores, mechanics', blacksmiths' and joiners' shops, the men's messroom, the foreman's room and workmen's lavatories; and off the paint shop there is the armature repairing shop, while below and above are still further rooms which are utilised for storage purposes. Below the level of the car-shed pit there is an open subway, which communicates with the lower floor storage rooms and also with the repair shop, so that motors can be taken from underneath the cars and carried along it on trolleys to a point near to the mechanics' shop. The whole of the buildings are of brick relieved by the introduction of terra cotta in the salient features of the design. The shed was designed to accommodate fifty-six cars of the type then in general use, but, owing to the subsequent introduction of large bogey cars, the accommodation is reduced to about forty-nine cars. There is room on the site, or on the opposite side of the street, for an extension. The shed was brought into use on July 15, 1904.

OFFICES.

The building is in the Renaissance style and of red brick, the front being relieved by the introduction of terra-cotta and white stone in the salient features of the design. It has an imposing frontage to Mellor-

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street, which is apt to give a somewhat false impression of its dimensions. Though occupying a large frontage, it has no great depth, all the rooms overlooking the street. Behind them is a corridor, 5 ft. wide, from which every apartment may be entered, and which also has easy communication with the shed, and, in turn, with the workshops. Passing into the hall through the entrance in the centre of the block on the right is an inquiry office, and adjoining it a small room in which business and other callers can interview members of the staff. Immediately beyond is the general office, 39 ft. by 18 ft., well lighted, and with ample accommodation for a large staff of clerks. Next to the general office is a room, 18 ft. by 15 ft. 6 in., used as an office for the inspectors. It is fitted with steel safes for conductors' ticket boxes, &c. Beyond is the office at which the conductors pay in their cash. This is 22 ft. by 18 ft., and is fitted with a long counter, screened from the corridor by six lifting sashes, and may be shut off entirely from the corridor at will. Adjoining the cash office are lavatories for the use of the motormen, &c.

Returning to the hall and traversing the corridor to the left from that point the first room is the draughtsmen's and cost clerk's office, a room 19 ft. by 18 ft. Adjoining this is the traffic superintendent's room, and next the general manager's office with a bay window. Opening out from the general manager's office is a room, 22 ft. by 15 ft., which is utilised as a stationery store and for the correspondence clerks. At the end are lavatories for the office staff. The main portion of the building in the centre has been carried two storeys high. On the second floor is a room originally intended for a committee room, 39 ft. by 24 ft. and 15 ft. in height, but now used for storage and issue of tickets. To the left of the landing are two rooms, one of which is used as a store fitted with partitions, and the other as a general store room for spare uniforms, lost luggage, &c., and at the end lavatory accommodation is provided. There are three cellars for heating, storage and other purposes, and here again communication is provided with the car shed behind. The heating of the offices is on the low-pressure hot-water system. The premises are lighted by electricity, and there is telephonic communication between every department as well as between any room in the offices and the car shed and workshop. A dwarf wall, 2 ft. 6 in. high, surmounted by wrought-iron railings, also 2 ft. 6 in. high, runs along the front of the building. The offices were brought into use on June 23, 1905. The offices and shed, combined with the workshops, &c., complete what is considered a well arranged and equipped depot. The builder's work, furnishing, laying of tracks, &c., were carried out from the designs and under the direction of the author, the electrical equipment and lighting under the borough electrical engineer, and the arrangement and fitting up of the workshops under the general manager.

The total cost of the depot and offices, including all equipment, &c., was about £32,000.

NOTES FROM ABROAD.

The only town in Bukowina which possesses a complete system of sewerage is Suczawa. It was completed in 1912, and involved several interesting features. In designing the outfall sewer it was found that, if it were constructed to convey the maximum volume of storm water, the conditions would involve a very high expenditure. In the end a smaller outfall sewer was provided, of sufficient capacity to carry about two-thirds of the estimated maximum volume, and a storage tank or pond was constructed at the upper end, large enough to contain the excess during a heavy storm. This excess would then be able to run off gradually through the smaller outfall sewer after the storm had subsided. The storage pond was also provided with an overflow at a higher level into a stream to act in case of unforeseen emergencies.—*Zeitschrift des Oesterreichischen Ingenieur-und Architekten-Vereins.*

* * * *

The construction of subways of New York has involved many alterations of existing sewers, in a number of cases involving the construction of inverted syphons. Details of these syphons were given in a recent issue of *Municipal Engineering*. In most cases the syphons consist of two or more pipes of different sizes, the smaller being designed to take the dry-weather flow, while the larger come into operation when the volume is increased by storm water. Another feature of interest is the introduction of a by-pass to facilitate the cleaning of the dry-weather pipe, should this ever become necessary.

* * * *

In the same journal we read that glazed ware drain-pipes are now being made by one firm up to 42 in. in diameter, and that there is a growing demand for these sizes. It is estimated that the smoother surface of these pipes, as compared with that of concrete or brick sewers, reduces the frictional resistance to such an extent that smaller pipes may be used to give the same capacity.

The Society of Engineers.—A large party of members of the Society of Engineers visited the Chingford Reservoir of the Metropolitan Water Board on Tuesday afternoon, the 17th inst., for the purpose of inspecting the reservoir and the Humphrey pumps installed there. Permission for the visit to take place had been kindly given by Mr. W. B. Bryan, M.INST.C.E., chief engineer to the Metropolitan Water Board, and by the Pump and Power Company, of 38 Victoria-street, Westminster. The reservoir, a full description of which recently appeared in our columns, has a capacity of 3,000 million gallons, an area of 416 acres, and 4½ miles of embankments, and water is raised from the River Lea by means of five Humphrey pumps, four of which have a capacity of 40,000,000 gallons per day, and the fifth of 20,000,000 gallons per day, the lift being 25 to 30 ft. The pumps, which are the invention of Mr. H. A. Humphrey, F.C.G.I., M.INST.C.E., M.I.MECH.E., employ the principle of internal combustion, and have no moving parts except the mushroom valves. A column of water, forming part of the water pumped, acts as a reciprocating flywheel, and also as a piston, having four strokes in each cycle. An explosive charge is ignited nine times per minute in each pump, and 15 tons of water are delivered at each explosion. The visitors greatly appreciated the opportunity of viewing this novel and ingenious application of a well-known principle.

Wakefield Corporation Waterworks.*

By CHARLES CLEMESHA SMITH, M.INST.C.E., Engineer.

In 1880 the Corporation of Wakefield, on the advice of Mr. Edward Filliter, M.INST.C.E., promoted a Bill to obtain water from the Rishworth Moors, about 25 miles to the west of Wakefield. These moors lie on the upper slopes of the Pennine Chain, heavy peat deposits in most parts covering the grits and shales of the millstone grits. . . . The scheme contemplated the construction of two reservoirs at Rishworth—namely, the Green Withens reservoir and the Ringstone reservoir, with catchwaters, a pipe line 17 miles in length to Ardsley reservoir, which was to be constructed some 5 miles north-west of Wakefield, filter-beds at Kirkhamgate, and a service reservoir at Lindale Hill. In 1889 powers were obtained to construct three smaller reservoirs at Rishworth—namely, the Booth Dean, Oxygrains, and Linsgreave reservoirs.

All the works authorised under the 1880 Act have been constructed, but the three reservoirs authorised under the 1889 Act have not been taken in hand.

DESCRIPTION OF WORKS.

The accompanying plan shows the position of the corporation's works and the area at present supplied. The gathering ground from which water is obtained is practically uninhabited, the only house being that of a gamekeeper. A small number of sheep graze on the moors in summer, but only some 150 acres are regularly grazed, the remaining portion being rough moorland.

The following table gives the capacities, &c., of the reservoirs:—

Name.	Million gallons.	Depth of water.	Height of embank. ment.	Date when first used.	Top bank level above O.D.
		ft.	ft.		ft.
Ringstone ...	244	50	60	1884	994
Green Withens	240	70	82	1898	1,178
Ardsley ..	334	74	84	1884	383
Booth Dean ..	100	75	80	Not yet	897·5
Oxygrains ..	80	78	83	con-	1,019
Linsgrave ...	100	60	68	structed.	1,290

The Ringstone, Green Withens, and Ardsley reservoirs are formed by earthen embankments with the usual puddle core, the trenches being filled with puddle.

The Green Withens reservoir has a double embankment. The valley in which it is constructed branches downstream instead of upstream, the stream evidently having at some time changed its course. The two embankments meet at right angles on the shoulder of the hill between the old and the new stream-courses. The trench is a long one, being 2,055 ft. in length, and its maximum depth is 75 ft. It was excavated in grits and shales, and at the south end of the main embankment faulted and disturbed rock was met with over a length of some 150 ft. The rock and shale, though broken and ground up, were quite watertight throughout this disturbed area. For the greater part of the length of the trench the bottom is protected by a brickwork shoe, and, in addition, concrete walls 18 in. thick were carried some distance up, so as to cover the face of a band of rock and protect the puddle against possible damage by water passing along the fissures in the rock. The main tunnel is 6 ft. in diameter and some 500 yds. in length, passing round the north-east end of the puddle trench and main embankment. This tunnel is used for the purpose of delivering compensation water into the gauge-basin at the foot of the main embankment. A tunnel 3 ft. 6 in. in diameter, at the south end of the small embankment, enables the top 15 ft. of water to be drawn off for the supply to the town.

Two catchwaters, respectively 1 mile and 1¼ miles in length, convey water to this reservoir. The cost of the reservoir with the catchwaters and ancillary works was £151,000.

The Ringstone reservoir has one feature which distinguishes it from most reservoirs—namely, that it is constructed in a recess or saddle between two hills, and lies at the upper end of two valleys across which embankments have been constructed. Each embankment is pierced by a culvert, the one on the south-west side for the supply of compensation water, and the one on the north-east side for the supply to the city. The reservoir has only about 60 acres of natural gathering ground, water being conveyed to it by means of a catchwater some 4½ miles long. The cost of the reservoir and its catchwater, &c., was £120,000.

When the scheme is complete the total gathering ground will be 3,337 acres.

Six rain-gauges have been fixed at various points on the catchment area, and the average rainfall varies, according to elevation and other circumstances, from 43 in. to 51 in. per annum.

Ardsley reservoir is on the coal measures, and both worked and unworked mines have been the cause of considerable expenditure. The Haigh Moor seam, which was between 2 ft. and 3 ft. thick, was worked many years prior to the construction of the reservoir, and as it is only some 60 ft. below the surface, it was possible for water to make its way from the reservoir to the workings. In order to prevent this a ring trench was excavated to protect the weakest portion of the bottom of the reservoir, this being connected to the main trench and tied into the shale below the High Moor coal. Outside the ring trench the bottom is good, there being a minimum thickness of 25 ft. of watertight shale above the old workings. It was thought desirable to purchase sufficient coal to protect the trenches and embankments from the effects of subsidence in the event of lower seams being worked, and the coal in three seams over an area of some 40 acres has been purchased. The purchase of coal has involved an expenditure of some £40,000, including heavy law and arbitration expenses.

It was in reference to this reservoir that the House of Lords decided (*Holliday* v. *Corporation of Wakefield*) that a mineowner was not entitled to claim compensation for prospective injury, but that he must wait until such time as the injury arises—*i.e.*, until he is in a position to work the coal for which he claims compensation.

The full cost of the Ardsley reservoir was £160,000. . . .

FILTRATION WORKS.

The filtration works are situated at Kirkhamgate, about 1 mile below the Ardsley reservoir. Three seams of coal having been worked under the site, the uppermost being some 20 yds. below the surface, it was considered advisable to carry clay-puddle sheeting under the whole area covered by the filter-beds; under the cross walls and outer walls of the beds gravel-puddle was used, and ordinary clay-puddle was continued at the back of the outer wall. The beds are five in number, having a total sand area of 10,000 sq. yds., capable of dealing with 3,500,000 gallons per diem. Messrs. Hunter & Goodman's ejector sand washers are used, and have proved to be useful and economical. The whole of the inlet and outlet wells are grouped in one building, each filter-bed having a separate outlet well, in which is fixed an automatic apparatus made by Messrs. Glenfield & Kennedy, Kilmarnock, controlling the rate of filtration. Owing to the presence of peat on the gathering ground, the water in its raw state is acid, and has a strong action upon lead, at times being capable of taking up 2½ grains of lead per gallon, if left standing in a lead pipe for twelve hours. In order to counteract the acidity, the water is treated with approximately 1½ grains of ground chalk or carbonate of lime per gallon before filtration, and 1½ grains of quicklime per gallon, in the form of clear limewater after filtration.

The plant used for the addition of the carbonate of lime consists of a hopper made from a 6-ft. length of 18-in. pipe, closed at the bottom by a fine copper gauze screen. Under the screen is a rose connected with a high-pressure main. The hopper is filled with sufficient carbonate of lime to last twelve hours, and water is allowed to play through the rose against the under side of the screen, the force of the jet being regulated so as to empty the hopper in twelve hours. The water with the added carbonate of lime

* Extracts from a paper prepared in connection with the recent summer meeting of the Institution of Water Engineers at Wakefield.

falls into a trough below the screen, and passes into the inlet well, where it is delivered through a perforated pipe and mixed with the raw water.

From the inlet well the water passes to the filter-beds, and the carbonate of lime is deposited in a very fine film over the surface of the bed. The quicklime is slaked, passed through a mill, and filled into a hopper similar to the one described above; the lime and water subsequently pass through a mixing and settling plant, consisting of twelve cast-iron pipes, 12 ft. long and 30 in. in diameter. These pipes are arranged vertically in two series, so that one-half may be disconnected if desired. The water and lime enter at the bottom of the first pipe, in which is an agitator driven by a water turbine; there is an outlet near the top of this pipe through which the mixture passes into pipe No. 2, and thence alternately ascending and descending through Nos. 3, 4 and 5. A cocoanut-fibre screen is placed in the last pipe to arrest fine floating particles of lime. From pipe No. 5 the clear lime-water passes through a measuring-trough to the clear-water well in the well-house. This plant is the outcome of experiments extending over five years, and has in its present form been working satisfactorily for the past five years.

From the clear-water well the water passes to a service reservoir at Lindale Hill, 1 mile nearer Wakefield. This is a covered reservoir or balancing tank, the walls, piers and covering arches being built of brickwork in cement. The capacity of the reservoir is 1,250,000 gallons. . . . The cost of the treatment varies from 3s. 6d. to 4s. 3d. per 1,000,000 gallons, according to the condition of the raw water. The quantity of water used for sand-washing is 0·5 per cent of the quantity filtered. Settling tanks and a small filter-bed are provided to clarify the water flowing from the sandwasher before passing it into the stream.

The area supplied by the corporation's works covers approximately 60 square miles, and is shown on the accompanying plan. In addition to the city of Wakefield, it includes the urban districts of Castleford, Altofts, Featherstone, Methley, Normanton, and Whitwood, and part of the rural districts of Pontefract, Tadcaster, and Wakefield. The population supplied is 160,000, of which 53,000 within the city are supplied directly, and the rest are for the most part supplied in bulk, the corporation's trunk mains extending to the boundaries of Featherstone, Whitwood and Normanton. The total length of trunk and distributing mains under direct control is approximately 100 miles.

CONSUMPTION.

The consumption of water in the city is 30·44 gallons per head, of which 8·02 gallons per head are used for trade purposes. Street-watering and sewer-flushing account for 0·3 gallons per head, and the domestic consumption (excluding large institutions such as workhouse, prison, asylum, &c.) is 18·84 gallons per head. If the large institutions are included, the domestic consumption is 22·12 gallons per head. Ninety per cent of the houses are now supplied with water-closets, and the conversion of the remaining privies is being rapidly carried out. In the districts outside the city the consumption is 12·8 gallons per head per day, mostly for domestic purposes. The water-carriage system is not largely in use in the agricultural districts, nor in the mining towns and villages in the area supplied, but it is anticipated that more water will be required for this purpose in the near future.

The quality of the water delivered to the town and out-districts is excellent. Bacteriological examinations show that, while the number of bacteria per c.c. in the raw water is small (usually about 30), the water after filtration is practically sterile. . . .

The Ardsley and Ringstone reservoirs, with the catchwater feeding the latter, were designed by the late Mr. Edward Filliter, M.INST.C.E., and were carried out under the supervision of Messrs. Filliter & Rofe. The Green Withens reservoir and catchwaters were designed and carried out by Mr. Henry Rofe, M.INST.C.E. The filtration works at Kirkhamgate and the reservoir at Lindale Hill were designed and carried out by the author.

The total capital expenditure amounts to £853,000. The revenue for the last financial year was £38,879, the expenditure being £41,262. The deficiency was met by a rate-in-aid of 3d. in the £. In past years the rate-in-aid of the water undertaking has been a heavy burden, in 1889 being as high as 2s. 2d. in the £, but it has been gradually reduced, and for the current year is estimated at 2d. in the £.

WAKEFIELD CORPORATION WATERWORKS: PLAN SHOWING RESERVOIRS, DRAINAGE AREAS, MAIN PIPE LINE AND DISTRICTS SUPPLIED.

Definitions of Road Materials.—The Dussek Bitumen Company, Canal Bank, Deptford, S.E., who have already distributed a large number of copies of their booklet giving definitions and dealing with the classification of bitumen, &c., state that they will be glad to forward copies to engineers requiring them.

The Cumberland Water Scheme.—In connection with the completion of a £10,000 Cumberland water supply scheme the opening took place recently of a new filter-house and reservoir at Quarry Hill, near Mealsgate, in connection with the Aspatria, Silloth, and District Joint Water Board's project, under which practically the whole area of North-West Cumberland is now supplied with water for domestic purposes. The latest developments bring the total capital expenditure upon this comprehensive scheme, since its inception twelve years ago, up to £68,000. Mr. Jos. Graham, Carlisle, was the engineer; Messrs. Bushby & Sons, Leeds, the contractors for the reservoir; and Mr. J. Routledge, Mealsgate, the contractor for the filter-house and pipe-line.

Tar-Spraying and Tar-Macadam in Situ.

By THOMAS AITKEN, M.INST.C.E., County Surveyor, Cupar Fife, Scotland.

[The following are some observations on the results obtained from actual experience in the use of high pressure tar-spraying machines in surface treating macadamised roads and in making tar-macadam "in situ," with some remarks on kindred matters. This paper was prepared by Mr. Aitken with a view to its being submitted to the International Roads Congress, but unfortunately time did not permit of its completion early enough for its inclusion with the other communications.]

The writer's practical experience on the above subject extends over many years in carrying out work in the principal counties of Scotland and, to some extent, in the North and Midland districts of England.

In submitting these observations the writer hopes that the particulars given may be useful not only to those who have already adopted the methods described, but also to those who may contemplate a preference in regard to the system which the writer has pioneered and successfully introduced in overcoming the dust nuisance, and at the same time diminishing the abnormal wear on macadamised roads caused by the ever-increasing volume and greatly diversified descriptions of traffic which now pass over them.

The tentative period in the use of tar for the suppression of dust has long since passed, and it is surprising to think of the many so-called objections to its use which were urged by writers in the daily press. It was, however, probably more a question of the system adopted in certain localities by treating the roads with crude tar, and also by using primitive methods in applying same, that brought forth these protesting observations.

The whole matter at present resolves itself into a question of efficiency combined with economy, and in this connection, considering the changeable nature of the climate in the British Isles, tar-spraying machines which can handle or apply the greatest quantity of tar each day are those which should be preferred.

The different methods of application, now practically reduced to high pressure and gravitation machines, were at one time numerous, and it is surprising how so many road engineers but a few years ago claimed, along with other things, that hand-painting was superior to machine work. It is quite possible that they had not then seen a thoroughly scientific and practical machine in every-day service and the excellent results which could be obtained. The small machines which squirt tar promiscuously over the road, and many of the gravitation machines in use, no doubt performed the work in a quicker or even better manner than that done by hand-painting.

The remarks made by Mr. Boulnois in his introduction in "Practical Road Engineering," issued December, 1910, lays down the gauntlet in regard to hand *versus* machine work in this connection, and it will be surprising indeed if any road engineer of standing, after experimenting, will now declare hand-painting to be the better method.

The system of tar-spraying roads by machines has greatly facilitated the work and reduced the cost, and this may be considered one of the greatest boons conferred upon the users of macadamised roads. It lessens wear and tear, prevents suction by pneumatic tyres of vehicles travelling at a high speed, reduces dust in dry and mud in wet weather to a minimum, and at the same time lengthens the life of a road.

It is usual with one of these tar-spraying machines, working under favourable conditions, to spray from 2,400 to 3,200 gallons of tar per day. This represents on an 18-ft. road a length of 1·37 miles at the former figure and 1·66 miles at the latter.

A tar-spraying machine to be of really good service should be economical in operation, constructed to withstand the hard usage naturally expected from the nature of the work it undertakes, and be capable of traversing the roads at a fairly high speed in order that full advantage may be taken of the limited time available for these operations.

There is absolutely no penetration by the hand or gravitation machine methods on an ordinary macadam road unless the tar used is of a very poor quality, applied exceedingly hot, and the metalling is in a practically loose state, certainly not the best combination to attain success. Overheating of refined tar, and even of some tar-compos when applied to the cold road surface, brings about results which are disastrous sooner or later. The idea of raising tar to a high temperature repeatedly, as has often to be done, is brought about by the necessity of making it sufficiently liquid so that it can be manipulated by the gravitation machines or used in carrying out other primitive methods of application without due attention being given to the fact that the quality of the tar is thereby impaired. A good quality of refined tar has in many instances been condemned through being badly handled by inexperienced persons.

Refined tar and "bituminous tar" heated, if necessary, by steam coils and sprayed by a high-pressure tar-sprayer effects beneficial penetration, providing the road surface is properly cleaned. The amount of penetration varies according to the description of binding used when the road was recoated last and its general condition at the time of treating with tar.

The writer has found it 1½ in. to 1¾ in. in depth in many cases, and in this connection it is not oil that is meant, but tar of the same binding quality as that on top of the road. Samples of pieces of road crust showing the amount of penetration have been preserved, and will be on exhibition during the Third International Road Congress meeting. Effective penetration, along with a good film of tar on the wearing surface, is just what is required, and, the whole being keyed, gives a waterproof crust. As surface spraying on important and medium-trafficked roads is of an annual or recurring nature, it is of great importance that, in the first instance, the penetration should be effective, even although a greater amount of tar per square yard be applied than that found necessary subsequently.

It is a significant fact, borne out by experience, that when recoating roads by the ordinary or water-bound method, and employing a binding material of a loamy-sand description, penetration is easy and effective compared with roads which have been repaired with road scrapings or other promiscuous matter as a binding material.

Heavy surface coatings of tar, unavoidable when using viscous tars applied by hand or gravitation machine methods with practically no penetration, forms a coating like a sheet of blotting paper, or otherwise blanketing, an American expression, which is easily disturbed during very wet weather or a sudden thaw after frost.

The surface then becomes a nasty sticky mass of oiliferous mud, which is difficult to remove from the surface of the road, but nevertheless clings with great persistency to pedestrians' footgear and garments, and to horses, vehicles and motor cars. The cost of removing this slurry, apart from the inconvenience and nuisance caused to the general traffic, may or may not be a serious item of expenditure in maintenance of the highways, depending on the method of accounting adopted by officials under the different authorities.

The application of "bituminous tars of high grade," or material of a similar nature applied as a blanket coat, providing there is a good key to the old surface, is not affected to the same extent, and may last for a considerable period of time. Without effective penetration in the first instance, however, the whole covering will sooner or later peel off and must be removed from the road surface, an expensive protective operation to begin with, and one having no lasting or compensating results.

Surface spraying over many of the principal counties in Scotland has occupied the writer's attention for some years past, and more especially in East Fife, where he holds an official position. Certain roads under the writer's jurisdiction have been treated with a variety of tars, oils and other dust preventives.

Refined tar has unquestionably given the most

effective and economical results for surface spraying existing roads from the dust point of view, and, in addition, has greatly reduced the cost of maintenance on these roads by reason of the penetration effected, which practically waterproofs the surface and, to a great extent, prevents internal friction and consequent wear of the road stones.

A section of the Dundee, Stirling and Glasgow road west of Cupar was recoated for 4 miles, and a portion of this road for a distance of ¾ mile was treated later on with refined tar in 1908, and again in 1909, and has not been sprayed since. The section beyond the tar-treated portion, or westwards, had to be repaired with a centre coating in 1911-12 to bring the surface into good repair in view of the numerous potholes then existing. The tar-treated section has not required any further attention or expenditure so far as repairs are concerned during the period in question. The cost of recoating and rolling the whole section was 7·55d. per square yard, and surface spraying on the section mentioned was 1·85d. for each application, which together equals 11·25d. per square yard during the period up to December, 1912, or five years. The section beyond, or westwards, has cost, first in 1908, 7·77d., and then in 1911-12, 7·77d. per square yard, or 15·54d. per square yard, so that, assuming the tar-treated section wears out about the same time before renewal, compared with the other section, which to all appearance is most likely, the comparative cost for ordinary macadam and ordinary macadam treated with tar per square yard per annum is 3·11d. and 2·25d., or nearly 28 per cent in favour of tar treatment.

On another road, the Dundee, Edinburgh and Glasgow road, 1 mile east of Cupar, the surface had similar spraying treatment, which was carried out in the spring of 1907 and early in the following year.

This section, or rather one side of it, was again sprayed with tar in October, 1908. On the latter occasion the tar-spraying was carried out to demonstrate the practical working of the tar-spraying machine to some road engineers from abroad, although the road did not actually require this application.

As it turned out, however, the second and third application had, combined with the previous treatment, very beneficial effects in so far that when the other portions of the road were recoated in May, 1912, the portion referred to did not require any repairs, it being then in excellent condition.

Although the portion was at the footpath side of the road, embracing the water table, a considerable volume of traffic passes over it, as the road, being only 21 ft. in width, is made use of practically from side to side by overtaking and passing vehicular traffic. In the illustration the contour of the road previous to the last rolling operations is shown by a white line, and the contour of road after the repairs were carried out is shown by a dotted line. It will be seen, point A, that the tarred portion has not been interfered with for a distance of 7 ft. from water table. Sample B of the scarified portion removed from road at this point shows the depth of penetration. The cost of the three applications of tar and chippings amounted to 5·55d. per square yard, while the cost of renewing the adjacent portion by ordinary macadam was 7·11d. per square yard. This would mean a considerable saving when long stretches of road are taken into account, and in this case represents £77 per mile over six years, or £12·83 per mile per annum. The condition of the portion of the tar-treated road referred to is in excellent condition, and may reasonably be expected to last as long as the newly-coated sections, or a period of from five to six years. The traffic on this road is principally that of motor cars.

Illustration Showing Treatment of the Dundee, Edinburgh and Glasgow Road near Cupar.

It is necessary, however, to state that, had the surface spraying mentioned been carried out at present-day prices, the cost of the three applications, in these successive periods, would have been 6·19d. per square yard, which represents approximately a saving of £44, or £7·33d. per annum per mile of road at the width stated, and which would show a considerable saving on an extensive mileage.

These costs per square yard for surface spraying mentioned in the preceding page include haulage of the tar to the place of operations, heating, repairs to and depreciation on the machines, and the cost of the tar and application of same.

In regard to fairly deep penetration, a road in the burgh of Newport, Fife, may be cited. The burgh engineer being desirous of thoroughly testing this point, and at the same time have a satisfactory surface, repeatedly washed the road to rid it of extraneous mud which had been incorporated in the crust at some previous time when the road was repaired and rolled. After the road dried out it was swept clean and the tar-spraying carried out in dry weather. The penetration was such that the tar

practically disappeared, which appears remarkable, considering the fact that 1 gallon of tar only covered 4 sq. yds. The road was duly spread with chippings, but did not present a surface which was likely to satisfy the burgh engineer. On the advent of warmer weather, however, the tar was gradually drawn to the surface, to the surprise of many who believed that little or no tar had been applied to the road. The penetration in this case was fully 2 in., which could not possibly have been done with any other machine than a high pressure one.

Similar cases could be described from data in the writer's possession of work carried out in and around Cupar Fife, but it may be more conclusive to describe some of the surface spraying carried out by Aitken's patent gold medal tar-spraying machine in another centre, the figures as to cost of maintenance and other details being given by the official in charge.

The road in question is an important one, leading from the city of Edinburgh to Queensferry, over which, especially during the summer months, a very heavy continuous traffic passes, including motor 'buses. The road for the most part is 40 ft. wide, and extends to about 1¼ miles, and the whole surface has been sprayed annually in the beginning of May for the last three years, and certain portions for the past five years.

The annual cost of maintenance previous to the tar treatment, including all items except establishment charges, was, on an average, for three years previously, £440 per mile, or 4·19d. per square yard per annum.

Since this thoroughfare has been tar sprayed the annual expenditure for materials and labour has been reduced to £399 per mile, or 3·84d. per square yard, which figure includes surface spraying. These figures represent a difference which is equal to ·35d. per square yard, or an annual saving on previous expenditure of 9½ per cent, in addition to a considerable reduction in the cost of watering and cleansing. The cost of surface spraying on an average for three years was, for tar and application, sweeping and chippings, 1·92d. per square yard.

It is necessary, however, to mention that this road was put in good repair previous to the first surface spraying, and the work was carried out in what the writer considers, and has always recommended, ideal methods of using 2-in. gauge metal with a binder of chippings—and it may be mentioned the latter material was produced from rock having stable constituent minerals—rolled and the surplus binding swept off. When the tar-spraying operations were commenced the road had been thoroughly swept, and was in a dry condition. The quantity of tar applied under these favourable conditions figures out at the somewhat excessive amount of 4·5 gallons per square yard, and it was remarkable how small a film of tar was apparent on the surface of the road immediately after the operations were carried out. On the advent of warmer weather, however, the actinic force of the sun's rays caused the tar to reappear, and, combined with the clean whin chippings applied, made an excellent surface, which was absolutely free from dust. This the writer considers is the proper condition in which a road should be for effectively waterproofing the surface, and which lays the groundwork for future spraying operations.

The writer considers the excellent condition of this road previous to being tar sprayed, combined with the deep penetration effected, has been instrumental in securing the results obtained, and the surface spraying, which has been carried out annually, has maintained these economical results.

Mr. Sim, city road surveyor, Edinburgh, kindly supplied the writer with detailed information, from which the preceding figures were extracted.

In carrying out surface spraying, the thorough cleansing of the surface of the road cannot be too strongly emphasised as an important factor in obtaining successful results. The surface of the road for treatment must be cleansed of all foreign matter by repeated applications of a rotary brush, or otherwise, so that the surface be left as open as possible to permit of penetration, and so allow the tar to act partly as a binder, and not merely forming a "blanket coat," which has already been referred to.

In the course of the writer's experience he has many times seen a good quality of tar, properly applied, give but poor results, entirely due to inefficient preparation of the road for the application.

Spreading clean, uniform-sized chippings on the newly-sprayed road surface is also a factor which assists in the attainment of satisfactory work, and should always be adopted. This important point has, however, apparently not been so well understood in some counties, as is noticed from time to time in the technical journals, that road scrapings have been used considerably for this purpose. This is remarkable, and certainly cannot lead to success, and it is a matter of surprise to the writer that any road engineer permits such material being used.

These remarks, so far as is possible in a paper so limited, practically conclude the writer's experience of surface spraying macadam roads from the point of dust prevention through the road crust being waterproofed by effective penetration of the tar. Unquestionably, tar spraying, when properly carried out, is a very effective remedy against the formation of dust, and also lessens the excessive wear of the roads by vehicular traffic.

This has been abundantly proved by the cases cited in the preceding pages, which roads have been treated with high-pressure tar-spraying machines.

In addition it may be stated that the cleansing of roads properly treated by high-pressure tar-spraying machines is considerably reduced, and, in fact, in many cases the cost of tarring is met by the reduced cleansing account, and in addition there are the economical results attained in the cost of maintenance.

On reviewing the judges' report on the subject of the "tar-spreading" trials which took place near Staines in 1907, and also one by Mr. Wakelam on behalf of the Roads Improvement Association, and published as a paper in the First International Road Congress "Proceedings," Paris, 1908, the writer makes the following observations on these generally.

First of all, the Roads Improvement Association, in so far as surface spraying by machines was concerned, held the monopoly in supplying the tar which the competitors had to pay for. Probably this was a desirable condition to impose with a view to test the competing machines properly, but when the judges' report and that by Mr. Wakelam refers to the lasting quality of the tar supplied by them compared with proprietary compounds, the effect of the observations made are very misleading and of little value.

The condition of the roads on the Hounslow and Staines main road, Middlesex, were far from being in an ideal state for surface spraying at that time, the binding on the surface being caked to an extent which no amount of sweeping could remove. Penetration, therefore, under such conditions was practically impossible, except in isolated places. Probably the binding used when repairing this road was of a heavy description, and possibly the sweeping of the surface previous to these trials taking place had been carried out in wet weather.

The sections near Staines, where the road was in open country, were for the most part in admirable condition for surface spraying, and good penetration would naturally be expected with approved spraying machines. These points may be known to road engineers in this country, but it is well to point out these facts as being factors governing the whole question of results, which information may be of some use to road engineers from other countries.

Many roads in the United States have been treated on the blanketing principle, but what has come under the writer's observation of this method of treatment in some of the leading States in that country gave him the impression that such expensive operations do not really serve any good purpose. When there had been even slight penetration the result was fairly good, but otherwise the wear was very unequal, and large tracts of roads so treated have had to be stripped and the slabs of material dumped on adjoining waste ground. Any considerable body of material used in this manner to attain any success must be of a really asphaltic description, because ordinary refined tar or "oil" has not the necessary resistance when applied as described. A blanket coat, even carried out with asphaltic material, will end in failure if the subsoil or ordinary drainage of the road is bad, and more especially on formations of a clayey nature, unless the latter is separated from the road crust by an intervening layer of suitable material.

(To be concluded.)

The Crystal Palace.—Lewisham Borough Council have agreed to contribute £10,100 to the fund for the purchase of the Crystal Palace.

Institution of Water Engineers.

SUMMER GENERAL MEETING AT WAKEFIELD.—(2.)

At the recent summer meeting of the Institution of Water Engineers at Wakefield, the opening proceedings in connection with which were reported in last week's issue, Prof. Percy F. Kendall, F.G.S., was to have given a lecture on "The Underground Waters of the Lower Calder." Prof. Kendall said he must offer his apologies for his inability to follow out the programme, but when he was asked to give a lecture he was obliged to attach a condition to his acceptance of the very courteous invitation. It would be within the knowledge of several present that there were sundry water undertakings in the air, so to speak, in the Calder Valley, and though they had not arrived in a condition of maturity they were emerging from the embryonic stage, and consequently he was debarred by considerations of propriety and delicacy from saying anything that would have a direct bearing upon them. He therefore proposed to refrain from dealing with details of particular localities, and just to outline the general character of the water supplies derived from underground sources in the general region of Yorkshire, and not in the Calder Valley particularly. Those, however, who chose to apply the principles to that area were quite at liberty to do so.

UNDERGROUND WATER SUPPLIES IN YORKSHIRE.

The underground water resources of the general region of Yorkshire were derivable from four sets of strata. Beginning at the bottom they had millstone grit, which was a very coarse sandstone. That at the outcrop was not only coarse, but very open in texture, encouraging high expectations of its water-yielding capacities that were not always realised. Bitter disappointment frequently arose from that source. Only within the last twelve months he had met with two cases in which cores from the millstone grit had really very much, on superficial inspection, the aspect of granite. In such cases they must rely upon the joints in the rock for water and not the interstices of the rock itself. It would be an interesting determination to ascertain what the percentage of porosity actually was, and that, he hoped, would be accomplished before long.

As to the quality of the millstone grit water, it was usually very soft and admirable in all other respects, but within the last three months he had met with cases of very soft water and very hard water in adjacent borings—borings within ¼ mile of each other. He would suggest theoretically—though they might, perhaps, regard it as far too speculative an explanation of this anomaly—that the difference of composition might be due to flow of water from different coal measures having acted as conduits conveying water across the gap; the anomaly occurred in the neighbourhood of a great pair of trough-faults.

Turning next to the coal measures which constituted the area of the lower Aire, Calder and the other rivers to the south, down below Sheffield, in a measure the water in like manner varied a good deal. They had very soft water from certain portions of the coal measures, a very hard water from others. They also had water which, without being unduly hard, was extraordinarily alkaline. The users of such water on the coal measures sometimes demanded one type of water and sometimes another. In wool washing the highly alkaline waters were very highly esteemed. They might get so large a percentage of carbonate of soda per gallon as to make it an exceedingly desirable water for the preliminary treatment of wool. In one of the cases which he had had under investigation recently the water was pronounced to be an exceedingly good water for certain purposes, but not for the purpose for which it was required. It was pointed out to him that it would make an excellent water for a mineral water manufacturer, as, indeed, it would, for he would be provided with carbonate of soda without any artificial admixture. He wished to point out, however, that the hardness might arise from various ingredients. Frequently there was a great deal of permanent hardness, and frequently there was a great deal of common salt—which was not really hardness.

The third source—he was taking them in their regular geological and geographical sequence—was the magnesium limestone water. That was a very hard water, which rendered it an undesirable agent for many purposes, but he wished to say as little as may be upon the subject of magnesium limestone water. There was abundant water in the magnesium limestone—far too much, in fact, from the point of view of those who mostly encountered it—mining engineers. Enormous difficulties had been encountered in mining engineerng from the deluge of water obtained from this magnesium limestone. Great developments in the Yorkshire coalfields were now taking place through the magnesium limestone, and most serious difficulties had been encountered that almost threatened to be an absolute bar to mining enterprise there. The water had to be pumped in very large volumes, and this had produced grave and very far-reaching effects upon neighbouring domestic small-scale water supplies. The last rock that could be considered as coming within the area under review was the red sandstones of the Trias. Provided the conditions were favourable, admirable supplies were to be obtained from these sandstones, and they yielded valuable supplies of water. Pontefract and Selby derived most valuable supplies of water, which was unsurpassed, except by Wakefield, from this red sandstone. It was a water of unexceptionable purity, and not of excessive hardness. The Selby hardness was about 8 deg., but the water had two severe limitations. In the first place there must be such a thickness of rock as would afford them a reasonable depth for the well. That compelled them to go far to the east. If, however, they went too far to the east, deterioration set in, and that deterioration became more and more pronounced until the water became almost undrinkable. Sometimes the transition was an abrupt one, but generally the deterioration was a gradual one.

Prof. Kendall then, with the aid of a blackboard, proceeded to illustrate some of the more noteworthy cases he had seen in regard to obtaining water supplies, prefacing his illustrations by the remark that his experience of water supplies, whether from gravitation or from underground sources, was like a medical man's experience of human physiology—he was called in to the sick man and not to the man in good health. His experience had embraced a larger number of other people's failures, no doubt, than other people's successes. He had recently had to deal with a borehole—he was called in when the boring had been practically completed—which passed through a great thickness of coal measures—400 ft. or so—into the top bed of the millstone grit. It yielded no appreciable water. At the time he was called in they were boring in the shales between the top bed of grit and the second one. He saw that if the top bed of grit failed to yield a water supply it was exceedingly improbable that the next one would be any better, because the outcrop would be more remote. He therefore proposed an expedient that was well known to water engineers. He saw that the cause of the trouble was that the millstone grit through which they passed was far too dense. There were very few fissures encountered, so that they were in the position of carrying the borehole down through the rocks that were almost impervious, and he saw that the only hope of obtaining a supply of water would be by the development of fissures that would promote the passage of water. He therefore proposed that shots should be fired with a high explosive with a view to the development of fissures upward from the borehole into the internal joint fissures of the rock, and he indicated the levels at which he thought it desirable that this should be done. It was desired, particularly in this case, not to obtain soft water, but hard water, and the harder the better, and of permanent hardness.

The level that he favoured most was about 600 ft., but he proposed that they should commence at the bottom of the borehole in the millstone grit, fire a heavy charge there and withdraw the lining tubes, progressively repeating the operation at several levels which he indicated, finishing at 400 ft. When they obtained the quality and the quantity of water they desired they could suspend operations and so shut out the soft water. The engineer who was engaged in the work wrote to him to say that their first charge had

been successful. He then recommended heavy charges of gelignite—in this case 35-lb. charges. This seemed rather ambitious, perhaps, but they used a 2-lb. charge of dynamite. The engineer had written him a letter describing the results, and there was a touch of humour in his letter. He said: "With respect to the shots used we did not use more than 2 lb. of dynamite, and I may say that we intended driving the shot 600 ft., but it exploded sooner than we expected—at 400 ft."

That was an eminently successful result, and he thought it could not be too widely known that the cause he had referred to—the density of the rock and the rarity of fissures of a suitable character—was a common cause of failure in deep boreholes. He recommended a similar expedient at Huddersfield, but it was not carried out for the reason that the borehole was within a large warehouse in a very populous area, and it was feared that serious consequences might ensue. Upon that point he had some fairly specific information as to the effect of a charge on a deep borehole. He had had two 35-lb. charges of gelignite fired at a depth of about 400 ft. in a borehole, and the only result was to lift a column of water about 80 ft.; there was no other effect produced besides. Therefore with great confidence under similar conditions with regard to depth of water, he recommended the firing of a shot even within a building. He felt quite certain it could often be done with advantage and without undue risk.

He might also give one other example which was well known to Mr. Silcock of a borehole which was one of the most remarkable in Yorkshire. The locality was Oswaldkirk, in the neighbourhood of Malton. He was particularly desirous of obtaining a true artesian water supply, and for the first time in his life he recommended works to be executed in the expectation of a true artesian supply. The strata were the Corallian limestone and sandstones underlain by the Oxford clay which rested on the Kellaways rock. The last-named formation outcropped at a high level on the Hambleton escarpment, and dipped down below the Oxford clay at Oswaldkirk. He was led to believe that this would yield an artesian supply, and he recommended a boring with this specific purpose. The result confirmed his anticipation, and at 316 ft. the Kellaways rock was pierced, when the water rose under a pressure sufficient to lift it 92 ft. above the surface. He did not know of any artesian supply in the kingdom that would send water to such an altitude as that. The supply had not yet been brought under control, so that for the last three months little less than 300,000 gallons of very beautiful water had been running to waste.

In conclusion, Prof. Kendall said he was conscious that he had only given a very discursive lecture on a very wide subject, and he asked the members to make a generous allowance for the difficult position in which he had been placed in not being able to address them on the subject on which he had originally intended to speak.

The President (Mr. C. Clemesha Smith) said he was sure they had all listened with great interest to Prof. Kendall's lecture, and they would wish to accord him their best thanks. As the Professor had said, he was usually called in to prescribe on other people's failures, and they usually learned more by studying people's failures than by studying their successes. With regard to his remarks about the millstone grit, several of their reservoirs in Wakefield were on the grit, and they did find on one occasion that the lower beds of the millstone grit were extremely dense, and one long length of one of the trenches was bottomed on very close millstone grit.

Mr. T. Molyneux (Stockport), in seconding the vote, said it was remarkable to note the difference to be found in the water from adjacent boreholes. He had just sunk a new borehole within 20 yds. of an old one. In the old borehole there was an iron solution which oxidised when the water was exposed to the atmosphere. In the new one, which was only 20 yds. away, there was nothing of the sort, but, instead, a bright, clear water 2 deg. less in hardness and with no permanent hardness. It was really marvellous how waters in close proximity differed from each other.

The vote of thanks was carried.

(To be continued.)

Decimal Acreage Tables.—A correspondent is desirous of obtaining a book of decimal acreage tables as used by surveyors, giving details from 1 to 1,000 acres, and reducing acres, roods, poles, &c., into acres and decimals of acres. Can any reader advise a suitable publication?

CORRESPONDENCE.

For every ill beneath the sun
There is some remedy or none;
If there be one, resolve to find it;
If not, submit, and never mind it.
—Anon., *circa* 1843.

SUMMER SCHOOL OF TOWN PLANNING.

To the Editor of The Surveyor.

Sir,—In connection with the Summer School of Town Planning to meet at Hampstead Garden Suburb in August next, will you kindly allow me a few lines to testify to the value of this school to all those who are engaged in the study and practice of town planning? As one who attended this course during the last summer session, and who is engaged daily in working out the problems of town planning, I am in a position to testify to the great value and to the practical utility, not only of the course of lectures, but of the practical demonstrations of the subject, included within the curriculum of this summer school.

I therefore cordially commend this school to all those, in particular, who are engaged in the office of municipal engineers, as a practical aid to the study of this subject.

The lectures are mostly by practical men, carried on, moreover, in the centre of an area offering the best opportunities for practical exposition of the subject, and I cannot speak with too much appreciation of the efforts of the lecturers to interest and instruct the students of the school.

The first summer school was one of undoubted success, and I am sure the importance of the subject, and the increased demands upon those engaged in it, call for the seizing of this opportunity by the many young men who are engaged in the profession of municipal engineering.—Yours, &c.,

A. H. Campbell,
City Engineer.

Edinburgh.
June 14, 1913.

SURVEYORS' INSTITUTION EXAMINATIONS.

To the Editor of The Surveyor.

Sir,—It has also been my unfortunate lot to have failed to satisfy the examiners in the typical subject of the intermediate examination, and with "Typicus" I feel it hard to have to wait another two years in order to be able to join the institution as a professional associate. Considering the high standard of questions set in each subject, I was not surprised at the result, and perhaps, under the circumstances, I ought to be satisfied with small mercies. However, I heartily wish "Typicus" success in his pleadings with the council of the institution, and I shall be pleased to help in the matter. Trusting that others will assist.—Yours, &c.,

Hopeful.

June 9, 1913.

To the Editor of The Surveyor.

Sir,—I notice that some correspondence from unsuccessful candidates with reference to the above has appeared in your columns.

May I crave a somewhat doubtful privilege as another unsuccessful "typical" candidate, and as an ex-student of the institution, of reminding them that there is more than one side to the case?

In the first place, I believe that I am right in saying that notice of the intended change of rules was given in 1908—five years ago. The object was, of course, to raise the status of the professional associate, giving him a somewhat similar position to an A.R.I.B.A. This the change will undoubtedly do, and yet we find a struggling crowd trying to get elected "on the cheap" after failing in their most important subject. It somehow gives one the impression that many of these men would have been content to have rested on the laurels (?) of a cheaply earned P.A.S.I., and never contemplated taking the F.S.I. examination.

I trust that in the interests of the status of the profession the council will answer these gentlemen by "referring them back to their studies in that subject." A concession would be palpable weakness, and an inglorious beginning to a better era.—Yours, &c.,

Asking No Favours.

June 16, 1913.

INSTITUTE OF CLEANSING SUPERINTENDENTS.

ANNUAL CONFERENCE AT ABERDEEN.

The sixteenth annual conference of the above institute was held last week at Aberdeen, the place of meeting being the Advocates' Hall. The attendance of delegates on the opening day (Tuesday) numbered about 150. A welcome was extended to them in the name of the Corporation of Aberdeen by Lord Provost Maitland.

Mr. Robert Williamson, of Manchester, the retiring president, having installed Mr. Findlay, of Aberdeen, as president for the ensuing year, Mr. Findlay delivered his presidential address. There was, he remarked, a time, and that not so very long ago, when it was thought that a corporation cleansing department was only work for old and worn-out men; but now a very high standard was set up in regard to cleansing generally, and a superintendent of cleansing in particular. The Institute of Cleansing Superintendents was a comparatively young organisation, but it had done a remarkable amount of good work, and it was to be expected that, as the institute increased its strength in regard to members and the capability of its members to satisfy the needs of the nation in regard to sanitation, in its early and most important stages, the institute would make even greater progress in the future than it had done in the past. The ideal of the institute was to educate its members in every phase and detail of cleansing work, so that the position of cleansing superintendent might become one of supreme importance, not for the sake or the benefit of the person holding the office, but in the interests of the life, health, and the happiness of the people. They could not hope, however, to realise their ideal until public bodies saw to it that those appointed to positions of authority in cleansing affairs were endowed with the requisite abilities for the proper discharge of their duties. When this was done, and this capacity was brought to bear upon cleansing work, the institute might then hope, but not till then, to make that steady progress towards its goal that would enable it at no very distant date to realise its high ideal. All things being equal, his sympathies were with those who advocated promotion from the ranks.

Councillor James George, convener of the Cleansing Committee of Aberdeen, read a paper on the "Cleansing Operations in Aberdeen."

EQUIPMENT OF CLEANSING DEPARTMENTS.

On the second day (Wednesday)—

Alderman Watson (Blackburn) read a paper on "The Equipment of a Cleansing Department." He said he knew that many would not agree with him, but he held very strong views that with a decrease in the weight of vehicle a department could well decrease its capital expenditure by the introduction of a much lighter and more active but less costly horse. Why for the sake of saying they had a great big, fine-looking horse should they pay £70, and reject the smaller, yet equally good-looking one, for £50? They wanted to devote themselves absolutely to their work, and secure plant and appliances useful and effective at a minimum of cost.

Mr. D. M'Coll (Glasgow) said the type of vehicle depended on the town and the stuff handled. A wagon 2 ft. deep was of no use in Glasgow. He should not like to try to buy a horse in Scotland at £48 or £50. It might be possible to get a van horse, but they needed for Glasgow a good Clydesdale horse, which at present costs £70, somewhat dearer than a year or two ago.

MOTOR VEHICLES.

Mr. Turner (Bury) read a paper on "Motor Vehicles for Municipal Purposes." In the course of discussion, Mr. M'Coll said his experience did not correspond with Mr. Turner's. Although it was given every chance by being put on a long-distance run, their motor vehicle cost more than horse-power to collect refuse. On the other hand, the motor sweeping machine was slightly cheaper.

TRADE REFUSE REMOVAL.

Mr. H. Hopkinson (Portsmouth) read a paper on "Trade Refuse Removal." He said that trade refuse was understood to mean a waste of any profitable trade, manufacture, or business. A large saving could be effected by the introduction of payment for the removal of this refuse, and in Portsmouth a scale of charges had been drawn up. These ranged from 2s. 6d. per two-wheeled cart load for ashes and other similar refuse to 2d. per sack of four bushels of paper. No charge was made when the quantity could be placed in an ordinary-sized sanitary bin and did not exceed the householder's ordinary output of refuse at any one time, but it must not include offal from butchers, fishmongers, and poulterers.

Councillor Brown (Blackpool) could not understand why tradespeople should be charged for the removal of trade refuse. At Blackpool they collected paper, cardboard boxes, &c., and sold the stuff at 10s. per ton. He thought it was humiliating for any corporation to stoop to such a low means of raising revenue.

Mr. W. H. Eccles (Stockport) argued that if they were to remove shop refuse free, the millowner, who paid much higher rates, would be entitled to claim the same facilities. A charge tended to minimise the quantity of refuse.

Mr. T. Stake (Stoke-on-Trent) said they got 10s. per ton for a certain class of refuse, but it cost them nearly 25s. to collect it.

Mr. A. May (Finsbury) remarked that what they wanted was a definition from the Local Government Board of what was domestic refuse, and then they could possibly classify all other refuse. He also pointed out that it had been ruled that hotels must be looked upon as private houses. The tradesman did not really pay, it was the purchaser of his goods. He moved the following resolution: "That this conference calls the attention of the President of the Local Government Board to the present unsatisfactory definition now existent in relation to trade refuse, and asks for a clear definition of what is house refuse."

Mr. R. Williamson (Manchester) seconded.

Alderman Dixon (Manchester), who objected to what he described as any official walking over the top of his head, moved that the matter be first referred to their Cleansing Committee for consideration.

Mr. Heavey (London) seconded.

Mr. May afterwards withdrew his motion.

Bridge Building.—Students, young engineers, and surveyors will find much useful information in "Preliminary Studies in Bridge Building," by Reginald Ryves, ASSOC.M.INST.C.E. (London: St. Bride's Press, Limited, 24 Bride-lane, E.C. Price 2s. nett.) The book is described as the "first of a series of small volumes, each complete in itself, dealing with the design of ordinary highway bridges of moderate span." Though highway bridges alone are referred to, the matter contained in this volume is largely applicable to railway bridges, aqueducts, and similar engineering undertakings. The five primary types of bridges are described, and the conditions determining the best site for each of the three types of streams are discussed in detail; while in connection with wandering streams various modes of designing abutments or approach spans are dealt with. Improvements of fords and the effect of eccentric loading of vehicles on the girder loads are among the numerous other items touched on.—*Scotsman.*

Reinforced Concrete Fire-resisting Doors.—The idea of constructing doors of concrete is not new, yet the use of such doors has been quite exceptional, and thus a series of tests by the British Fire Prevention Committee with doors of a non-proprietary character, designed in Belgium in the public interest by the chairman of the Belgium Government Technical Committee of Fire Protection, and tested and reported upon in this country by the London committee, may claim special attention. The doors under test comprised two single doors to two openings, fitted as sliding doors, and one set of double doors fitted to a third opening, also sliding. The single doors were tested for two and a-half hours at temperatures between 1,800 deg. and 2,000 deg., and the double doors for four hours at similar temperatures. In each case water was applied from a steam fire engine at the end of the test to the inside face of the doors. The tests, from which some very useful facts were drawn, showed that the doors should be most valuable as an addition to our ordinary fire-resisting materials after some of their minor defects have been remedied. A limited number of copies of the report can be obtained by the public, for 3s. 6d. each, from the secretary of the British Fire Prevention Committee, 8 Waterloo-place, S.W.

Institution of Municipal and County Engineers.

MEETING AT ROCHDALE.

A meeting of the Institution of Municipal and County Engineers was held at Rochdale on Saturday last. This is the third meeting which the institution has held in Rochdale, and in attendance of members and the interest of the paper submitted by Mr. Platt the meeting was entirely successful. Mr. R. J. Thomas (Aylesbury), president, was in the chair, and there were present Messrs. S. S. Platt (Rochdale), J. S. Brodie (Blackpool), W. Stubbs (Blackburn), H. Yarwood (Rochdale), J. Mitchell (Birkdale), S. E. Jones (Tyldesley), A. E. Cooper (Fulwood), W. Holt (Sale), E. Pilling (Lytham), G. H. Wild (Littleborough), R. Holt (Rawtenstall), C. Hall (Droylsden), B. J. Wolfenden (Bootle), W. Clough (Audenshaw), E. Bleakley (Tyldesley), A. T. Gooseman (Wigan), C. Brownridge (Birkenhead), E. Worrall (Stretford), F. J. Dixon (Ashton-under-Lyne), W. Wellburn (Middleton), J. B. Nuttall (Heywood), M. A. Piercy (Warrington), E. W. Booth (Manchester), J. England (Wrexham), J. A. Settle (Bury), J. R. Mead (St. Helens), V. W. Laithwaite (Turton), M. H. Wilkinson (Leyland), A. P. Statham (Salford), A. J. Price (Eccles), J. Wilson (Bacup), J. R. Hill (Bacup), J. H. Mountain (Barton-on-Irwell), F. Waddingham (Hebden Bridge), H. G. Whyatt (Grimsby), J. Cunliffe (Willington), F. W. Dean (Willington), H. C. Swindells (Willington), W. H. Elce (Bacup), H. Hamer (Accrington), F. H. Holden (Accrington). Among the visitors were Messrs. G. Biddle (Didsbury), J. W. Gleave (Haywood), W. L. Williams (Wrexham), H. A. Shaw (Bacup), and E. R. Cunliffe (Rochdale).

The Mayor (Alderman W. Cunliffe) gave the members of the institution a hearty welcome to Rochdale. He said he realised that in visiting other municipalities and their workers there was a good deal to be learnt. There was this advantage about municipal works, that there were no closed doors. With reference to sewage, water, and other municipal works, they had a free hand, and were able to gain experience for the good of all of them. With regard to Rochdale, it was a progressive borough, and very few towns could boast of such a civic centre. He looked upon municipal engineers as the first line of defence with regard to national health. The medical profession made advance in surgery, and science, and the treatment of disease, but he recognised that municipal engineers were engaged in preventing many of those diseases to which the human race was subject, and he hoped that side of their work would not be lost sight of.

The President thanked the mayor for his very hearty welcome to them. They knew how hearty Lancashire people were, and they appreciated this evidence of his sympathy with them in the work they did. That institution was founded to benefit its members by friendly intercourse, by which alone business men could hope to progress in the profession they had taken up. He felt certain that the municipalities who employed them would not lose by offering their officials opportunities for attending these meetings in this very progressive age. It was very interesting to find what Rochdale had done in developing that centre and putting up that beautiful town hall. It was an indication of the far-seeing views of the council. Their reception they took as a compliment by the municipality to their engineer, Mr. Platt. They knew no municipality was better served than Rochdale was by Mr. Platt, who was an authority on several subjects, particularly ferro-concrete. He looked forward to seeing Mr. Platt's work in that direction. He was among the first in the kingdom to carry out ferro-concrete work.

The Mayor said he endorsed everything Mr. Thomas had said as to their engineer. He was a worker, and thorough in everything he did.

ROCHDALE'S MUNICIPAL WORKS.

A paper descriptive of some of the more recent municipal works of Rochdale was afterwards read by Mr. S. S. Platt, M.Inst.C.E., the borough surveyor, and is reproduced elsewhere in this issue.

Mr. J. S. Brodie (Blackpool) proposed a vote of thanks to Mr. Platt for the interesting paper which he had given to them. The first part of the paper would be very interesting to those engineers who had to tackle the problem of sewage disposal in inland towns. He would like to ask Mr. Platt what he did with his sludge. Further, as a matter of information, he would like to ask what period the Local Government Board allowed for repayment of loans for this kind of work. He had not a practical experience in this matter, but he had read from time to time what had taken place in Rochdale upon this subject. The Rochdale works appeared again and again in the report of the Sewage Commission, which seemed to show that they were a model in this class of work. Coming to the reinforced concrete he was a little more at home, and the works described by Mr. Platt were certainly very interesting examples of reinforced concrete. He had the pleasure of knowing the late Mr. Mouchel in connection with ferro-concrete work, and a more able and honest engineer he never met. If the work was not suitable for ferro-concrete, or there was no advantage in its use, Mr. Mouchel always had the manliness to tell them. That was a great point in a contractor, for him to say when he did not see any immediate benefit to himself or to the people he was proposing to tender for. It was interesting to notice the good results of concrete made from the Lonkey rock. He did not know a rock of this name, but Mr. Platt was a geologist, and knew these technical terms better than he did. He had also made concrete from a broken rock of this kind, and he could bear testimony to the high efficiency of the concrete. With reference to the ferro-concrete bridges, Mr. Platt estimated the saving over steel construction was 20 per cent. Mr. Platt was to be congratulated on this saving, and on initiating work of this kind with this gratifying result. Mr. Platt alluded to the short term of repayment which the Local Government Board had granted for this work—namely, fifteen years instead of the usual thirty years. A good many engineers had written to him as to their experience in this matter, and he had always told them, "If you don't like the Local Government Board don't go to them; proceed, in works of any magnitude, by private Act." One really could not blame the Local Government Board for a policy of safety, especially with work upon which they had had no time to mature their judgment. He had no doubt that in time the full period of thirty years would be allowed for works of ferro-concrete. The only thing which would upset that would be if someone worked with a poor cement and the wet got in and set up erosion of the bars. While thirty years might be allowed for proper work inferior work would be highly rated at ten years. If it was a question of workmanship it should be taken into account. That took him to a peculiarity of the Local Government Board. They held an inquiry, they sanctioned work, and allowed a time for the repayment of the loan, and then they very rarely came to look and see how the money had been spent. There was no check upon them. He supposed the board, with the more modern and scientific conditions under which work was carried out, would send an inspector round to see how the money had been spent, and it might be in the wisdom of the board that the period of the loan would be modified if the work was properly carried out. If the work was not first class, one could not be surprised if the work did not last very long. He would like to add a word of congratulation to Mr. Platt. He noticed in the "Minutes" of the institution they had a meeting there in 1883, another in 1897, and now this third meeting. He believed Mr. Platt had had all these meetings, and he congratulated him, and he hoped that he would be to the fore in another sixteen years' interval to welcome them again to the town of Rochdale.

Mr. W. Stubbs (Blackburn) seconded the vote of thanks to Mr. Platt for his valuable paper. He had carefully read the paper, and had seen most of the works carried out. In ferro-concrete work Mr. Platt was a pioneer. He had done considerable work on similar lines, and, knowing Mr. Platt's work, he brought his committee over to Rochdale to see the bridge over the canal. Since then they had carried out four bridges over the canal in Blackburn, beside a large tank to hold 3,000,000 gallons of water. He would like to ask Mr. Platt what he did with the solids from the humus tank. There was not much difficulty in pressing the sludge from the septic tanks, and the ordinary sludge there was no difficulty with, but the

humus it was impossible to press. They had 500 acres of land, and they squeegeed it on the land. They were paying from 3s. 9d. to 4s. per ton for the pressing of sludge, which was rather an expensive matter for them. It was as practical a paper as they had ever had before the institution.

Mr. Gilbert Whyatt (Grimsby) said the very first building that he was taken over during his pupilage was the Rochdale Town Hall, and he had notes of some of the things he saw then, and which struck him as being most interesting. Those who had not been over the building until that day would be exceedingly pleased with it. He had two or three questions to ask. He was not quite sure about the sediment in the humus tanks what it consisted of. Personally he had not got the sewage problem. He put his into the river without treatment in any way, except that he had to pump it half the time, and the other half flowed out in a state of nature. He used to be in touch with the sewage problem, but now he was a bit out of touch, and it seemed there was a good deal of treatment if the sewage first went through settling tanks, then through percolating filters, and then was sedimented again in humus tanks. What did the sediment consist of? Was it disintegrated coke, or was it some oxidisable matter which formed in the sewage in the filter? Mr. Stubbs raised the question as to how they managed to press this humus sludge. He could quite see the necessity of taking it through the settling tanks again, because then it mixed with the ordinary sludge. With regard to the Lonkey rock to which Mr. Brodie had referred, they used Lonkey setts in Salford twenty years ago, and he understood it was the local quarrymen's term for that strata. He did not known that there was any other origin for the term. It was a good hard stone fit for second-class streets. A point struck him as to the pile foundation for the Mellor-street bridges. Mr. Platt had carried the foundation down through the coal workings to the solid fireclay. As subsidences would go on would the bridges stand up some feet above the adjoining streets? He had a similar problem. He was carrying a sewer through an old river bed, and in the excavation they found five different lots of road metal over the peat, a matter of 5 ft. thick. The pipes would hold the sewer up, while the surrounding ground went down. He would like to ask whether Mr. Platt anticipated a similar effect, and whether the bridges would stand up above the surrounding ground as the ground subsided.

Mr. E. Worrall (Stretford) added his thanks to Mr. Platt for the valuable information he had imparted to them. What struck him principally in connection with the ferro-concrete structures was the central fact of how little difference there was in principle between the many systems. Whenever they proposed to embark upon this method of construction they were besieged by some dozen agents of different systems, each one of whom claimed his was pre-eminent. The real engineering difference, however, was small. One firm distorted its reinforcement, and gave it a name, another firm twisted its reinforcement in a different direction, gave it another name, and claimed for that twist some particular advantage. He discounted these claims by reference to the fact that the adhesion between ordinary concrete and steel bars could not be exceeded in actual practice. Hence, to increase that adhesion is superfluous. Another thing which struck him about the Mellor-street bridge was the fact that rubble backing had been provided for the bridge at its abutments and the arch. One questioned the use of rubble backing on a bridge constructed with brickwork; but in ferro-concrete he did not quite see the reason for the extra cost incurred in backing up the whole structure with rubble. Reference had been made by one or two speakers to Lonkey, as applied to the lower strata of Haslingden stone. He had heard it variously described. One foreman had told him it was a corruption for Lancashire. That was not a very scientific derivation, but it was his view. In that connection one described Lonkey stone for Lancashire paving with setts. He thought Mr. Platt was very modest in his estimate of the saving he attributed to reinforced concrete for the structure in front of the town hall, and if the saving for maintenance in the course of years could be capitalised it would represent nearer 40 or 50 per cent instead of the modest 20 per cent he estimated.

Mr. W. Wellburn (Middleton) supported the vote of thanks, as he knew very well the large amount of work that had been carried out by Mr. Platt. He very often visited Rochdale, and knew what was going on. There was one question he wished to ask Mr. Platt as to the sewage disposal that was the cost per 1,000,000 gallons. He admitted that the question was rather premature, because the works were not in full working order. The other matter was how they disposed of their sludge, and what quantity of sludge they had to dispose of?

Mr. Platt: That is mentioned in the paper.

Mr. Wellburn said the dealing with the sludge was a difficult matter. They had an offer from a Yorkshire firm who were prepared to buy their sludge if they would cart in and put it on the railway trucks. He found it would cost them more to cart it 2 miles to the station and put it on the trucks than to press their sludge.

Mr. C. Brownridge (Birkenhead) said he wished to bear testimony to the excellence of Mr. Platt's work. As engineers it was their duty to profit by mistakes. Fortunately Mr. Platt had no examples there of mistakes made in ferro-concrete work. For the information of members he would say that the paragraph in the paper dealing with the necessity of the work being entrusted only to persons properly qualified was a very important one. In Birkenhead they had a reinforced concrete floor, supported on reinforced concrete piles. This floor was constructed to carry a stable. It was constructed by specialists under professional supervision. He might say, in passing, that the professional supervision was not his. At any rate, he took certain exception to their proposals; but they considered that their proposals were ample for the purpose. The floor collapsed and seriously injured several men. He thought it was necessary to bring before a meeting such as that cases of failures as well as examples of successes, in order that they might be on their guard. It was no doubt because of things like that the Local Government Board limited the period for which they granted loans. On the question of length of life, he agreed at times when the period for which the loan was granted was half expired, if later experience proved it was not granted for a sufficiently long period, then the period might be lengthened; but he did agree with the policy of the Local Government Board in limiting the period of loans for ferro-concrete work. With regard to Mr. Platt's most excellent experiments with various kinds of sand, he was rather interested in seeing that the Lonkey stone crushed rather coarse, because in looking at the setts, and with one's experience of them, the grains did not appear very large; but he would bear testimony to the excellence of Lonkey stone. He had a considerable quantity of it, and there was no doubt it was of very great wearing capacity, and he was glad to find it of value in concrete work. His experience of sewage work was now restricted to visiting excellent works like those of Rochdale. Some twenty years ago he was up to his eyes in it; but now he was fortunate in turning his into the river, and he was pleased to say the commissioners were content with their action. There was one portion of the paper which had not been referred to, and that was the very important question of the tramways. He would like to know what was the general nature of the subsoil upon which the tracks were laid, and whether there was any quantity of clay. The question of subsoil in tramway work was a very important one. He found where they had an ordinary rail upon a dead bed the track would stand practically without repair, but where he had the track laid upon clay the repairs were very considerable.

Mr. Booth (Manchester) said he had one question with regard to manufacturers' refuse. Mr. Platt said it was largely wool scouring. Was it of a similar character to the refuse in Bradford? He believed the Bradford works made a good deal of money out of their sludge. It struck him as to whether the wool scouring in Rochdale was similar to Bradford, and whether there was money value in their sludge in the same way as the Bradford people so successfully made it.

Mr. H. Yarwood (Rochdale) said some curiosity had been expressed as to the derivation of Lonkey. There were Lonkey sheep before there was Lonkey stone, and the Lonkey sheep were noted for a blue tint in the wool, and the Lonkey setts were noted for their blue tint.

Mr. W. A. Piercy (Warrington) asked the name of the quarry from which the non-slippery setts came.

The President remarked, with reference to the sewage disposal works, that the corporation had been moving forward gradually, and had so far excellent results with a very foul sewage. He was sure what they would see at the sewage disposal works would satisfy them Rochdale was on the right track. Reinforced concrete was a matter which concerned them all very deeply nowadays, and he agreed with Mr. Brownridge that they, as engineers, should openly confess and tell each other when failures occurred. That was of even greater advantage than seeing works which had been successfully carried out. He was recently at a meeting of the Concrete Institute, and he ascertained from the president that the Local Government Board had written a letter stating the period for their loans, and although it was a characteristic letter written in general terms, not committing themselves very much, it stated that for bridges in the form of beams ten years would be allowed, and where the bridge was in arch shape fifteen years. He was inclined to agree that the Local Government Board were well advised in not extending the period of loan, although the suggestion of Mr. Brownridge was a very practical one, that when the period of the loan was partly expired they might extend the period. They had been carrying on the ferro-concrete work for some years, and the whole secret of success depended upon supervision—supervision not only by the foreman in charge, but by the engineer in charge. As far as he was concerned in work he had in ferro-concrete, he always had an assistant permanently on the job, because, however well the foreman might supervise, even he could not knock out of workmen that ingrained instinct or desire to scamp things. Workmen had got so imbued with the idea of getting over their work quickly and getting away that they did not get the old type of man who liked his work, and was ambitious to make a good job. He agreed that it was most essential to get their councils to see the necessity and the economy of efficient supervision of ferro-concrete work. As to the tramways, he saw no reference to corrugations. It seemed to be a horrible nightmare in the South of England, how they were caused and how they were to be prevented. If Mr. Platt had no corrugations to complain of they must congratulate him; if he had he would like to know what was the reason he suggested for corrugation and what was the remedy. They had a meeting some months ago on this vexed question, and it was surprising to find the difference of opinion on corrugation. Some said it was due to one thing and some to another. There were two schools—one said corrugations were due to too firm and solid a foundation, others to having a resilient foundation.

The vote of thanks having been accorded,

Mr. Platt, in reply, said that in preparing the paper and putting the information before them he had tried to give them something to think about. He did not know that he had any failures to show them. They would see, if they read between the lines, that there were things at the sewage works where they did not follow his advice and had to come to it later. Mr. Brodie asked about the disposal of the sludge. They pressed the sludge in six presses, and they got it down to 50 per cent of moisture. A lot of it—perhaps one-third to one-half—was taken by local farmers, and they gave them 6d. per load to fetch it away. If they did not fetch it sufficiently fast they sent it to Ormskirk and paid the railway carriage. They intend to go in for a plant to supplement the pressing; that was for further drying and getting it into such a condition that they could get a good price for it. They had had a good price offered to them by a firm at Liverpool which would pay the carriage and everything else. It appeared there was a large demand for cheap manure in Canada and South America, and there were firms picking it up. That was what they did at Bradford; beside recovering the grease it was further dried and packed to go abroad. With regard to the loans for sewage works, they had thirty years for the general construction and fifteen for the electrical plant to do the pumping. Referring to the ferro-concrete bridges, when he showed Mr. Mouchel the Lonkey stone he said it was an excellent stone; he had never seen a better, and if they could get it the work would be good. The percentage of saving was about 20 per cent over steel work in this particular job; but apart from that steel and masonry were out of the question without raising the road, which was already of a steep gradient. The Mellor-street bridges were constructed under an Act of Parliament. The Firgrove Bridge was under the Local Government Board, which gave them an informal sanction. They said go on with the work and they would inspect it and see the result of the test. The test was perfectly satisfactory, and the Local Government Board gave them a loan for fifteen years. As to moisture in the ferro-concrete in one of the jobs—the river covering—there was a little moisture came through at one or two places, and he was a little concerned about it, but it racked off. It was where the men had left off their work and started again. Now he insisted upon it being picked away before any further concrete was added. At the same time, where they had a thickness of only 6 in. of concrete, it was a question whether it was not well to put asphalt over it, because everything depended upon the wet being kept from the steel. He had therefore put a thin layer of asphalt sheeting over the work. Mr. Stubbs mentioned the solids from the humus tank. It was really some sludge in a very fine state of division. The peculiarity about percolating filters was that if they put 50 grains of solids in 50 grains would come out, but it would be so broken up that they did not see it; whereas if they did not take it out of the humus tanks it would slough up. They pumped it into the branch outfall main and made the sewage carry it to the main works, and then precipitated it with the other solids in the tanks. It was of so slimy a character that it could not be pressed. The sludge from the small experimental fillers they had always had to mix with two or three times the quantity of ordinary sludge to press it at all. He was pleased to hear Mr. Whyatt's remarks respecting the town hall. It was really a magnificent building. He had travelled all about Europe, and he did not know a building he liked better. It was under his charge, and he took very great pride in it. The modern stained glass in it was the finest he knew. Mr. Whyatt asked about the possibility of subsidences. He did not fear any subsidences in connection with the bridge. The struts were not settling down to any appreciable extent. It was not like peat. But to put bridges on a strata which was undermined would be to court disaster. Mr. Worrall referred to the variety of reinforced systems. In the competition they were running things too fine for safety. Mr. Worrall was correct in saying there would be a saving in maintenance as well as in the initial cost of the river covering. He was sorry he could not give Mr. Wellburn the cost of sewage treatment per 1,000,000 gallons. The cost of pressing was about 3s. 6d. per ton. That did not allow anything for interest and sinking fund charges. Mr. Brownridge had referred to the cautiousness of the Local Government Board. He was not surprised at it, considering the variety of systems on the market. Mr. Brownridge had referred to the tramways. The concrete had stood very well. His experience with ferro-concrete had made him careful as to having good concrete. The work was all done by administration, and he got a good set of men together. With regard to corrugation he was sorry to say he could not throw any light upon it. He was proud to say their track had stood very well, and would compare with any, especially in maintenance. It was wool scouring in the sewage, but not to the extent at Bradford. For a considerable time their manager scraped off the scum, and sold the fat. Mr. Piercy asked as to the non-slippery setts. They were Gimley rock, Pethelly; he did not know a better sett for steep gradients. The president hit the nail on the head when he said capable supervision was the secret of success in ferro-concrete work.

The members had luncheon together at the town hall under the presidency of Mr. R. J. Thomas, and in the afternoon visited Falinge Park, the branch police station, tramway depot and offices, ferro-concrete bridges, sewage disposal works, and other municipal undertakings. Afternoon tea was served at Roch Mill House.

Ellesmere Port's Bowling Green.—A new municipal bowling green, constructed, at a cost of £300, by the urban district council of Ellesmere Port, was formally opened on Wednesday last.

Street Watering in German Towns.—Statistics furnished by the authorities of eight German towns show that the quantities of water used in street sprinkling vary very much in different places. The unit of area being taken as 100 square metres, the following are the quantities of water used in sprinkling that area: Frankfort-on-Main 19 cubic metres, Hanover 15, Leipzig 11, Königsberg 9, Karlsruhe 8, Dresden 7, Halle 3, Aachen 2 cubic metres.

Assistants' and Students' Section.

CONDUCTED BY SYDNEY G. TURNER, ASSOC.M.INST.C.E.

All communications in regard to this page must be addressed to The Editor, St. Bride's House, 24 Bride-lane, Fleet-street, E.C. *Envelopes must be marked "Assistants' Section" in the top left-hand corner. Correspondents are invited to submit questions for consideration and answers to the questions which appear. For the contributions considered to be the most meritorious, one or more premiums in books will be awarded monthly. Diagrams must be drawn to scale on separate sheets, ready for reproduction.*

QUESTIONS.

This week answers are invited to the following questions:—

324. Oil Engines. Assuming two engines of equal horse-power (4-h.p.), one an oil engine and the other a petrol, what would be the approximate cost for running each engine for fuel and repairs? How would the costs compare with each other, including first outlay and oil, repairs, &c.? In regard to efficiency, which engine would be the more efficient from an economic standpoint? ("Griffo.")

325. Air Compressors.—How is the size of an air receiver calculated in connection with an air compressor? Of what thickness of metal would it be made if (1) of cast iron, (2) wrought iron, assuming it had to withstand a pressure of from 15 lb. to 40 lb.? Give any further particulars regarding same. ("Griffo.")

327. Flow of Sewers.—State the advantages of egg-shaped and circular sewers, and give conditions under which such advantages would occur. Give proofs of velocities and discharge. (D. G. B., *Darlington.*)

330. Sewage Disposal.—Design a small sewage disposal system for a gentleman's residence, capable of dealing with 500 gallons per day. The sewage is fairly strong on account of the drainage from a small cowshed. The available fall can be neglected, and the earth is of a sandy-clay nature. State approximate cost. The effluent should discharge into a soakaway. ("Inky.")

332. Roadmaking.—What is the best form of cross-section for the surface of a macadam road? Give reasons. ("Ehu.")

333. Sewage Tank Construction.—What is a suitable formula for calculating the requisite thickness of sewage tank walls? Give an example. ("Check.")

REPLIES TO QUESTIONS.

329. Sewerage.—Using the generally accepted most accurate formula, at what gradients must 9-in., 12-in. and 15-in. pipe sewers be laid to give a uniform velocity of 4 ft. per second when flowing two-thirds full? ("M. C. E.")

The formula generally recognised in these days as being the most accurate for the velocity and discharge of water in pipes and conduits is that of Kutter. This formula, together with tables giving the value of n—the coefficient of roughness of the material of which the channel is composed—is given in "The Sewerage Engineers' Note-book," published by The St. Bride's Press, Ltd. For glazed stoneware pipes the table gives $n = .011$ when the condition of the surface is good, and .013 when the surface is fair.

For a velocity of 4 ft.-sec. with sewer two-thirds full, the following gradients will be required:—

Diam. of pipe.	9″	12″	15″
When $n = .013$	1 in 94	1 in 147	1 in 205
When $n = .011$	1 in 143	1 in 230	1 in 320

(H. F. W., *Tottenham.*)

331. Sewerage.—In the case of the oval sewer in the sketch, 5,790 lin. yds. long, having a total fall from inlet to outlet 15 ft., what flow will be discharged when quarter, half, three-quarters, and full?

As no indication is given in the question as to the materials of which the sewer is to be constructed, it is evident that the use of the more accurate Gauguillet and Rutter formula is not necessary. The approximation obtained by the use of the Chezy formula will be sufficient, especially when taking into consideration the large size of the sewer.

(*a*) *Running full.*

$V = C\sqrt{RS}$ where V = velocity of flow.
R = hydraulic mean radius.
S = line of inclination.
C = a constant (in this case 120).

$S = 15\text{ft. in } 5790 \times 3\text{ft.} = \frac{1}{1158}$

$R = .2897$ D (from tables) $= .2897 \times 5.3 = 1.545$

$\therefore V = 120\sqrt{1.545 \times \frac{1}{1158}}$

$= 4.383$ft. per sec.

$Q = AV$ where V = velocity of flow.
A = area of cross section of stream.
Q = discharge in cub ft. per sec.

$A = 1.1485d^2$ (from tables) $= 1.485 \times 5.3^2 = 32.67$ sq. ft.

$\therefore Q = 32.67 \times 4.383.$

$= 143.2$ cub. ft. per sec.

(*b*) *Running ¾ full.*

$R = .3325d = .3325 \times 5.3 = 1.7735$

$V = C\sqrt{RS}$

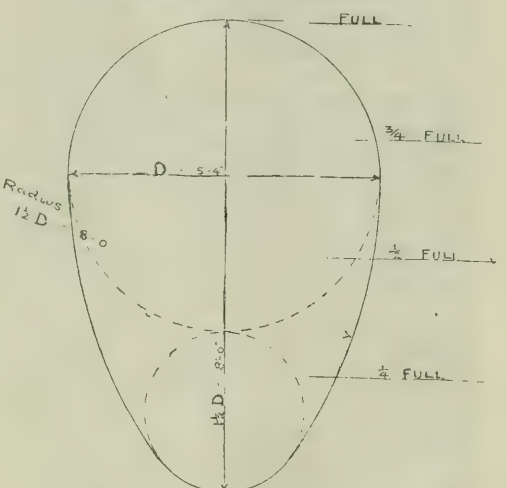
$= 120\sqrt{1.7735 \times \frac{1}{1158}}$

$= 4.698$ft. per sec.

$A = .8795d^2 = .8795 \times 5.3^2$

$Q = AV.$

$= .8795 \times 5.3^2 \times 4.698 = 117.4$ cub. ft. per sec.



SKETCH ACCOMPANYING QUESTION 331.

(*c*) *Running ½ full.*

$R = .269$ D $= .269 \times 5.3 = 1.435$

$V = C\sqrt{RS}.$

$= 120\sqrt{1.435 \times \frac{1}{1158}}$

$= 4.224$ft. per sec.

$A = .5091\ D^2 = .5091 \times 5.3^2$

$Q = AV.$

$= .5091 \times 5.3^2 \times 4.224$

$= 60.115$ cub. ft. per sec.

(*d*) *Running ¼ full.*

$R = .2066$ D $= .2066 \times 5.3 = 1.101$

$V = C\sqrt{RS}$

$= 120\sqrt{1.101 \times \frac{1}{1158}}$

$= 3.701$ft. per sec.

$A = .1862\ D^2 = .1862 \times 5.3^2$

$Q = AV$

$= 1.862 \times 5.3^2 \times 3.701$

$= 19.6$ cub. ft. per sec.

Summarising.

Running full	143·2	cub. ft. per sec.
,, ¾ full	117·4	,, ,,
,, ½ full	60·115	,, ,,
,, ¼ full	19·6	,, ,,

It is interesting to note that the velocity of flow is considerably higher when running ¾ full than at any of the other given depths, though of course the discharge is not greatest then. (E. D., *Sidcup*).

LOCAL GOVERNMENT BOARD INQUIRIES.

The Editor invites the co-operation of Surveyor *readers with a view to making the information given under this head as complete and accurate as possible.*

INQUIRIES HELD.

Blaenavon U.D.C. (May 27th. Mr. R. G. Hetherington).—£2,200 for the provision of a public cemetery, and £14,940 for a scheme to improve the water supply. The site for the new cemetery, it was explained, was 10½ acres, of which it was only proposed to lay out 5¼ acres for the time being. It was desired that the loan in respect of the proposed water supply scheme should be extended over a period of forty years. The waterworks comprise four reservoirs and three filter-beds, and it is desired to improve and extend what was up to 1899 the gas and water company's undertaking. The proposals relate to reservoirs 3 and 2, and certain filter-beds in connection with them. These are fed by springs rising in the hillside, the water being conveyed partly by underground mains and partly by an open channel in the mountain. The engineer proposes to improve those and so exclude a considerable amount of pollution which exists at present. It is further proposed to construct two new reservoirs adjoining No. 3 reservoir, near Llanover-road.

Bradford T.C. (May 30th. Major C. E. Norton).—£10,000 for purposes of sewerage work, and £1,840 for the erection of eight workmen's dwelling-houses on the Esholt estate.—The deputy town clerk, Mr. N. L. Fleming, stated that the reason for the application was that the last £3,000 sanctioned by the board in December, 1911, had been exhausted, and they had decided to ask the board to sanction practically three times that amount to cover a period of three years. During the past five years the average yearly expenditure on sewerage work had been £1,500. With reference to the application for powers to borrow £1,840 for the erection of eight workmen's dwellings, Mr. Fleming stated that the Sewage Committee had considered the question, which arose out of the removal of the works from Frizinghall to Esholt. The area of the proposed site covered half an acre, and it was some three-quarters of a mile distant from the new works. The Sewage Committee regarded this scheme in the nature of an experiment they would let the houses at such a rent as would cover the cost—and if it proved a success they would continue to erect workmen's houses.

Falmouth T.C. (June 10th. Mr. H. A. Chapman).—£8,928 for the purchase of land and the erection of forty-four working-class dwellings at Trevethan, behind Berkeley Vale.—The town clerk, Mr. E. E. Armitage, stated that the object of the scheme was to provide houses for artisans, who would vacate houses that would be available for the people living in the slums, and there would be a general lifting up. It should be mentioned, however, that the housing conditions in the town were infinitely superior to what they were years ago. The borough surveyor, Mr. J. S. Walton, said the scheme as submitted provided for forty-four houses, comprising scullery, living room, three bedrooms, and usual offices. There was no probability of private enterprise meeting the situation owing to the price of land and the cost of materials.

Hampton U.D.C. (June 13th. Mr. Edgar Dudley). £430, the council's share of the cost of the purchase of Ferry-house, Thames-street, for widening purposes, and £430 for the extension of Bell-hill Recreation Ground. £430 is also to be paid by the Middlesex County Council towards the cost (£660) of the widening improvement. There were only four persons present, including Mr. S. H. Chambers, the surveyor, who said the area of the land was 211 sq. yds., about one half of which would be thrown into the street.

Newry U.D.C. (June 11th. Mr. P. C. Cowan).—£700 for the purpose of making improvements at the gasworks, and £400 for sett paving a portion of the quays of the town.—It was stated in the course of the evidence that there had been a loss on the year's working of the gas undertaking of £800, and the inspector remarked that unless the concern was better managed no one would recommend a loan to the gas committee.

Pontypridd and Rhondda Joint Water Board (June 5th. Mr. A. W. Brightmore).—£9,690 for necessary extensions.—The clerk, Mr. W. P. Nicholas, explained that the money was required for works of extension and alteration at the Lluest Wen and Castell Nos reservoirs.

APPLICATIONS FOR LOANS.

Brierfield U.D.C.—£200 for electricity extensions.

Bingley U.D.C.—£1,500 for the supply of electrical energy.

Boston R.D.C.—£600 for four cottages.

Bury T.C.—£2,323 for the purposes of the housing scheme.

Cheadle R.D.C.—£500 for the purchase of land for a new road.

Horncastle U.D.C.—£2,854 for works of road improvement.

Nelson T.C.—£3,000 for new water mains.

Rotherham R.D.C.—£520 for extending the water supply.

Tiverton T.C.—£3,500 for a housing scheme.

LOANS SANCTIONED.

Beeston U.D.C.—£2,000 for footpath improvement.

Boston R.D.C.—£600 for building cottages.

Bridport T.C.—£570 for works of sewerage.

Brumby and Frodingham U.D.C.—£625 for a water supply extension.

Chester-le-Street R.D.C.—£11,272 for a housing scheme, and £728 for road works.

Dover T.C.—£600 for improvements at the baths on the sea front.

Hexham U.D.C.—£1,134 for works of private street improvement, and £830 for alterations to the slaughter-houses.

Horsham U.D.C.—£1,600 for the North-street improvement scheme.

Leigh-on-Sea U.D.C.—£2,510 for gas supply extensions.

Maldens and Coombe U.D.C.—£465 for the improvement of the highway depot in King's-avenue, on condition that any lengths of drain which are laid with less than 4 ft. of cover be surrounded with at least 6 in. of Portland cement concrete.

Margate T.C.—£2,051 for street works.

Margate T.C.—£555 for the purchase of land for the extension of the reservoir.

Omagh R.D.C.—£21,930 for the provision of cottages.

Paignton U.D.C.—£5,117 for the purchase of the foreshore and adjoining land at Preston for purposes of public walks and pleasure grounds.

Penistone U.D.C.—£4,100 for a new town hall.

Rathdrum R.D.C.—£1,500 for sewerage purposes.

Southampton T.C. — £2,135 for working-class dwellings.

Walsall T.C.—£3,000 for electricity purposes.

FORTHCOMING INQUIRIES.

	£
23.—**Peterborough.** For new concrete paths (Mr. R. H. Bicknell)	1,100
24.—**Chelmsford.** For street improvement works (Mr. R. H. Bicknell)	1,875
24.—**Loftus.** For works of sewerage (Major J. Stewart)	1,100
24.—**Ossett.** For works of sewage disposal (Major C. E. Norton)	1,206
24.—**Southwold.** For the erection of working-class dwellings (Mr. Courtenay Clifton)	2,400
25.—**Birmingham.** For street and lighting purposes (Mr. Edgar Dudley)	15,338
25.—**Dewsbury.** For street and sewerage works (Major C. E. Norton)	103,115
25.—**Dudley.** For the purchase of property for a street improvement (Mr. Edgar Dudley)	1,100
25.—**Ellesmere Port.** For constructing a new road (Mr. M. K. North)	9,730
25.—**Middlesbrough.** For bowling-green and housing purposes (Major J. Stewart)...	5,800
26.—**Swinton.** For private street works (Mr. M. K. North)	10,111
27.—**Berwick.** For road improvement works (Major J. Stewart)	1,200
27.—**Litherland.** For private street works (Mr. M. K. North)...	121
27.—**Worcester.** For recreation ground purposes (Mr. Edgar Dudley)	400

Municipal Work in Progress and Projected.

The Editor invites the co-operation of SURVEYOR *readers with a view to making information given under this head as complete and accurate as possible.*

The following are among the more important projected works of which particulars appear below: Buildings—Brighton, Bristol, Glamorgan; refuse collection and disposal—Hessle; roads and materials—Linlithgowshire £8,200; sewerage and sewage disposal—Dublin £28,000, Marlborough, Newcastle-on-Tyne £17,000, Weston-super-Mare; water, gas and electricity—Bideford £2,000, Hertford, Marlborough £3,200. Particulars of other works projected will be found on our "Local Government Board Inquiries" page.

BUILDINGS.

Brighton T.C.—A sub-committee has been appointed to consider a proposal to construct a hydropathic spa and bathing establishment in connection with the proposed new concert hall for the municipal orchestra at the Aquarium.

Bristol T.C.—It is proposed to build immediately a new warehouse at the docks for the storage of tobacco, at a cost of £60,000, and subsequently to erect another warehouse at a cost of £65,000.

Brumby and Frodingham U.D.C.—A scheme has been adopted for the erection of public baths, at an estimated cost of £2,500 for the building.

Chesterfield T.C.—It has been decided to proceed with alterations to the market hall, at an estimated cost of £2,500.

Exmouth U.D.C.—The surveyor, Mr. S. Hutton, has received instructions to prepare a plan and report on the necessity of placing a new bridge over the brook at Littleham, at the bottom of Castle-lane.

Frodingham U.D.C.—A scheme has been approved for the erection of public baths, at an estimated cost of £2,500.

Glamorgan C.C.—A new school is to be built at Grovesend at an estimated cost of £5,000, and one at Upper Loughor at a cost of £10,200.

Hindley U.D.C.—Additional hospital accommodation is to be provided at an estimated cost of £4,000.

Kensington B.C.—A scheme has been adopted for the development of the depot in Pembroke-road, at an estimated cost of £6,500.

Maldens and Coombe U.D.C.—Of eight tenders received for the erection of boundary walls, piers and entrance gates, &c., and for the construction of surface water drainage at the highway depot, King's-avenue, that of Mr. C. H. King, New Malden, has been accepted at £462.

HOUSING AND TOWN PLANNING.

Docking (Norfolk) R.D.C.—A letter has been received from the Local Government Board bearing on the report of their inspector, Mr. Thompson, who had recently visited the villages in the district with a view to ascertaining the conditions of the houses of the working classes. From the report they had gathered that there was urgent need for more dwellings for these classes in Brancaster, Ringstead, Syderstone, and Burnham Market. Some of the houses should be entirely demolished, and others needed very drastic improvements. The other villages having unsatisfactory property were Burnham Deepdale, Burnham Norton, Stanhoe, Thornham, Docking, Sedgeford, and Heacham. Immediate action in regard to these properties was necessary. The new houses to be erected should each contain three bedrooms and adequate garden ground, and, as there appeared to be no prospect of private individuals coming forward to build, the council should take steps to put into operation Clause 3 of the Housing of the Working Classes Act, and provide in each of the villages mentioned six or eight cottages to deal with the worst of the existing cottages.

Lanark T.C.—Four semi-detached cottages, eight houses in all, are to be erected at an estimated cost of £1,960. Each house will consist of kitchen, two rooms, scullery, bath-room, washhouse, and coal cellar. It has also been decided to build a similar number of cottages of the same dimensions, but without a bath room, to be erected at a total cost of £1,680, making a total cost of the scheme, exclusive of the ground, the feu-duty for which is estimated at £16 annually, £3,640. The estimated income from the sixteen houses is put at £232 annually, and the estimated expenditure, including £158 for interest and repayment on the annuity principle, £230.

Marlborough T.C.—The tender of Messrs. Hoskins Brothers, of Newbury, has been accepted for the erection of sixteen working-men's dwellings. Owing to the rise in the price of materials the general run of prices was considerably higher than the estimated cost.

PARKS AND OPEN SPACES.

Brighton T.C.—That the municipal golf links are proving increasingly popular is shown by the statement of accounts for the year ending March 31st, which indicates a surplus income of £78, as compared with a deficit of £56 in the previous year. A sum of £864 was realised by the sale of tickets, compared with £686 in 1911-12.

Glasgow T.C.—Sir John Stirling-Maxwell has gifted to the council a plot of land at Cathcart as an open space.

Skegness U.D.C.—A proposal is to be submitted to the ratepayers for the purchase, making up, and equipment of the Pleasure Gardens, at an estimated cost of £10,000.

Townhead T.C.—It is proposed to erect bowl-houses in Richmond Park and Kennedy-street recreation ground, in connection with the public bowling-greens being formed there, at an estimated cost of £500 and £550 respectively.

REFUSE COLLECTION AND DISPOSAL.

Hessle (Yorks) U.D.C.—Attention has been called by Dr. Molyneux, medical officer, to the need for a refuse destructor, as the Anlaby authorities had refused to permit the removal of dust to their district.

Hove T.C.—An agreement has been entered into with the Hove Electric Lighting Company, Limited, for the tenancy of a piece of land adjoining the electric light station in Leighton-road, at a rental of £100 per annum, on which to erect a crushing machine for experiments in crushing house refuse.

Richmond (Surrey) T.C.—The council have renewed their contract with Mr. C. Murrell, of Blackfriars Wharf, Southwark, at 3s. 3d. per ton, an increase of 3d. per ton upon the price paid to Mr. Murrell during the last eight years.

Westbourne (Sussex) R.D.C.—The Local Government Board are urging the council to take steps for the proper disposal of house refuse—which is at present deposited on the foreshore—at Bosham and Westbourne, and for the provision of a receptacle for refuse in connection with every dwelling-house.

ROADS AND MATERIALS.

Bideford R.D.C.—A proposal by the council to appoint an additional surveyor has been referred to the county council with a request that that authority should pay a moiety of the new officer's salary.

Bradford T.C.—Messrs. P. W. Macvay & Co., civil engineers, 19 Old Queen-street, S.W., have been instructed by the corporation to proceed with an extensive street survey in the city.

Camborne U.D.C.—The council have accepted a tender from the Empire Stone Company, London, for the supply of 700 yds. of concrete flags at 4s. 6d. per yard. A four-wheeled watering cart is to be purchased from Messrs. Burrow & Co., of Banbury, at £45.

East Preston (Sussex) R.D.C.—A special committee that has been appointed to watch the matter has received authority to consult an engineer as to the best means of preserving Sea-road, Rustington, against the inroads of the sea.

Festiniog U.D.C.—The Road Board have advanced a loan of £500, free of interest, to be repaid in five years, for local road improvements.

Hawick T.C.—The council have accepted a grant of £500 from the Road Board, and a loan of £1,800 from the same authority for road improvement purposes. The tender of Messrs. W. G. Walker & Sons, Ayr, at £2,561, has been accepted for laying with "Bitromat" the section of the main road from the

Tower Knowe to the North Bridge, with maintenance over a stipulated period at a graduated charge per yard.

Hexham R.D.C.—A scheme of the surveyor, Mr. G. F. Surtees, has been adopted for a road improvement in the Hallington district, which includes the straightening of a road and the enclosing of a stream, at an estimated cost of £305.

Holland (Lincs) C.C.—The Road Board have again made a grant of £800 towards the tar-spraying of main roads. The board have also made a grant of £1,150 towards the strengthening of the Fleet, Gedney, and Moulton main roads, which, with a loan of £2,500, repayable in five years, makes a total of £3,650.

Kensington B.C.—The need for the widening of Church-street and High-street, Notting Hill-gate, as a county improvement, is being pressed upon the London County Council. The council express themselves as prepared to make a contribution towards the cost.

Kettering U.D.C.—Application is to be made to the county council for a grant of £400 for improving the footpaths.

Lichfield T.C.—On the recommendation of the Streets and Highways Committee, a resolution has been adopted expressing the opinion that, having regard to the heavy and growing cost of maintenance and upkeep of highways as a result of the ever-increasing use thereof for purposes of through traffic by motor cars and locomotives, it is imperative that a more adequate contribution should be made from the Imperial Exchequer towards the cost of that national service.

Linlithgowshire C.C.—The road surveyor of the Bathgate District Committee, Mr. Ramsay, reported at a meeting recently that he had lately been in communication with the Road Board regarding the scheme for the improvement of the surface of the Shotts-road, extending from the county boundary with Lanarkshire at Harthill, to the boundary with Mid-Lothian, near Livingston, a distance of about 9 miles. The estimated cost of the proposed work is £8,200, and towards this the Road Board had offered to give a free grant of £3,000, also a loan of £3,700, free of interest, but repayable over a period of five years. Satisfaction was expressed by the committee at the satisfactory result of the road surveyor's negotiations, which were cordially approved.

Lowestoft T.C.—Road improvements are to be carried out in St. Peter's-street and Oulton-road, the latter at an estimated cost of £147, exclusive of the value of the land, which has been given by a private owner.

Maldens and Coombe U.D.C.—The surveyor, Mr. R. H. Jeffes, has been authorised to order from Messrs. Morden & Co., for experimentally treating a length of Malden-road, 4 tons of "Fluxphalte," at 4½d. per gallon delivered at nearest station in 4-ton lots. Of five tenders received for paving with artificial stone slabs part of the footways in Coombe-gardens, the tender of Messrs. John Wainwright & Co. has been accepted at £143. For the making up of Coombe-gardens-road the tender of Messrs. J. Mowlem & Co. has been accepted at £567. The surveyor's estimate was £555.

Rochdale T.C.—The Road Board have sanctioned grants of £2,500 in aid of the improvement of Manchester-road, near Sudden Brow, and £500 for the widening of Whitworth-road.

Stirlingshire C.C.—In view of the contributions which had been received from various parties interested, in money and materials, it has been agreed by the Eastern District Committee that the Almond-road Muiravonside, be put in order, the committee granting the use of steam plant and labour, and that when made the road be taken over and added to the statutory list of roads in the county.

SEWERAGE AND SEWAGE DISPOSAL.

Ayr T.C.—£250 is to be expended on the provision of public conveniences.

Bowland (Yorks) R.D.C.—The sewerage scheme for Bolton-by-Bowland was formally inaugurated on Monday last.

Burton T.C.—For the new rising main at the sewage pumping station the council have accepted the tender of Messrs. J. & J. Warner, of Mickleover, and for the supply of 4·27 in. double-flanged sluice valves, and 2·27 in. sluice valves, the tender of Messrs. J. Blakeborough & Sons, of Brighouse.

Dublin T.C.—The tender of Messrs. H. & J. Martin, Dublin, at £28,000, has been accepted for the construction of a considerable extension to the sewer at North Lotts, on the North side of the city.

Ely U.D.C.—The council have agreed to proceed with the following sewerage works, subject to a loan for the cost being sanctioned: 15-in. outfall sewer from the end of Broad-street to Common Muckhill, 438 yds., £509; 12-in. sewer from corner of Newnham-street down Fore-hill to corner of Broad-street, 404 yds., £486; 9-in. sewer from Sextry House up the Cambridge-road, 816 yds., £838; 9-in. sewer in Witchford-road in connection with proposed isolation hospital, 232 yds., £234.

Halifax T.C.—The corporation sewage works have now been completed, with the exception of the storm-water overflow. Up to date the works have cost £147,000.

Keady (Ireland) U.D.C.—Consideration is to be given to a letter from the Local Government Board endorsing a report of the medical officer of health for Keady, in which it is stated: "The water supply of Keady Urban District is impure, and the work sanctioned to improve it has not been carried out. With regard to the sewerage of the district, the dry system adopted should be enforced or new sewers laid down in the town. Abatement of nuisances in the town should be properly enforced. The common lodging-houses in the town are not registered. A number of houses have damp earthen floors."

Lowestoft T.C.—The borough surveyor, Mr. G. H. Hamby, has submitted plans and estimates of the cost of draining the outlying portions of the borough, the consideration of which has been deferred.

Marlborough T.C.—Expert opinion is to be obtained on the working of the sewage disposal system, the Thames Conservancy having threatened to take steps to procure an injunction unless the overflow into the Thames is remedied.

Newcastle-on-Tyne T.C.—A scheme has been adopted for a drainage area for Heaton and Walker, at an expenditure of £17,000.

Sheffield T.C.—The progress of the city's sanitary arrangements is commented upon favourably by the *Sheffield Telegraph*. In 1900, it states, only about one house in six had a water-closet. Now more than half the houses are so provided. But for all that there are still more than 48,000 houses with the old, evil prehistoric middens. As to baths, twelve years ago only one house in fourteen had a bath-room, now the proportion is one in six. But there are over 74,000 houses without baths.

Truro R.D.C.—A report has been received from the sanitary inspector advising that a comprehensive scheme of drainage was necessary for Perranporth. Many complaints, he stated, had been received with respect to the condition of the numerous cesspools in the district.

Weston-super-Mare U.D.C.—The surveyor, Mr. H. A. Brown, has submitted plans and sections for the proposed drainage of the eastern portion of the district, which the council have approved. The scheme involves the erection of a pumping station on land opposite the electric lighting station, and the Weston-super-Mare Building Estates, Limited, have provisionally agreed to make over to the council sufficient land for the construction of the pumping station, subject to the council making the latter sufficiently deep for the satisfactory drainage of their estate. The surveyor has also submitted plans showing his proposals for the drainage of Meadow-street and neighbourhood, which involves certain sewerage work in St. James-street, Regent-street, Palmer-street and North-street, and the relaying of certain private drains. This has also been approved, and the surveyor has been instructed to prepare specifications and a detailed estimate of the cost of the schemes with a view to an application being made to the Local Government Board for sanction to a loan for carrying out the works.

WATER, GAS, AND ELECTRICITY.

Aberdeen T.C.—It has been agreed to adopt a 10,000,000 gallons per day scheme for the city, but to defer for a fortnight deciding whether the source of supply should be the rivers Dee, Avon, or Dye. Meantime the Water Committee have agreed to proceed with a treatment of the existing supply from the Dee with lime, at an estimated cost of £28,000.

Bexhill T.C.—The profits of the electric light undertaking during last year were £665.

Bideford T.C.—Instead of adopting the recommendations of the Waterworks Committee to accept the contracts for the provision of the pumping station and the construction of the reservoir at Bibery, at a cost of £17,339, the council, by eight votes to six, have decided to deepen the upper reservoir, at a cost of just over £2,000.

Esher and the Dittons U.D.C.—Thirty-three specified lamps are to be fitted with clock-work apparatus for all-night lighting. The surveyor, Mr. H. C. Fread, estimates the initial cost at £49 10s., and the additional annual cost at £11 2s. 9d.

Hertford T.C.—The council have approved a report by the borough surveyor, Mr. J. H. Jevons, with respect to an extension of the water supply, and plans and specifications are to be prepared for carrying the scheme into effect.

Horsham U.D.C.—The accounts of the waterworks and electric lighting undertakings for the year ending March 31st last showed nett profits respectively of £1,151 and £264.

Listowel R.D.C.—A water supply scheme is to be carried out for Ballybunion, at an estimated cost of £1,800.

Lynn T.C.—The electricity undertaking yielded a profit of £876 last year, compared with £503 in the preceding year

Marlborough T.C.—Experts who have been called in recommend that the storage tank at the waterworks be trebled in size, and that new pumps be introduced, at a total estimated expenditure of £3,200.

Morecambe T.C.—Last year's working of the gas undertaking resulted in a nett profit of £2,011.

Newport (Mon.) T.C.—The tender of the A.E.G. (Electric) Company, at £7,120, has been accepted for a 3,000-kilowatt turbo-generator and 3,000-kilowatt condenser, and the tender of the Lancashire Dynamo Company for a 600-kilowatt direct-current generator at £935.

Sleaford R.D.C.—A water scheme is to be prepared for Evedon, Ewerby, Haverholme, and Anwick, and East Heckington is to be provided with a supply, at an estimated cost of £2,700. Other applications have been received for water schemes from North Kyme, South Kyme, and Praie Grounds.

Stirlingshire C.C.—The Eastern District Committee have authorised the supply and erection of a lighting plant at Redding, and that the public lighting of the roads in the district be commenced this season; also that an assessment of 1½d. per £1 on owners and occupiers equally be levied in the special lighting district for the current year.

West Bromwich T.C.—The nett profit from the gas undertaking last year was £4,824, a decrease of £1,015 upon that of the previous year. The tramways account showed a profit of £336.

MISCELLANEOUS.

Bournemouth T.C.—It has been agreed that it would be inadvisable to proceed with the trackless trolley scheme until after the completion of the Undercliff Drive.

Derby T.C.—The council have passed a resolution urging the Government to introduce legislation to give effect to the Royal Commission on Canals, as to the acquisition by the State of the trunk and subsidiary canal routes.

Kingstown (Co. Dublin) U.D.C.—A report has been presented recommending the purchase of a motor fire-engine.

Melton Mowbray U.D.C.—The council have approved the scheme prepared by the surveyor, Mr. Edmund Jeeves, for the extension of the cemetery, at an estimated cost of £700.

Morecambe T.C.—The nett surplus from the tramway undertaking last year was £676.

Westminster B.C.—Four motor wagons are to be purchased from Leyland Motors, Limited, at a cost of £2,640.

Road Mushrooms.—In consequence of mushrooms forcing their way through the tar-paving, 2½ in. thick, a portion of the footpath in Fairhazel-gardens, Hampstead, has had to be repaired. "The road superintendent reported the discovery," said Mr. O. E. Winter, the borough engineer and surveyor, last Friday, "and brought me seven or eight mushrooms quite fit to eat."

PERSONAL.

Mr. James B. Nuttall, borough surveyor of Heywood, has been granted an increase of salary.

Mr. S. Russell, surveyor to the Pickering Rural District Council, has been voted £10 a year increased salary.

Mr. J. W. Holbrook, surveyor to the Houghton-le-Spring Urban District Council, has been voted an increased salary of £30 a year.

Mr. H. H. Burnage, assistant surveyor to the Warrington Rural District Council, has been granted an increased salary of £20 per annum.

Mr. A. Culkin, highways surveyor to the Sculcoates Rural District Council, will represent that authority at the International Road Congress.

Mr. T. H. Lightbody, surveyor to the Hemel Hempstead Rural District Council, is to receive £45 per annum towards the upkeep of a motor cycle.

Mr. A. R. Bolwell, road surveyor to the Bath Rural District Council, who was rather severely injured by a fall from his bicycle, is making satisfactory progress.

Sir Charles Rose, M.P. for the Newmarket Division, and a member of the Road Board, left estate valued for probate of the gross value of £355,417, of which the nett personalty is £150,534.

Mr. Albert Toft, who this month completes twenty-nine years' service with the Bakewell Rural District Council, will shortly relinquish his duties as highway surveyor for the South District owing to continued ill-health.

Mr. A. J. Martin, M.INST.C.E., of 7 Victoria-street, Westminster, S.W., has been requested by the Orsett Rural District Council to prepare a preliminary scheme and estimate for sewerage and sewage disposal for the parish of Aveley.

Messrs. C. Brownridge, borough engineer of Birkenhead, and J. E. Swindlehurst, city engineer of Coventry, have been elected Fellows, and Mr. E. J. Franklin, council offices, Finchley, a member, of the Royal Sanitary Institute.

Mr. J. Murray McGregor, Sutherland, has been appointed road surveyor for the Carrick District of Ayrshire, at a salary of £300 per annum, in succession to Mr. Robert Moir, who has been appointed chief surveyor to the Midlothian County Council.

Mr. J. Montague Gameson, of West Bromwich, Mr. Douglas R. Nicholls, of Derby, and Mr. George Milnes, of Wellingborough, have been appointed engineering assistants in the Halifax borough engineer's department, at the commencing salaries of £130, £110 and £100 per annum respectively.

Mr. Dennis V. Howard, of the engineer and surveyor's department, Leigh-on-Sea, was on Saturday last presented with a silver epergne by his fellow officials on the occasion of his leaving to take up the position of assistant surveyor to the Chesham Urban District Council, to which post he was recently appointed.

Mr. John Edward Abrams, housing surveyor to the Birmingham City Corporation, has passed the examination of direct fellowship to the Surveyors' Institute. Mr. Abrams has been surveyor to the above department for the past ten and a-half years, prior to which he was assistant surveyor to the housing department in Hull.

Mr. Charles Adami, the assistant secretary of the British Fire Prevention Committee and senior permanent official of that body, died after a short illness on Friday last at St. Thomas's Hospital. He had held his post with considerable ability for over ten years. His funeral took place at Wandsworth cemetery, and was attended by the chairman (Mr. Edwin O. Sachs, F.R.S.(ED.), the hon. treasurer (Mr. Horace Folker, F.A.I.), the general hon. secretary (Mr. Ellis Marsland), and other members of the executive of the British Fire Prevention Committee.

Dover's Municipal Water Supply.—Dover municipal waterworks, on its working for the last twelve months, made a profit of £5,130, which the council, on Wednesday last, decided to transfer to the credit of the general rates. The Dover water supply is the cheapest in Kent.

FOR OTHER ADVERTISEMENTS

See End of Paper.

TO CONTRACTORS AND OTHERS.

The Council of the Metropolitan Borough of Wandsworth is prepared to receive Tenders for the Making-up and Paving of Shamrock-street, Clapham North.

The Specification and Drawings may be seen, and Forms of Tender obtained, of the Borough Engineer, Mr. P. Dodd, M.INST.C.E., at the Office of the New Streets Department, No. 56 East-hill, Wandsworth, S.W., between the hours of 10 and 4 (Saturdays 10 and 12), upon payment of a deposit of Five Guineas.

Tenders, enclosed in sealed envelopes, and endorsed "Tender for Paving Shamrock-street," must be delivered at the Council House, East-hill, Wandsworth, S.W., and may be placed by the person tendering in the box provided for the purpose, not later than Four o'clock in the afternoon of Monday, the 7th July next.

Persons tendering must, in the case of all workmen employed by them in and about the execution of the Contract, pay wages at not less and observe hours of labour not greater than the rates and hours recognised by the Associations of Employers and Employees, and in practice obtained in the district where the work is to be executed.

No Tender will be received unless it be made upon one of the Forms provided for the purpose.

The Council does not pledge itself to accept the lowest or any Tender. If required, the Contractor must provide two sureties for the due execution of the Contract.

D. A. NICHOLL,
Town Clerk.

Council House,
Wandsworth, S.W.
June 18, 1913. (570)

URBAN DISTRICT COUNCIL OF BUXTON.

SEWAGE TREATMENT.

The Buxton Council invite applications for the Appointment of Foreman, to take charge of the Sewage and Refuse Destructor Works, Stone Crushing Plant, &c.

Candidates must have had experience in the management of similar works, and be able to execute ordinary repairs.

Wages 37s. 6d. per week, rising to £2 5s. per week on approved service.

Applications, in candidate's own handwriting, stating age, previous experience, with copies of not more than three recent testimonials, to be sent to the undersigned not later than 12 o'clock noon on Tuesday, July 1st.

F. LANGLEY,
Engineer and Surveyor.

Town Hall, Buxton.
July 18, 1913. (564)

TWICKENHAM URBAN DISTRICT COUNCIL.

STONE-PITCHED EMBANKMENT.

The above Council hereby invite Tenders for the Construction of a length of about 650 ft. of Stone-pitched Inclined Embankment along the river frontage at Radnor House Pleasure Ground, Cross Deep, Twickenham.

Plan and Specification may be seen, and further particulars obtained, on application at the Office of Mr. Fred. W. Pearce, F.S.I., Surveyor to the Council, Town Hall, Twickenham.

Sealed Tenders, endorsed "Tender for Radnor House Embankment," to be delivered to the undersigned not later than noon on Wednesday, the 9th day of July, 1913.

The Council do not bind themselves to accept the lowest or any Tender.

(By order)

H. JASON SAUNDERS,
Clerk to the Council.

Town Hall,
Twickenham.
June 21, 1913. (569)

THE CORPORATION OF DUKINFIELD are prepared to receive Tenders for the supply and delivery of 1,000 tons of 6-in. Gritstone Setts. Specification and Form of Tender may be had on application of the Borough Surveyor, Mr. S. Hague, Town Hall, Dukinfield. (566)

BROWNHILLS URBAN DISTRICT COUNCIL.

SHELFIELD SEWERAGE.

GAS ENGINE, SUCTION GAS PLANT AND THREE-THROW PLANT.

The above Council invite Tenders, from Manufacturers *only*, for the supply, erection and maintenance for 12 months of Gas Engine, Suction Gas Plant and Three-throw Pump capable of lifting 22,500 gallons per hour.

Tenders will not be entertained from Agents or Merchants.

Copies of the Specifications and Form of Tender can be obtained at the Offices of the Council's Consulting Engineer (Mr. Robert Green, M.INST.C.E., 37 Waterloo-street, Birmingham) on and after Wednesday next, the 25th inst., upon the deposit of £5, which will be returned on the receipt of a *bonâ-fide* Tender not afterwards withdrawn.

The Council do not bind themselves to accept the lowest or any Tender.

Sealed Tenders to be sent to the undersigned not later than 10 a.m. on Monday, the 14th July, 1913.

(By order)

HARRY H. JACKSON,
Clerk to the Council.

35 Bridge-street,
Walsall. (565)

BOROUGH OF CHELMSFORD.

WOOD PAVING OF STREETS.

The Town Council of Chelmsford invite Tenders for the Paving of High-street and portions of Moulsham-street and Springfield-road, containing together an area of about 9,000 sq. yds., with Creosoted Deal Blocks.

Forms of Tender and full particulars may be obtained, and the Plans and Specifications may be inspected, at the Borough Engineer's Office, 16 London-road, Chelmsford.

Tenders, which must be on the form provided (enclosed in sealed envelopes endorsed "Wood Paving"), must be delivered at my Office by not later than Wednesday, 9th July.

The Contract will contain a clause providing that the Contractor shall, so far as regards any work executed in the Borough, pay rates of wages not less favourable than those commonly recognised by employers in the Borough for the particular class of work to be performed under the Contract.

The Council do not bind themselves to accept the lowest or any Tender, and reserve the right to divide the Contract between two or more Contractors, and to accept a part only of any Tender.

GEORGE MELVIN
Town Clerk.

Municipal Offices,
Chelmsford.
June 18, 1913. (567)

THE URBAN DISTRICT COUNCIL OF BARNES.

TO BUILDERS AND CONTRACTORS.

The above Council is prepared to receive Tenders for building a Keeper's Cottage at Barnes Common, S.W.

The Drawings and Specification can be seen, and Form of Tender obtained, on application to the Engineer and Surveyor at the Council House, to whom Tenders, sealed and endorsed "Common Keeper's Cottage," must be sent in not later than twelve o'clock noon on Tuesday, the 8th day of July, 1913.

The Council will not be bound to accept the lowest or any Tender, and no Tender will be considered except on the prescribed form.

(By order)

G. BRUCE TOMES, ASSOC.M.INST.C.E.,
Surveyor to the Council.

The Council House,
High-street, Mortlake, S.W. (568)

ASSISTANT, 21, desires appointment, home or abroad. At present engaged in office of M.Inst.C.E. in private practice. Efficient surveyor, leveller and good draughtsman; has served four years' pupilage, including a year's foundry experience, and is studying for the Assoc.M.Inst.C.E. Reference can be given. Box 1,261, office of THE SURVEYOR, 24 Bride-lane, Fleet-street, E.C. (562)

ASSISTANT desires change. Pupilage under M.I.C.E.; 12 years' experience in Sewage Disposal, Sewerage, Private and Public Street Works, Hospitals, &c., Specifications, Quantities, Estimates. Good organiser of Surveyor's Book-keeping; accurate, reliable.—Gandy, 136 High-street, Eastleigh. (563)

Some Recent Publications.*

ASPHALT CONSTRUCTION FOR PAVEMENTS AND HIGHWAYS. A Pocket-book for Engineers, Contractors and Inspectors. By Clifford Richardson, M.Am. Soc.C.E., F.C.S. Price 8s. 4d. nett. London: The Hill Publishing Company, 6 Bouverie-street, E.C.

In his preface the author points out that the demand for highway engineers, contractors and inspectors skilled in the preparation and management of asphalt pavements, and other kinds of asphalt road surfaces, far exceeds the supply, with the result that "many have entered these fields who do not realise the importance of careful attention to details which is necessary to ensure complete success in this line of work." It is for such persons that this pocket-book has been prepared, "with the hope that it will do something towards ensuring better work in the future than has been done in some cases during recent years by inexperienced contractors and engineers, and supervised by inexperienced inspectors." It is important that this limitation of the main purpose of the book should be clearly understood, because the practical effect of it is that a large proportion of the 150 pages is occupied by matter for which more highly trained engineers, contractors and inspectors have no use.

The words of the sub-title would suggest that the book is mainly occupied by data, tables, memoranda and specifications, and such outline descriptions of certain methods of construction as might be useful to qualified men of the three classes mentioned. It would be assumed, perhaps, that a part of the matter would be elementary, and that the junior or less qualified men would be considered, but it would certainly not be supposed from the title and sub-title that the author had set himself the particular task indicated in his preface. He is, however, to be congratulated on having definitely stated in the preface what is the purpose of the book, a purpose which, as far as an English critic is competent to judge, he seems to have carried out very well.

It must also be pointed out that the book is by no means useless to fully qualified men who are fairly well versed in the subjects dealt with. On the contrary, it is of value to such persons in two ways. First, the actual data are worth attention because, even when they are such as can readily be found elsewhere, the remarks with which they are accompanied give them additional value, and, in several cases, are such as will suggest to the engineer or contractor considerations which, though not of a technical kind, are of considerable practical importance. Here the essentially American outlook is distinctly useful. In the second place it should be noted that the book is one which really does deal with the subject of asphalt pavements, though it does not, of course, carry one far in the matter of asphalt construction for highways generally.

Though the author is but poorly equipped in the matter of literary composition, and is somewhat inclined to repeat himself, the dilution or "fluxing" of bituminous data with sentences which are at least the expressions of definite thoughts is welcome at a time when we are somewhat overloaded with details concerning the materials themselves. It may be suggested that the author writes with greater knowledge and authority when he is dealing with Trinidad and Bermudez asphalt than when he refers to other material, or to asphalt generally. For instance, his warning as to the use of hot smoothing irons which "do very serious damage to the surface with which they come in contact" should have been qualified by the statement that this warning does not apply to all asphalts or all kinds of asphalt pavement. Further, Mr. Richardson is less reliable as a guide when he is outside his special subject than when he is within it. For instance, his knowledge of the behaviour of asphalt pavements leads him to prefer the smooth floated surfaces of British and Continental foundations to the rough surface, often studded with projecting stones, which has usually been regarded as desirable in the United States. When, however, he recommends that the stone for a concrete foundation should be as nearly as possible cubical, he suggests an expenditure of time and money on a matter of no real importance. Indeed, a few passages further on, he states that "clean screened gravel alone makes excellent concrete if the components are properly proportioned." It is a curious thing that in the United States there is a tendency on the part of technical writers, when referring to concrete and concrete aggregates, to say one thing on one page and something else which is not in harmony with it on another page.

It is gratifying to find that matter appearing in THE SURVEYOR so recently as February 7th of this year finds a place in Mr. Richardson's book, but it must be pointed out that in the passage quoted Dr. Owens did not say that concrete should not be rammed too long, *especially* if it is very wet, but referred to "concrete mixed with too much water." The difference between "if" and "especially if" is really important, as the kind of ramming to which Dr. Owens referred is properly applied to one kind of concrete but not to another. As regards the filling of the voids between the pieces of broken stone in a road foundation, the author's view is one which deserves attention, but he ought not to say that the practice is "a great mistake," especially since he does not state what he means, in this connection, by "fine material." In referring to "carpet coats" such as those formed by surface tarring, Mr. Richardson's references to the effects of motor and horse-drawn vehicles respectively are unhappy. He has tried to say something useful in a very few lines, and has failed. On the other hand, a good point is made with regard to the repair of broken stone roads; "the cut should be filled with the same character of material as that which was used in the original construction of the surface, and not with coarser or finer material, as is sometimes done"—too often.

As regards the preparation of the asphaltic materials and the construction of the pavements, the author writes in an authoritative manner, and his observations regarding the nature of the sand and the filler, or dust, which should be used in this work may be regarded as very important. A notable feature of the book is the considerable use that is made of quantitative data, not only that relating to what should be done, but also with respect to what has been done.

It remains to be pointed out that the book has so far been considered rather in the light of its title and sub-title than in view of its special aim as indicated in the preface. The conditions there referred to, which more particularly led to its preparation and publication, are not found in this country; but, granting that the classes of persons referred to are responsible for the expenditure of really important sums of money, the book would seem to have in the United States a value and importance considerably greater than would be suggested by a review written for British readers.

NATURAL ROCK ASPHALTS AND BITUMENS: Their Geology, History, Properties and Industrial Application. By Arthur Danby. Price 8s. 6d. nett. London: Constable & Co., Limited.

This is a really important work. The author, who is described on the title page as a "chemist and public consultant on rock asphalt and bitumen," has produced a book which will command the respectful attention not only of highway engineers generally, but also of those who may claim to have special knowledge of the subject with which it deals. The nature of the subject-matter is correctly indicated by the title and sub-title, no part of the subject being so elaborated as to leave insufficient space for the proper treatment of the subject as a whole. Thus we find that the value of the seventy pages which are covered by the term "industrial application" is greatly enhanced by the information given in the preceding 170 pages, and that the relatively large amount of space devoted to these last four chapters is necessary, simply because this kind of matter makes, in proportion to the amount of information given, larger demands upon the printed page.

The introductory pages are devoted to a discussion of terminology, and this welcome contribution to a subject of immediate interest is followed by a chapter on the geology of bitumen and rock asphalt, in which various theories as to the origin of these materials are considered. The next chapter, on "Appearance and Physical Structure," is of practical importance in connection with specifications, on which point the author makes some definite recommendations. Chapter III., "History and Ancient Use," provides further material for the study of

*Any of the publications reviewed, or referred to as received, will be forwarded by the St. Bride's Press, Limited, on receipt of published price.

terminology. The author points out that the words "asphalt" and "bitumen" are to be found in the literature of our own country from early times. His expression is "the very earliest times," but the earliest of the passages quoted are from writings of the fourteenth century, and most of the quotations suggest that the writers were referring to imported words. For instance, "a thing that men clepen (call) asphalt," "cleped (called) bitumen," and "a certain mire or sue, otherwise called bitumen," all suggest that the word was not one of English origin. There are many points of practical importance to engineers in the chapters on "Modern Exploitation of Rock Asphalt" and "Sources of Rock Asphalt and Bitumen," and in view of the fact that most of the literature of the subject is inspired by faith in particular deposits and hope for the future exploitation of these deposits, the independent treatment of this subject in chapters V. to VIII. is of special value to engineers and surveyors. The chapter on "Tests and Analyses" is very well written, the purpose of each test and the way in which it should be done being explained without haste and without vain repetition, and the nature and purpose of the materials and apparatus used are clearly indicated. The chapter on "Physical Properties of Rock Asphalt" is suggestive of considerations which are of much practical importance. It is pointed out, for instance, that clay and marls have a great affinity for bitumen; and attention is directed to the difference between "porous penetration" and "intercalation" in the case of the impregnation of a rock with bitumen. Chapter XII. is on the "Carrying Out of Rock Asphalt Work." It is pointed out that the choice of compressed rock asphalt powder, or of rock asphalt mastic, may depend on whether the traffic is heavy or light; and it is suggested that the compressed rock asphalt tile is a form of paving which deserves more attention than it has so far received in the United Kingdom. The chapter on "Macadam Roads" is worthy of careful study.

The author discusses the economic position as regards the use of tar, and makes the noteworthy suggestion that road surveyors should purify their own crude tar when it is possible to obtain it from a gasworks in the vicinity. Certainly, some very good work has been done in this way, but the methods so far employed are, perhaps, hardly suitable where a large mileage of roads has to be tarred in a few weeks. Mr. Danby has produced a valuable and timely work, which will rank high in the economic and technical literature of the year, and is an eminently practical and readable volume.

Photographic Supplement to Stanford's Geological Atlas of Great Britain and Ireland. Arranged and edited by Horace B. Woodward, F.R.S., F.G.S., with the co-operation of Miss Hilda D Sharpe. Price 1s. London: Edward Stanford, Limited.

The aim of the compilers of this work has been to gather together a series of views representative of the rock features and scenery of the principal formations of Britain, in illustration of the Geological Atlas. There are 108 photographs, which have been well reproduced on art paper. Attached to each is an explanatory note describing the *locus in quo*, and the principal features of geological interest. References are also given in each case, not only to the Geological Atlas, but also to other publications where fuller information may be found. The photographs have as far as possible been arranged chronologically in regard both to the stratified formations and those of igneous origin. The photographic supplement should certainly be available for reference by all who are accustomed to use the Geological Atlas.

Chloride of Lime in Sanitation. By Albert H. Hooker. Price 12s. 6d. nett. London: Chapman & Hall, Limited.

This work consists primarily of a comprehensive account of the various uses to which chloride of lime may be put in sanitary practice, and demonstrates the immense value of this inexpensive chemical as a protector of the public health. In water purification, sewage disinfection, street flushing and general sanitation a free use of chloride of lime can do much towards arresting the spread of disease. A particularly interesting and valuable chapter is that which deals with the war against the ordinary house fly. The latter part of Mr. Hooker's book consists of a series of abstracts and references to various sources of information, by consulting which the reader may readily pursue his researches into any desired branch of the subject. The work is a valuable contribution to the science of preventive medicine, and should be read by all who are practically interested in health science.

Liverpool Market Scheme.—The Liverpool City Council have rejected a proposal that negotiations should be entered into for the purchase of a site for the purpose of erecting permanent abattoirs and meat markets.

Spalding's New Housing Scheme.—The Spalding Urban District Council recently had under consideration a new housing scheme. The first scheme had been negatived by the Local Government Board on the ground that allotment land belonging to the council could not be used for the purpose. Several other sites had been suggested, and the council adopted one offered by a member of the council, in Barrell's-lane. The proposal is to erect thirty houses on this site, giving to each about half a rood of land. The total cost is put at £5,400, of which £711 is for land and £4,260 for the erection of the houses. The rent of the new houses is expected to be about 4s. per week, as against 3s. 6d. under the original scheme without land attached.

INSTITUTION OF MUNICIPAL AND COUNTY ENGINEERS.

President Mr. R. J. Thomas, M.Inst.C.E., County Surveyor, Buckinghamshire.

ANNUAL GENERAL MEETING AND TOWN PLANNING CONFERENCE, GREAT YARMOUTH.

(*July 16th—19th.*)

Wednesday, July 16th.—Morning: General business of the institution; presidential address and presentation of premiums; adjournment for lunch. Afternoon: Conference on Housing and Town Planning Act.

Thursday, July 17th.—Morning: (*a*) Papers on road matters; (*b*) conference (continued); adjournment for lunch, given by mayor and corporation to members of the institution and delegates to the conference. Afternoon: (*a*) Papers on road matters (continued); (*b*) conference continued and concluded. Evening: Annual Dinner.

Friday, July 18th. Morning: Papers on road matters and subjects of general interest. Afternoon: Trip to waterworks at Ormesby Broad.

Saturday, July 19th.—Morning and afternoon: Trip by rail and steam launches over some of the rivers and broads of Norfolk.

The following is a preliminary list of the papers to be read and discussed at the Town Planning Conference:

"Town Design in Practice," by J. E. Wilkes, town planning engineer, Dunfermline.

"Legal Aspects of Town Planning," by J. L. Jack, town clerk, Dunfermline.

"Description of Birmingham Schemes," by H. E. Stilgoe, city engineer, Birmingham.

"Early Examples of Town Planning in the City of Edinburgh," by A. H. Campbell, city engineer, Edinburgh.

"Cities Beautiful by the Sea," by J. S. Brodie borough engineer, Blackpool.

"The Small Dwellings Acquisition Act, 1899," by J. L. Redfern, borough engineer, Gillingham.

"The Housing Question and its Solution," by Reg. Brown, surveyor to the urban district council, Southall.

"Factors Causing Bad Housing," by G. B. Hartfree, surveyor to the urban district council, Alton.

"Description of Town Planning Schemes and Housing in Sheffield," by C. F. Wike, city surveyor, Sheffield.

"A Description of the Ruislip-Northwood Town Planning Scheme," by W. Louis Carr, surveyor to the urban district council, Ruislip-Northwood.

The delegates to the conference will be welcomed by the mayor and corporation of Great Yarmouth, and entertained to luncheon by kind invitation of the mayor and corporation.

An important exhibition of plans of town planning schemes, kindly lent by authorities in various parts of the kingdom, will be available during the meeting.

LEEK MEETING.

A meeting of the institution in the West-Midland District will be held at Leek on July 5th (Saturday).

CONGRESS WEEK, JUNE 23rd to 28th.

Members whose districts are conveniently near London, who will be carrying out tar-macadam construction or tar surfacing during this week, are requested to communicate with me. Members also of towns within an easy distance from London having a population from 15,000 to 30,000 who have recently installed a modern system of slow-sand filtration for water supply, are also requested to communicate with me. The information is inquired for on behalf of members residing outside England.

THOMAS COLE,
92 Victoria-street, S.W. *Secretary.*

INSTITUTION OF MUNICIPAL ENGINEERS.

President—Mr. FRANK LATHAM, M.INST.C.E.I., F.S.E. Borough Engineer and Surveyor, Penzance

A meeting of the North-Western District of the institution will be held at Wellington (Salop) to-morrow (Saturday).

PROGRAMME.

1.30 p.m. Meet at Council Chamber, Walker-street Wellington.
2 p.m. Inspect fire station, public baths, library, market, gasworks, water pumping station, Cottage Hospital and recreation ground.
3 p.m. Drive to sewage disposal works, impounding reservoir and water filtration works at the famous Wrekin. Brake tickets, 2s. 6d. per head.
6 p.m.—Members and friends will be entertained to tea by John Bayley, Esq., C.C., principal of Wellington College, at the college

J. W. GLEAVE,
Hon. District Secretary.

GENERAL MEETING.

A general meeting will be held in the Council Chamber, No. 4 Southampton-row, W.C., on Wednesday, June 25, 1913, at 7.45 o'clock, when a paper, "The Relations of the Engineer and the Municipal Engineer," by Mr. H. C. H. Shenton (member), will be presented for discussion. An advance copy of the paper will be sent on request.

INTERNATIONAL ROAD CONGRESS.

As a number of members will be in London during the congress, it has been decided to hold an informal meeting at the institution offices on Wednesday, June 25th, in order to facilitate intercourse between members. The meeting will run from 10.30 to 1.

COUNCIL MEETINGS.

The following council meetings have been arranged: June 25th, London; July 30th, London.

B. WYAND.
Secretary.

39 Victoria-street, S.W.
May 1, 1913.

ROADS IMPROVEMENT ASSOCIATION CONFERENCE.

The first Roads Improvement Association conference is to be held at the Royal Automobile Club, Pall-mall, London, S.W., to-morrow (Saturday), at 3 p.m.

PROGRAMME.

3 p.m.—Opening of the conference in the Committee Room.

Two papers, as follows, will be submitted for consideration and discussion:—

(1) "The Trend of Modern Road Construction," by Colonel R. E. Crompton and Mr. H. Percy Boulnois (vice-chairmen).
(2) "The Organisation and Work of the Branches of the Roads Improvement Association," by Messrs. E. S. Shrapnell-Smith (hon. treasurer) and Wallace E. Riche (general secretary).

5.30-6 p.m.—Approximate time of conclusion of conference.
7.30 p.m.—Dinner, by invitation of the council, in the Great Gallery.

ROYAL SANITARY INSTITUTE.

ANNUAL CONGRESS AND EXHIBITION, EXETER.

The annual congress of the Royal Sanitary Institute will be held at Exeter from July 7th—12th next, under the presidency of Earl Fortescue, K.C.B., Lord-Lieutenant of Devonshire. The order of proceedings will be found set out in our issue of May 23rd.

E. WHITE WALLIS,
Secretary.

APPOINTMENTS VACANT.

Official and similar advertisements received up to 4.30 p.m. on Thursdays will be inserted in the following day's issue, *but those responsible for their despatch are recommended to arrange that they shall reach* THE SURVEYOR *office by noon on* Wednesdays *to ensure their inclusion in the weekly list of vacancies. Such advertisements may, in cases of emergency only, be telephoned (No. 1529 Holborn), subject to later confirmation by letter.*

BOROUGH SURVEYOR. June 21st.—Banbury Town Council. £250–£350.—Mr. A. Stockton, town clerk.

SURVEYOR.—June 21st.—Barrowford Urban District Council. £145–£175. Mr. A. T. Chandler, clerk.

TEMPORARY ASSISTANT. June 23rd. Horbury Urban District Council. 30s. per week. Mr. W. Sugars, engineer and surveyor.

ACCOUNTANT CLERKS (Engineer's and Surveyor's Department).—June 23rd.—Beckenham Urban District Council. First-class clerk, £165–£200; third-class clerk, £75—£115.—Mr. F. Stevens, clerk.

ASSISTANT SURVEYOR.—June 23rd.—Blean Rural District Council. 30s. per week. Mr. J. E. Burch, clerk, 39 Castle-street, Canterbury.

CLERK.—June 23rd.—Fourth-class clerk in Deptford borough surveyor's department. £40–£70.—Mr. V. Orchard, town clerk.

CLERK OF WORKS.—June 23rd. Carnarvonshire Joint Standing Committee. £2 10s. per week.—Mr. A. Bodvel Roberts, clerk of the peace, Carnarvon.

SURVEYOR'S ASSISTANT. June 25th. Seaham Harbour Urban District Council. £78 per annum. Mr. J. W. Richardson, clerk.

TEMPORARY ARCHITECTURAL ASSISTANT. June 25th.—Corporation of Huddersfield. £3 3s. per week. Mr. K. F. Campbell, borough engineer.

SANITARY INSPECTOR.—June 26th.—Islington Borough Council. £148 per annum. Mr. W. F. Dewey, town clerk.

ROAD SURVEYOR'S CLERK.—June 28th.—Corporation of Birmingham. £60—£110.—Mr. Henry E. Stilgoe, city engineer and surveyor.

SEWAGE OUTFALL WORKS MANAGER.—June 28th.—Willenhall Urban District Council. £100 per annum with house and light.—Mr. Rowland Tildesley, clerk.

ASSISTANT ENGINEER AND SURVEYOR.—June 30th. Corporation of Chelmsford. £150—£180. Mr. P. T. Harrison, borough engineer and surveyor.

ASSISTANT VALUER AND SURVEYOR. June 30th.—Calcutta Improvement Trust. 600–800 rupees per month.—Mr. C. H. Bompas, chairman, 5 Clive-street, Calcutta.

CITY SURVEYOR'S DEPUTY (ENGINEERING DEPARTMENT).—June 30th.—Corporation of Manchester. £750 per annum.—City Surveyor, Town Hall.

BOROUGH ENGINEER'S TEMPORARY ASSISTANT.—June 30th.—Corporation of Dorchester.—Mr. A. G. Symonds, town clerk.

GENERAL ENGINEERING AND SURVEYING ASSISTANT.—June 30th.—Corporation of Stoke-on-Trent. £90—£120.—Mr. A. Burton, borough surveyor.

CITY SURVEYOR'S DEPUTY (SURVEYING DEPARTMENT).—June 30th.—Corporation of Manchester. £750 per annum.—City Surveyor, Town Hall.

DRAUGHTSMAN. — June 30th. — Hampstead Borough Council. £80 per annum.—Mr. Arthur P. Johnson, town clerk, Town Hall, Haverstock Hill, N.W.

SEWAGE WORKS FOREMAN.—July 1st.—Buxton Urban District Council. 37s. 6d.—£2 5s. per week.—Mr. F. Langley, engineer and surveyor.

HIGHWAY SURVEYOR'S ASSISTANT.—July 1st. Elham Rural District Council. £100 per annum.—Mr. B. C. Drake, Hythe, Kent.

ASSISTANT SANITARY INSPECTOR.—July 1st.—Merton Urban District Council. £75 per annum.—Mr. C. J. Mountifield, clerk, Merton, Surrey.

ASSISTANT ENGINEER.—July 5th.—Corporation of St. Helens. £2 per week.—Mr. Arthur W. Bradley, borough engineer and surveyor.

ENGINEER'S ASSISTANT.—July 7th.—Corporation of Worcester. £130 per annum.—Mr. T. Caink, city engineer.

INSPECTOR OF NUISANCES.—July 8th.—Clutton Rural District Council. £130—£150.—Mr. J. Sumner Dury, clerk, Temple Cloud, Bristol.

TECHNICAL (SANITARY) INSPECTOR.—October 1st.—Municipality of Alexandria.—The Director-General of the Municipality.

COST CLERKS.—Sheffield Corporation Water Department.—Mr. William Terrey, general manager, Town Hall.

BOROUGH SURVEYOR'S TEMPORARY ASSISTANTS.—Corporation of Southend-on-Sea. 35s. per week.—Mr. E. J. Elford, borough engineer.

MUNICIPAL COMPETITIONS OPEN.

Official and similar advertisements received up to 4.30 p.m. on Thursdays will be inserted in the following day's issue, *but those responsible for their despatch are recommended to arrange that they shall reach* The Surveyor *office by noon on* **Wednesdays** *to ensure their inclusion in the weekly list of summaries. Such advertisements may, in cases of emergency only, be telephoned (No. 1359 Holborn), subject to later confirmation by letter.*

LIVERPOOL.—July 24th.—Designs for a sanatorium of 250 beds. Premiums, 150, 100 and 50 guineas.—Mr. Edward R. Pickmere, town clerk.

CHEPPING WYCOMBE.—September 1st.—Designs for town-planning the borough and an area immediately adjoining. Premiums, £25, £10 and £5.—Mr. T. J. Rushbrooke, borough surveyor, High Wycombe.

MUNICIPAL CONTRACTS OPEN.

Official and similar advertisements received up to 4.30 p.m. on Thursdays will be inserted in the following day's issue, *but those responsible for their despatch are recommended to arrange that they shall reach* The Surveyor *office by noon on* **Wednesdays** *to ensure their inclusion in the weekly list of summaries. Such advertisements may, in cases of emergency only, be telephoned (No. 1359 Holborn), subject to later confirmation by letter.*

Buildings.

NORFOLK.—June 21st—July 9th.—For the erection of a school, for the Education Committee.—Mr. J. E. Burton, architect, Victoria Chambers, Bank-place, Norwich.

HARROW-ON-THE-HILL.—June 21st.—For the erection of two cottages, stables, and stores, and additions to hospital, for the urban district council.—Mr. J. P. Bennetts, engineer and surveyor.

WEST RIDING.—June 23rd.—For the widening (in masonry) of Cottingley Bridge, for the Highways Committee.—Mr. F. G. Carpenter, West Riding surveyor, County Hall, Wakefield.

TOTTENHAM.—June 23rd.—For redecoration of schools, for the Education Committee.—Mr. W. H. Prescott, surveyor.

CARLISLE.—June 23rd.—For the extension of electricity buildings, for the corporation.—Mr. H. C. Marks, city engineer.

PICKERING.—June 23rd.—For the construction of 4 miles of 3½-in. and 3-in. water mains with valves, and service reservoir, for the rural district council.—Mr. J. E. Parker, Post Office Chambers, Newcastle-on-Tyne.

SWINDON.—June 23rd.—For the erection of a cemetery chapel, for the corporation.—Mr. H. J. Hamp, borough surveyor.

READING.—June 23rd.—For the building of a lairage shed and construction of roadway at the market, for the corporation.—Borough Engineer.

DARLINGTON.—June 23rd.—For the erection of three cottages, for the corporation.—Mr. G. Winter, borough surveyor.

GLASGOW.—June 23rd.—For the erection of a coal store, for the corporation.—Mr. A. Wilson, engineer, 45 John-street.

DEVON.—June 23rd.—For the erection of a school, for the Education Committee.—County Architect, 1 Richmond-road, Exeter.

SOWERBY BRIDGE.—June 23rd.—For excavation and walling, for the urban district council.—Mr. G. Wrigley, engineer.

SOUTHAMPTON.—June 23rd.—For reconstructing a warehouse, for the Harbour Board.—Mr. J. E. Pailthorpe, clerk, Town Quay.

CARDIGAN.—June 23rd.—For the construction and extension of waterworks, consisting of mains, valves, hydrants, and supplemental reservoir, for the corporation.—Mr. D. Morgan Jones, town clerk.

HINCKLEY.—June 23rd.—For building twelve workmen's dwellings, for the urban district council.—Mr. E. H. Crump, engineer and surveyor.

HORNSEY.—June 23rd.—For the erection of a fire station, for the corporation.—Mr. E. J. Lovegrove, borough engineer.

WEST SUSSEX.—June 23rd.—For the erection of an infants' school, for the Joint Education Committee.—Mr. H. P. Roberts, county education architect, Thurlow House, High-street, Worthing.

SOUTHGATE.—June 24th.—For private street works, for the urban district council.—Mr. C. G. Lawson, surveyor.

LEWISHAM.—June 24th.—For covering the floors of the council chamber and committee rooms with parquetry flooring, for the borough council.—The Surveyor.

ABERDARE.—June 24th.—For the erection of a domestic subjects centre, for the Education Committee.—Mr. J. L. Smith, architect, 7 Victoria-square.

FARNHAM.—June 24th.—For the erection of five cottages, for the urban district council.—The Surveyor.

WATERLOO-WITH-SEAFORTH.—June 25th.—For additions to a school, for the urban district council.—Messrs. Appleyard & Quiggin, architects, 67 Lord-street, Liverpool.

TWICKENHAM.—June 25th.—For the erection and completion of the first portion of the Orleans school, latrines, play shed, boundary walls, and other works, for the urban district council.—Mr. Fred. W. Pearce, surveyor.

WALTHAMSTOW.—June 25th.—For the erection of a tuberculosis pavilion, for the urban district council.—Mr. G. W. Holmes, engineer.

LEWES.—June 25th.—For building municipal offices, for the corporation.—Mr. Rowland H. Halls, architect, Seveirg Buildings, Lewes.

WATERLOO.—June 25th.—For the erection of manual instruction centre and other works, for the urban district council.—Mr. J. I. Thompson, clerk.

FARNWORTH.—June 25th.—For the erection of a fire station, for the urban district council.—Mr. W. Tyldesley, clerk.

SOUTHWARK.—June 25th.—For the extension of the electricity station, for the borough council.—Borough Engineer.

HERTFORDSHIRE.—June 27th.—For the construction of a new bridge over the Stort Navigation at Bishops Stortford, for the county council.—Mr. Urban A. Smith, county surveyor, Hatfield.

HERTFORDSHIRE.—June 27th.—For the construction of a new bridge over the Stort Navigation at Sawbridgeworth, for the county council.—Mr. Urban A. Smith, county surveyor, Hatfield.

TIVERTON.—June 28th.—For the erection of eighteen cottages, for the corporation.—Mr. J. Siddalls, borough surveyor.

SOUTHAMPTON.—June 30th.—For the construction of Great Town Bridge, Whitchurch, consisting of four small brick arches with concrete abutments and piers, the construction of 1 mile of surface-water drains, and the construction of short lengths of surface-water drains, for the county council.—Mr. H. Barber, clerk, The Castle, Winchester.

ROMFORD.—June 30th.—For the erection of eighteen cottages, for the rural district council.—Mr. W. J. Grant, surveyor.

SEAHAM HARBOUR.—June 30th.—For the erec-

tion of forty-five houses, road and sewer works, and fencing, for the urban district council.—Mr. F. E. Boaz, surveyor.

ESSEX.—July 1st.—For alterations and additions to Hadleigh school, for the county council.—Mr. F. Whitmore, county architect, Duke-street, Chelmsford.

SEVENOAKS.—July 2nd.—For the erection of six cottages, for the rural district council.—Mr. C. W. Bowles, architect, 9 Staple-inn, Holborn-bars, London W.C.

GODSTONE.—July 3rd.—For the construction of a reinforced-concrete bridge, for the rural district council.—Mr. Geo. E. Crowter, engineer and surveyor.

BRECON.—July 4th.—For the construction of school latrines and drainage, for the Education Committee.—Mr. C. W. Best, surveyor, County Hall, Brecon.

GUILDFORD.—July 7th.—For alterations and repairs to schools, for the Education Committee.—Mr. C. G. Mason, borough surveyor.

MALDENS AND COOMBE.—July 8th.—For the erection of new council chamber and offices, for the urban district council.—Mr. R. H. Jeffes, Municipal Buildings, New Malden.

BARNES.—July 8th.—For building a keeper's cottage at Barnes-common, for the urban district council.—Mr. G. Bruce Tomes, surveyor.

TWICKENHAM.—July 9th.—For the construction of about 650 ft. of stone-pitched inclined embankment along the river frontage of Radnor House pleasure ground, for the urban district council.—Mr. Fred. W. Pearce, surveyor.

GREAT BERKHAMPSTEAD.—July 10th.—For the construction of an open-air swimming bath, for the urban district council.—Mr. E. H. Adey, surveyor.

STEPNEY.—July 10th.—For the erection of an iron and steel high-tension electricity generating station, offices, messrooms, and lavatories, for the borough council.—Mr. M. W. Jameson, borough engineer, Municipal Offices, Whitechapel, E.

Iron and Steel.

SALFORD.—June 23rd.—For the supply of steel tie-bars, for the corporation.—Tramways General Manager.

NEWPORT (I.W.).—June 23rd.—For providing and laying cast-iron water main, for the corporation.—Mr. T. Ross Pratt, clerk.

EAST GRINSTEAD.—June 28th.—For the supply of fencing and gates, for the urban district council.—Mr. W. E. Woollam, engineer.

OUNDLE.—July 12th.—For providing and laying 4-in. and 3-in. cast-iron water mains with valves and hydrants, for the rural district council.—Messrs. G. & F. W. Hodson, engineers, Bank Chambers, Loughborough.

BROWNHILLS.—July 14th.—For the supply, erection, and maintenance for twelve months of gas engine, suction gas plant, and three throw pump, capable of lifting 22,500 gallons per hour, for the urban district council.—Mr. Robert Green, 37 Waterloo-street, Birmingham.

Roads.

WORCESTER.—June 21st.—For work of piling for a river promenade, for the corporation.—Mr. T. Caink, city engineer.

WEST ASHFORD.—June 23rd.—For the supply of granite, for the rural district council.—Mr. A. Sims, surveyor.

BATTERSEA.—June 23rd.—For laying down Norwegian granite kerbing, for the borough council.—Town Clerk.

WANDSWORTH.—June 23rd.—For repairs in part of Moyser-road, Streatham, for the borough council.—Mr. P. Dodd, borough engineer.

YIEWSLEY.—June 23rd.—For kerbing and paving with concrete slabs, for the urban district council.—The Surveyor.

DUBLIN.—June 23rd.—For the supply of cube paving setts, for the corporation.—Mr. M. J. Buckley, city engineer.

LEYTON.—June 24th.—For the supply of Leicester granite and chippings, for the urban district council.—Mr. E. H. Essex, surveyor.

GOSFORTH.—June 24th.—For laying down flags, for the urban district council.—Mr. G. Nelson, engineer and surveyor.

COWES.—June 24th.—For the supply of broken granite and other material, for the urban district council.—Mr. J. W. Webster, engineer.

BELFAST.—June 24th.—For paving and sewering works, for the corporation.—City Surveyor.

ASHTON-UPON-MERSEY.—June 24th.—For making up two roads, for the urban district council.—Mr. F. Hutton, surveyor.

ANDOVER.—June 24th.—For paving work, for the corporation.—Mr. R. W. Knapp, borough surveyor.

SOYLAND.—June 24th.—For the supply of broken granite and tarviated granite, for the urban district council.—Mr. W. Whitehead, surveyor.

NEWCASTLE-UNDER-LYME. — June 24th. — For making-up several streets, for the corporation.—Borough Surveyor.

ROCHDALE.—June 25th.—For making-up work, for the corporation.—Borough Surveyor.

MIDDLESBROUGH.—June 25th.—For making-up certain streets, for the corporation.—Borough Engineer.

CRANBROOK.—June 25th.—For steam rolling and scarifying, for the rural district council.—Mr. Eric Clarke, clerk.

DEWSBURY.—June 25th.—For paving and flagging, for the corporation.—Borough Surveyor.

KEARSLEY.—June 25th.—For repaving with granite setts, for the urban district council.—The Surveyor.

WOKINGHAM.—June 25th.—For fixing Norwegian kerb and channel, concrete slab paving and paved crossings, for the corporation.—Mr. C. W. Marks, borough surveyor and engineer.

HORNSEY.—June 25th.—For making-up work, for the corporation.—Mr. E. J. Lovegrove, borough engineer.

EAST SUSSEX.—June 26th.—For hiring steam rollers and scarifiers, for the county council.—Mr. Fred. J. Wood, county surveyor.

LAMBETH.—June 26th.—For the supply of 40,000 ft. of paving flags, for the borough council.—Mr. H. Edwards, borough engineer.

ALNWICK.—June 27th.—For the supply of hand-broken whinstone, for the urban district council.—Mr. G. Wilson, surveyor.

RHONDDA.—June 27th.—For the construction of a new road, for the urban district council.—Mr. W. J. Jones, engineer and surveyor.

CANNOCK.—June 27th.—For a new 10-ton steam road roller, for the urban district council.—Mr. C. A. Loxton, clerk.

WALMER.—June 28th.—For making-up work, for the urban district council.—Mr. H. W. Baker, surveyor.

NEYLAND.—June 28th.—For carrying out private street works, for the urban district council.—Mr. F. W. Evans, surveyor.

BASINGSTOKE.—June 30th.—For the supply of flat granite kerb, granite channel, granite setts, and Bristol pennant channel, for the corporation.—Mr. F. R. Phipps, borough engineer.

BECKENHAM.—June 30th.—For the supply of 300 cub. yds. of tarred road material, for the urban district council.—Mr. John A. Angell, surveyor.

BECKENHAM.—June 30th.—For the supply of about 600 super. yds. of artificial stone paving, 2 in. thick, for the urban district council.—Mr. John A. Angell, surveyor.

LOUGHTON.—June 30th.—For the supply of broken granite, gravel, and hire of steam roller, for the urban district council.—Mr. H. White, surveyor.

TOTTENHAM.—July 1st.—For making up Wargrave-avenue, second section, for the urban district council. Mr. W. H. Prescott, surveyor, Town Hall, Tottenham.

WATFORD.—July 1st.—For road making, drainage, and fencing, for the urban district council.—Mr. D. Waterhouse, engineer and surveyor.

LONDON.—July 1st.—For repairs to carriageway, for the county council.—Mr. G. W. Humphreys, clerk.

CHISWICK.—July 2nd.—For making up a road, for the urban district council.—Mr. E. Willis, surveyor.

BASINGSTOKE.—July 2nd.—For work of road rol-

ling, for the rural district council.—Mr. R. Forrester, surveyor.

STRETFORD.—July 5th. For paving work in rock asphalt, for the urban district council.—Mr. E. Worrall, surveyor.

CHELMSFORD.—July 9th.—For paving High-street and portions of Moulsham-street and Springfield-road, containing about 9,000 sq. yds., with creosoted deal blocks, for the corporation.—Borough Engineer.

ATCHAM. July 12th. For the hire of a 10-ton steam roller, for the rural district council. Mr. E. P. Everest, clerk, St. John's-hill, Shrewsbury.

WATFORD. July 15th. For the supply of broken granite chippings and dust, for the urban district council.—Mr. D. Waterhouse, engineer and surveyor.

FEATHERSTONE. July 26th.—For private street work, for the urban district council.—Mr. S. Chesney, engineer and surveyor.

AMBLE.—No date.—For the supply of 560 tons of highway materials, for the urban district council.—Mr. W. Gibson, surveyor.

DUKINFIELD.—For the supply of 1,000 tons of 6-in. gritstone setts, for the corporation.—Mr. S. Hague, borough surveyor.

Sanitary.

BEDWELLTY. June 21st. For laying sewers and surface-water drains, for the urban district council.—Mr. D. H. Price, surveyor.

ASHTON-UNDER-LYNE.—June 21st.—For the supply of 4,000 yds. of sludge press cloth, 41 in. wide, for the corporation. — Mr. Edward Stamp, manager, Sewage Disposal Works, Dukinfield.

WITHERNSEA. June 23rd. For repairs to the sewer outfall, for the urban district council.—Mr. N. Dixon, clerk.

BROMSGROVE.—June 23rd.—For the construction of sewers and sewage disposal works, for the rural district council.—Mr. W. Fiddian, engineer, Old Bank Offices, Stourbridge.

NEWCASTLE-UNDER-LYNE.—June 24th.—For carrying out a sewerage scheme, for the corporation.—Borough Surveyor.

BERWICK. June 24th.—For the construction of pipe sewers, iron manholes and settling chambers, for the corporation. Borough Surveyor.

LYTHAM.—June 24th.—For the provision and erection of a 12-in. compound centrifugal pumping engine at the sewage works, for the urban district council. Mr. A. J. Price, engineer.

CASTLEFORD.—June 24th.—For laying earthenware pipes, for the urban district council. Mr. H. H. Pemberton, clerk.

RUNCORN.—June 25th. For emptying ashpits, for the rural district council. Mr. G. F. Ashton, clerk.

CHIPPENHAM.—June 27th. For laying sewer and making connections, for the rural district council.—Mr. M. Awdry, clerk.

WHITTINGTON AND NEWBOLD.—June 30th.—For the construction of 1,600 yds. of 12-in., 15-in. and 18-in. earthenware pipe sewers, with manholes, tanks, filters, engine and pump house, machinery, and other works, for the urban district council.—Mr. Bathgate Cook, surveyor, St. John's-road, Whittington Moor, Chesterfield.

HAMPSHIRE.—June 30th.—For the construction of surface-water drains, for the county council.—Mr. W. J. Taylor, county surveyor, The Castle, Winchester.

TENDRING.—June 30th.—For laying sewer with manholes and ventilators, for the rural district council.—Mr. A. J. Martin, 7 Victoria-street, Westminster.

NORTH BROMSGROVE.—June 30th.—For the construction of 1,000 yds. of 6-in., 7-in. and 9-in. diameter stoneware pipe sewers, manholes, overflow chamber, ventilating columns, and other works, for the urban district council. Mr. Francis T. Leven, clerk.

HOUGHTON-LE-SPRING. July 1st.—For scavenging work, for the rural district council. Mr. R. B. Marley, clerk.

BOWLEY REGIS.—July 1st. For works of sewerage, for the urban district council. Mr. D. Wright, clerk, Old Hill, Staffs.

[illegible]BURN. July 1st. For carrying out drainage works, for the rural district council.—Messrs. Swiney & Crossdale, engineers, Royal-avenue, Belfast.

KANTURK (Co. Cork).—July 2nd.—For sinking wells, erecting pumps, and constructing sewers, for the rural district council.—Mr. T. Guiney, clerk.

HARTSHORNE AND SEALS.—July 4th.—For constructing detritus tanks, percolating filter, dosing chamber, carriers and subsidiary works, for the rural district council.—Mr. Norman F. Spence, engineer and surveyor.

MADRAS.—September 9th.—For the supply and delivery of English stoneware pipes and specials, varying from 4 in. to 21 in. internal diameter, and aggregating a total length of about 143 miles, for the corporation.—Messrs. James Mansergh & Sons, agents, 5 Victoria-street, Westminster, S.W.

Stores.

LEEDS.—June 21st.—For the supply of iron, steel, gas and pipe hooks, bolts, nuts, tin plates, tin ingots, shovels, coke forks, files, brushes, brackets, lead, lead tube, and Portland cement, for the Gas Committee.—Mr. R. H. Townsley, general manager, Market Hall, Leeds.

BIRMINGHAM.—June 23rd.—For the supply of general and engineering stores, for the electricity department.—Mr. R. A. Chattock, city electrical engineer, 14 Dale-end, Birmingham.

WEYMOUTH.—June 26th.—For the supply of brooms, brushes, ironmongery, iron castings, bricks, cement, stoneware goods, and timber, for the corporation.—Mr. K. J. S. Harris, borough surveyor.

KEIGHLEY. June 30th.—For the supply of ironmongery, iron castings, pitch, oil, broken limestone, granite, earthenware pipes, and cement, for the corporation.—Borough Engineer.

CROOK.—No date.—For the supply of oils, brooms, shovels, disinfectants, road materials and team labour, for the urban district council.—Mr. H. P. Douglas, clerk.

Miscellaneous.

KING'S LYNN.—June 24th.—For the supply of 500 tons of coal (best hand-picked hards), for the corporation.—Mr. Alfred J. Smith, borough surveyor and waterworks engineer.

CHEPPING WYCOMBE.—July 8th.—For a supply of best anthracite coal, for the corporation.—Mr. T. J. Rushbrooke, water engineer.

TENDERS FOR MUNICIPAL WORKS OR SUPPLIES.

The Editor invites the co-operation of Surveyor *readers with a view to making the information given under this head as complete and accurate as possible.*

* Accepted. † Recommended for acceptance.

ALSAGER.—For the boring and lining of Borehole No. 2 in connection with the Oak Farm water supply, for the urban district council.—Mr. H. V. Lyman, engineer :—

	£
Le Grand & Co.	691
Oil Well Company	685
New England Boring Company, Peterborough	535
Potter & Co.	512
H. Brown & Co.	486
John Thom, Patricroft	483
Timmins & Son, Runcorn	478

AXBRIDGE.—For the supply of 8,000 tons of granite or basalt macadam and chippings, for the rural district council.—Mr. J. Knight Dunster, district surveyor, Winscombe, Somerset :—

	Per ton. s. d.
H. L. Cooper & Co., London (stone from Llithfaen)	10 10
Penlee and St. Ives Stone Quarries, Limited, Bristol (Penlee basalt)	10 9
St. Keverne Stone Company, Helston (Porthonstock Quarries)	10 6
Teign Valley Granite Company, Bovey Tracey (stone from Dunsham)	9 8
Tytherington Stone Company, Tytherington (Tytherington)	9 7
Clevedon Stone Firms, Bristol (Porthgain granite)	9 7
Somerfield & Lang, Liverpool (Cargleu basalt)	9 6
Castle Hill Quarries (Carlingford), Limited, Dublin (7,000 tons, delivered to Highbridge Wharf)	9 0
Roadstone Supply Company, Shepton Mallet (stone from Cremorne Quarries)	9 0

BARNES.—For paving the carriageway of Sheen-lane from High-street to Upper Richmond-road with creosoted deal blocks laid on a concrete foundation, for the urban district council.—Mr. G. Bruce Tomes, surveyor, Council House, High-street, Mortlake, S.W. :—

	£
Griffiths & Co, Bishopsgate-street	3,554
Moxlem & Co., Westminster	3,492
Improved Wood Pavement Company, Queen Victoria-street	3,386
Acme Flooring and Paving Company, Victoria-park	3,386
Wimpey & Co., Hammersmith	3,281

BELFAST.—Accepted for the supply of a circulating water pump, for the corporation. Mr. T. W. Bloxam, city electrical engineer, East Bridge-street :—

British Electric Plant Company, Limited, Alloa, Scotland.

CHEADLE.—For providing and laying cast-iron water mains and sluice valves, for the rural district council.—Mr. W. P. Inskipp, surveyor:—

Saunders & Torrance, Stoke-on-Trent	£1,452
T. Hughes, Stoke-on-Trent	1,265
F. Barke & Son, Stoke-on-Trent	950
T. Moss, Ashbourne	898
J. & A. Ratcliffe, Stoke-on-Trent	749
J. Taylor & Son, Stoke-on-Trent*	667
E. R. Plant, Stoke-on-Trent (withdrawn)	597

HOVE.—For carrying out road work for the corporation. Mr. H. H. Scott, borough engineer:—

Lyndhurst-road—J. Parsons & Sons, Hove	£520
Holland-road—J. Parsons & Sons, Hove	163

JARROW.—For laying tar-macadam in several streets, for the corporation.—Mr. J. S. Weir, borough engineer.

David Glen, Jarrow-on-Tyne.
W. Kennedy & Son, Jarrow-on-Tyne.
E. Clarkson, Bolton.
Bunch, Newcastle-on-Tyne.
T. Wardlaw, South Shields.*

KENSINGTON.—Construction of an underground convenience, for both sexes, for the borough council:

G. Jennings, Limited	£1,735
Doulton & Company, Limited	1,710
A. Roberts & Co., Limited	1,663
C. P. Roberts & Co., Limited	1,634
E. Proctor & Sons	1,596
Strand Building Company	1,550
Davey & Armitage*	1,530

LLANDILO-FAWR.—For the construction of works of water supply, for the rural district council.—Mr. Henry Herbert, engineer, Brynmarlais, Ammanford.

J. S. Thomas, Ammanford	£6,847
J. D. Howells, Brynamman	4,120
Hall Bros., Sketty, near Swansea	3,995
E. Powell, Whitchurch, near Cardiff	3,850
J. W. Thompson, Neath	3,691
Parkinson & Hodgens, Swansea	3,578

LOUGHTON.—For making up a road and a footpath, for the urban district council.—Mr. H. White, engineer.—

	Road.	Path.
T. Adams, Wood Green, N.	£475	£68
G. Bell & Sons, Limited, Tottenham	474	85
W. and C. French, Buckhurst-hill*	455	64

MALDENS AND COOMBE.—For the erection of boundary walls, piers and gates, and the construction of surface-water drainage, for the urban district council.—Mr. R. H. Jeffes, engineer and surveyor:—

G. W. Stapeley, New Malden	£622
Humphreys & Allen, Streatham	556
H. Burfoot & Son, Windsor	514
F. W. Streeton, New Malden	503
Strand Building Company, London	496
W. H. Lorder & Son, Limited, Upper Tooting	484
J. Mowlem & Co., Limited, Westminster	470
Chas. H. King, New Malden*	451

Engineer and surveyor's estimate, £454.

ORRELL (Lancs).—The following tenders have been accepted by the urban district council:—

Pitch and creosote oil—R. Burland & Son.
2½-in. flags—J. Marsh.
Setts—J. Southworth.
10-in. kerb—Bispham Hall Colliery Company.

PORTSMOUTH.—For the erection of a dispensary, for the corporation.—Mr. A. W. Ward, borough engineer:—

J. Lay & Co., Portsmouth	£820
Woods & Co., Southsea	749
W. W. Evans, Southsea	739
South Western Building and Steam Joinery Co., Limited, Gosport*	689

ST. HELENS.—Accepted for alterations at Cowley Secondary School, for the Education Committee.—Messrs. Baron & Fletcher, architects, George-street.—
General Building Contract.—Joseph Yearsley, St. Helens.
Plastering.—Leathwaite & Booth, St. Helens.
Plumbing, &c. A. Higginbotham & Sons, Bradford, Yorkshire.

ST. NEOTS.—Recommended for acceptance for the supply of broken granite, tarred slag and slag dust, for the urban district council.—Mr. J. Edey, surveyor:—
Groby Granite Company, Groby, near Leicester.—1 in., 7s. 1d. per ton; 1½ and 2 in., 11s. 1d.; 2½ in., 11s. 1d.
Jees Hartshall Granite Company, Hartshill, Atherstone.—1½ in., 9s. 1d. per ton; 1½ in., 9s. 10d.; 2½ in., 10s. 7d.
Enderby and Stoney Stanton Granite Company, Stoney Stanton.—1, and 2 in., 10s. 9d. per ton.
Cliffe Hill Granite Company, Narborough, Leicester.—2½ in., 11s. 7d. per ton.
Mountsorrel Granite Company's Stoney Stanton Quarries, Sutton Bridge.—1½ and 2 in., 11s. 3d. per ton.
Tarmacadam equally divided between J. Smart & Son, Victoria-street, S.W., 14s. 3d., 15s. per ton; W. Prestwich & Sons, Dronfield, for all sizes, 13s. 3d., 15s. 9d., 18s. 3d.
Slag Dust.—W. Prestwich & Sons, 5s. per ton.

WALTON-UPON-THAMES.—For making up a private street, for the urban district council.—Mr. R. Wilds, surveyor:—

Ed. Free & Son, Maidenhead	£921
W. Wright, Chesham	887
G. Wimpey & Co., Hammersmith	887
W. Maunders & Co., Leyton	871
J. Mowlem & Co., Westminster	861
S. Kavanagh & Co., Surbiton-hill*	844
W. H. Wheeler & Co., Blackfriars-road	843

WANDSWORTH.—Accepted for the execution of wood paving and other works, for the borough council.—Mr. P. Dodd, M.INST.C.E., borough engineer:—

Tooting Bec-road—J. Mowlem & Co., Limited (5 per cent above schedule prices)	£17,685
Putney Bridge-road—W. Griffiths & Co., Limited (6 per cent above schedule prices)	8,837
Cedars-road—W. Griffiths & Co., Limited (6 per cent above schedule prices for extras and omissions)	1,479

WANDSWORTH.—For making up and paving part of Tooting Bec gardens, Streatham, for the borough council.—Mr. P. Dodd, M.INST.C.E., borough engineer:—
J. Mowlem & Co., £1,340, and 5 per cent above schedule prices for extras or omissions.

WHITLEY.—For the erection of a retaining wall, for the urban district council.—Mr. A. J. Rousell, surveyor:—

M. D. Young, Whitley Bay	£405
W. Beautyman, North Shields	335
Davidson & Miller, Newcastle	300
H. Millar, Whitley Bay	231
G. Armstrong, Whitley Bay	208
W. Weir, Howdon-on-Tyne	204
C. S. Bunch, Newcastle	190
R. Fisher, North Shields	178

WINDLESHAM.—For laying a 24-in. concrete tube culvert, inspection chamber, and branch drains, for the urban district council. Mr. Edwin T. Close, clerk, Bagshot:—

24-IN. CULVERT, &C.

Turner & Kersley, Blackwater	£267
S. Kavanagh & Co., Surbiton-hill	261
A. J. Catley, Lloyd's square, W.C.	201
Hardy & Co., Woking	195
G. A. Franks, Guildford and Sunningdale	194

SUPPLY AND LAYING BELL PENNANT KERBING.

A. J. Catley, Lloyd's square, W.C.	£88
S. Kavanagh & Co., Surbiton-hill, S.W.	84
Turner & Kersley, Blackwater	70
G. A. Franks, Guildford and Sunningdale	70
Hardy & Co., Woking	70
Gamble Wood, Brompton-square, S.W.	68
E. Free & Sons, Maidenhead	58
C. E. Free & Co., Bristol*	56

MEETINGS.

Secretaries and others will oblige by sending early notice of dates of forthcoming meetings.

JUNE.

21. Roads Improvement Association Conference. Royal Automobile Club, Pall Mall. 3 p.m.
25. Institution of Municipal Engineers. Mr. H. C. H. Shenton on "The Relations of the Engineer and the Municipal Engineer," 4 Southampton-row, W.C. 7.45 p.m.
23-28. International Road Congress in London.

JULY.

5.—Institution of Municipal and County Engineers: Meeting at Leek.
7-12.—Royal Sanitary Institute: Annual Congress and Exhibition at Exeter.
16-19.—Institution of Municipal and County Engineers: Annual Meeting at Great Yarmouth.

APPOINTMENTS OPEN.

Official and similar advertisements received up to 4.30 p.m. on Thursdays will be inserted in the following day's issue, *but these responsible for their despatch are recommended to arrange that they shall reach* THE SURVEYOR *office by noon on* **Wednesdays** *to ensure their inclusion in the weekly list of summaries. Such advertisements may, in cases of emergency only, be telephoned (No. 1359 Holborn), subject to later confirmation by letter.*

CITY OF WORCESTER.
ENGINEER'S DEPARTMENT.

The Corporation are about to appoint an Assistant in the City Engineer's Department, at a commencing salary of £130 per annum.

A List of the duties and other particulars can be obtained from the office of the undersigned.

Applications, in Candidate's own handwriting, stating experience, age, &c., and accompanied by copies of not more than three recent testimonials, must be delivered at the office of the undersigned not later than 10 a.m. on Monday, the 7th July next.

T. CAINK, ASSOC.M.INST.C.E.,
City Engineer.

Guildhall, Worcester.
June 17, 1913. (554)

BOROUGH OF HAMPSTEAD.
DRAUGHTSMAN IN BOROUGH ENGINEER'S DEPARTMENT.

The Council of this Borough invite applications for the appointment of a Draughtsman and Junior Assistant in the Borough Engineer's Department. Commencing salary £80 per annum.

Applications from persons, who must be competent to survey and level, and who must be neat and expeditious draughtsmen, to be made in their own handwriting, stating age and previous experience, accompanied by copies of not more than three testimonials of recent date, to be sent to the undersigned not later than Monday, 30th June, 1913.

Canvassing will disqualify.

(By order)
ARTHUR P. JOHNSON,
Town Clerk.

Town Hall, Haverstock-hill, N.W.
June 18, 1913. (561)

COUNTY BOROUGH OF HUDDERSFIELD.

The Education Committee require the services of a competent Temporary Architectural Assistant to act as Clerk of Works for New Schools. The engagement will be for about 12 months, subject to satisfactory service.

Candidates must be capable of preparing, under supervision, detail drawings, measuring up and taking off quantities.

Preference will be given to applicants with previous experience in school buildings.

Salary £3 3s. per week.

Applications, in candidate's own handwriting, stating age and giving full particulars of experience, accompanied by three testimonials of recent date, to be sent to me not later than 10 a.m. on Wednesday, the 25th June, 1913.

Canvassing strictly prohibited.

K. F. CAMPBELL, M.INST.C.E., M.I.E.E.,
Borough Engineer.

1 Peel-street,
Huddersfield.
June 17, 1913. (558)

COUNTY BOROUGH OF ST. HELENS.

The St. Helens Corporation invite applications for the position of Engineering Assistant in their Borough Engineer and Surveyor's Department, at a salary of £2 per week.

Preference will be given to candidates with municipal experience in the design, construction and supervision of engineering works.

The person appointed must, if required, become a contributing member to the No. 2 Superannuation Fund.

Applications, stating age and previous experience, and accompanied by not more than three recent testimonials, must be sent to Mr. Arthur W. Bradley, M.INST.C.E., the Borough Engineer and Surveyor, at the Town Hall, not later than the 5th July next.

Canvassing will be a disqualification.

W. H. ANDREW,
Town Clerk.

Town Hall, St. Helens.
June 17, 1913. (559)

CITY OF BIRMINGHAM.
APPOINTMENT OF CLERK.

The Public Works Committee are prepared to receive applications for the appointment of a Clerk (Male) in the Road Surveyor's Office. Applicants (whose age should be about 20) must be good Shorthand Writers and Typists, and have had experience in correspondence and general office work. Salary will be according to scale, commencing at £60 at 20 years of age and rising to £110 at 25. The candidate appointed will be required to devote the whole of his time to the Service of the Corporation. Applications, in Candidate's own handwriting, stating age, experience, and present employment and salary, and accompanied by copies of not more than three recent testimonials, to be sent to the undersigned not later than Saturday, 28th June. Canvassing, either directly or indirectly, will be a disqualification.

HENRY E. STILGOE,
City Engineer and Surveyor.

Council House,
Birmingham.
June 13, 1913. (545)

COUNTY BOROUGH OF STOKE-ON-TRENT.
BOROUGH SURVEYOR'S DEPARTMENT.

The Corporation invite applications for the appointment of a General Engineering and Surveying Assistant in the Borough Surveyor's Office, at a salary of £90, rising, in the discretion of the Council, to £120 per annum.

Applicants must be neat and expeditious Draughtsmen and accurate Surveyors and Levellers.

Preference will be given to candidates who have had experience in a Borough Surveyor's Office.

Applications, stating age and experience, accompanied by not more than three recent testimonials, and endorsed "General Assistant," must be sent to me not later than Monday, the 30th June, 1913.

Canvassing, directly or indirectly, will be a disqualification.

A. BURTON, ASSOC.M.INST.C.E., F.S.I.,
Borough Surveyor.

Town Hall,
Stoke-on-Trent.
Saturday, June 14, 1913. (546)

MUNICIPALITÉ D'ALEXANDRIE.
AVIS.

La Municipalité d'Alexandrie a l'honneur d'informer le Public qu'elle met au concours un poste de Surveillant Technique attaché au Service Sanitaire de la Classe de L.E. 16-20 avec un traitement initial de la classe.

Les candidats devront accompagner leur demande des pièces suivantes:—

(1°) Certificats d'aptitude technique justifiant les connaissances suivantes—

(*a*) Mathématiques élémentaires et préparation de plans et croquis.

(*b*) Connaissance générale des questions de drainage et d'assainissement.

(2°) Extrait de naissance. Le candidat doit avoir moins de 35 ans et jouir d'une bonne santé.

(3°) Certificat de bonne vie et mœurs.

(4°) Connaissance de la langue française ou anglaise.

Le candidat ne connaissant pas l'arabe, devra dans un délai d'un an de sa nomination, avoir un usage pratique de cette langue et subira alors un examen du quel dépendra son maintien définitif.

Les demandes d'admission au Concours seront adressées à Mr. le Directeur Général de la Municipalité d'Alexandrie jusqu'au 1er Octobre prochain.

Alexandrie, le 29 Avril, 1913.

LE DIRECTEUR GENERAL.
(515) (Signé) A. Granville.

[TRANSLATION.]

MUNICIPALITY OF ALEXANDRIA.
NOTICE.

The Municipality of Alexandria has the honour to inform the Public that it offers for competition a Technical Inspectorship attached to the Sanitary Department in the class [rated at] L.E. 16-20 with the commencing salary of that class.

Candidates must send in with their application the following documents:—

(1) Certificates of technical proficiency showing the following attainments—

(*a*) Elementary mathematics and the preparation of plans and sketches.

(*b*) General knowledge of drainage and sanitation questions.

(2) Certificate of birth. The candidate must be under 35 years of age, and in the enjoyment of good health.

(3) Certificate of good character and conduct.

(4) Knowledge of French or English language.

A candidate not knowing Arabic must, within a period of one year from his nomination, possess a practical command of that language, and will then have to pass an examination on which his definitive appointment will depend.

Applications for admission to the Competition are to be addressed to the Director-General of the Municipality of Alexandria up to the 1st of October next.

Alexandria, the 29th of April, 1913.

THE DIRECTOR-GENERAL.
(515) (Signed) A. Granville.

BOROUGH OF DORCHESTER.

The Corporation of Dorchester invite applications for the position of Temporary Assistant in the Borough Engineer's Office.

The person appointed must be a good Draughtsman and Surveyor, and have good knowledge in Building Construction, and possess practical knowledge of the work in a Municipal Engineer's Department.

He will be required to devote the whole of his time to the duties of the office.

Applications, stating age, experience and salary required, together with copies of three recent testimonials (which will not be returned), must be sent to the undersigned, not later than Monday, the 30th June next, endorsed "Assistant Engineer."

Canvassing prohibited.

A. G. SYMONDS,
Town Clerk.

11 South-street,
Dorchester. (548)

BOROUGH OF SOUTHEND-ON-SEA.
TEMPORARY ASSISTANTS IN ENGINEER'S AND BOROUGH SURVEYOR'S OFFICES WANTED.

Two Temporary Assistants required immediately in the Borough Engineer and Surveyor's Department, Southend-on-Sea. Must be good Draughtsmen and have general Municipal Drawing Office experience. Salary, 35s. per week. Applications, with copies of testimonials, and particulars of training, experience, age, &c., to be delivered at once to the Borough Engineer, Southend-on-Sea.

(By order)
E. J. ELFORD,
Borough Engineer.

June 16, 1913. (549)

The Surveyor

And Municipal and County Engineer.

Vol. XLIII. JUNE 27, 1913. No. 1,119.

Minutes of Proceedings.

Small Holdings and Housing.

The Departmental Committee appointed by the President of the Board of Agriculture in February last year "to enquire and report as to the nature and character of the buildings which should be provided for use in connection with small agricultural holdings in England and Wales" have issued a report which forms a very valuable contribution to the discussion of the rural housing question. Not only has a thorough investigation been made into the requirements of small holders, and of the possibilities of economy in making provision for those requirements, but a series of plans and specifications has also been prepared in the light of the information gathered by the Committee, and these are appended to the report. We are not so much concerned in this place with the general equipment of a small holding as with the particular problems touching the provision of the cottage—a matter to which a considerable part of the report is devoted. After pointing out that although practical suggestions for reducing the cost of building are offered, any attempt to cheapen construction at the cost of the ordinary requirements of health, decency and convenience is to be deprecated, the report proceeds to deal in detail with the planning and construction of the small holder's cottage, and to describe and explain the plans which are appended. While we are in general agreement with this part of the report, we would specially commend to our readers the soundness of the opinion expressed by the Committee that in deciding on the structural character of the dwelling-house, while the importance of economy in outlay must always be considered, the first cost should be the last cost, and both the style of the building and the character of the work should be such as to ensure the minimum expenditure in subsequent repairs and renewals. Economy should be sought, therefore, in careful planning and simplicity of arrangement and construction, and not in the undue cutting down of the quality of the materials, fittings, or workmanship.

The problem of economy in construction is rendered more difficult of solution owing to the fact that the prices of all classes of materials, as well as wages, have risen in recent years. The question must nevertheless be faced, and it should be borne in mind that, whatever effect fluctuations in prices may have upon the cost of building for the time being, the application of right principles and methods must always ensure a relative degree of economy. The practicability of erecting cottages for which the usual worker can afford to pay an economic rent is a matter which has been shown to depend upon the harshness or otherwise of the building by-laws in force in the district in which they are to be built. The complaints which used to be made of the unreasonable character of local by-laws have been met to a certain extent by the issue of the model series of by-laws for rural districts, but the fact remains that to-day—ten years after the publication of the rural code—a large number of rural district councils have failed to effect any revision of their old code which is more fitted to meet urban requirements. It is abundantly clear that some spur is needed to secure an adequate revision of the by-laws in these districts. The Local Government Board have no general power to enforce revision, and the recent circular which they issued calling attention to the desirability of replacing obsolete by-laws by a more up-to-date code has produced comparatively little result. The Committee therefore think—and with this view we entirely concur—that if a wider power of initiative were given to the Local Government Board with the view of enabling them, upon sufficient cause being shown, to secure the alteration of local by-laws, it would have good effect, and would stimulate local authorities whose by-laws are unsuitable or obsolete to take the necessary steps to get them revised.

It is further pointed out that the real difficulty in regard to by-laws can never be met so long as a single code has to operate throughout a district which, although technically "urban" or "rural," may in fact be partly built over and partly undeveloped. The remedy proposed in the report to meet this difficulty is that wherever a rural or semi-rural character of development could be assured, a code of by-laws corresponding roughly to the existing rural model should apply automatically. Most small holdings, naturally, would comply with this condition, while in the case of rural housing generally it could be secured by a definite restriction of the number of houses to the acre—for example, eight or ten. The advantage of this arrangement would be that matters of sanitation, such as the provision of a dampcourse and so forth, would continue to be subject to inspection by the local surveyor; but in rural areas forming parts of districts where urban by-laws are in force it would be possible for any owner erecting houses on small holdings, or building rural cottages, provided he agreed to limit the number to the acre, to exercise the right of building subject to a code of regulations enforcing only minimum requirements, the operation of the general by-laws of the district being automatically suspended. We have said enough to show the value of the report, which is worthy of the careful consideration of all who are interested, either officially or otherwise, in the important question of rural housing.

* * *

The International Road Congress.

Far from disclosing any intention on the part of the present Government to bring in fresh legislation in highway matters, the address of the Chancellor of the Exchequer in his capacity of chairman of the opening meeting of the Road Congress was absolutely non-committal and included no reference whatever to considerations which might be regarded as pointing in one direction or the other in the matter of highway administration. On the other hand, Sir George Gibb's address contained a very important expression, not of his personal views, but of his interpretation of the general trend of well-informed opinion with regard

to highway administration as a matter more or less of local importance and more or less of national importance. Sir George pointed out that if certain roads, such as, for instance, the more important main roads of the country, are to be the subject of grants in aid of maintenance, that would involve a certain amount of State control and State supervision, and we take it that he intended to convey the impression that such control and supervision must be distinguished from the general control and general supervision which in a greater or less degree must necessarily accompany a policy of grants in aid of maintenance or improvement. If there are persons who believe that it is more necessary to exercise careful supervision in the spending of money for maintenance than it is in the case of expenditure on improvements, it may be suggested that they should reconsider this opinion. It is surely more reasonable that the State should insist upon skilled supervision being given to works which, however paid for, are in fact carried out by expenditure of capital, than that they should exercise such control and supervision in the case of expenditure on maintenance. In the one case the effect is at the most more or less accumulative, in the other case it is permanent.

As regards the carrying out of the highway duties of the local authorities, Sir George Gibb made two important suggestions or recommendations. He said that areas too small to provide adequate finance or sufficient engineering supervision might be absorbed in larger areas. He also said that it was generally recognised that modern roadwork must be in charge of thoroughly trained and skilful engineers with adequate staffs and sufficient pay. Now one of these matters can only be settled by the Government, and improvement in this direction is therefore a matter of legislation, except in so far as the present law provides for combinations of local authorities for the purpose of carrying out highway duties. The employment of properly trained and suitably paid engineers, assisted by technical and accounting staffs, is, on the other hand, a matter which rests with the local authorities themselves; and it is quite clear that if the proper development of the highway system of this country depends upon the adoption of such a policy by the local authorities, and the local authorities fail in this duty, the balance of opinion is likely to tilt in the direction of more State supervision and control of highways. To some extent, then, the general policy indicated by Sir George Gibb as on the whole that which is favoured in this country, cannot be maintained and developed without the assistance, on the one hand of the public and Parliament, and, on the other hand, of the local authorities themselves.

* * *

Congress "Questions" and "Communications."

The organisation of the Road Congress has necessarily involved a great amount of labour, close attention to a host of details, and the exercise of much forethought. The amount of time and energy which honorary workers have been able to devote to this work has necessarily been limited, in view of their other important engagements, and it is therefore only fitting that special recognition should be given to the excellent work performed by the whole-time staff, the steady preparations for the final "rush" having done much to promote the successful carrying out of a large and varied programme. The organising council are to be congratulated upon the splendid series of entertainments which have been provided for the members of the congress, and the well-considered arrangements for the official and unofficial gatherings, and in this respect the congress is, we consider, at the time of going to press, proving to be most successful.

As regards the meetings of sections and the subjects chosen for the presentation of reports and for discussion, it is difficult to take quite so optimistic a view. The amount of the subject-matter in the form of reports is far too great to be adequately considered by those taking part in the meetings, and the amount of such matter, in the reports and involved in the subjects included in the "Questions" and "Communications," is too much, by a very great deal, to be suitably discussed. It seems to have been overlooked that the programme as it appears in the agenda-paper must be multiplied several times if we are to grasp the significance of the word "discuss" in this connection; for, not to mention the participation in the discussion of delegates from other countries, the proceedings are conducted in three official languages—French, German and English. The result sometimes is, as in the case of the extraordinary discussion on the lighting of roads and vehicles—to which we shall have occasion to refer again—that the meeting becomes the scene of a kind of scramble to get certain opinions recorded as those of the congress with the minimum of discussion. In other cases, members whose opinions on certain subjects might, it would be supposed, have been regarded as specially valuable in view of their experience and qualifications have been unable to attend the meetings for the discussion of those subjects since the council has asked for their services in connection with other subjects. Another matter of some importance is the distinction made between subjects classed as "Questions" and those classed as "Communications," to be discussed "if time permits." No doubt the latter are, on the whole, of less importance, but not in every case. The great bulk of the roads of the world are provided with water-bound crusts, the subject of a "Communication." The qualifications of engineers and surveyors and of their staffs is a subject also regarded as of minor importance. Wood paving, on the other hand, which presents fewer variations and fewer difficulties in its use than almost any other type of paving, is the subject of a "Question," as is the matter of one detail of bridge design, the kind of surfacing to be adopted on bridges and roadways; and the services of two of the most experienced members of the congress have been engaged in the reporting of these two subjects.

There is, of course, enough matter in the smallest of the subjects chosen for discussion to make it worthy of careful debate for a period much exceeding that which can be allotted to it at a congress; but in regard to the limitations of time and of speed in discussion it is a pity to load up the congress with so enormous an amount of material, much of which is only of secondary importance. It detracts very seriously from the value of the conclusions to which the congress finds itself finally committed. On the other side of the question it may, of course, be urged that the opportunity of collecting a great mass of useful data and opinions must not be lost, and that something very solid in the nature of permanent records is desirable in view of the large aggregate of time devoted to the congress by the individuals composing it; but we do not think that this consideration should altogether outweigh the advantages of the concentration of the energies of the members upon a moderate number of definite points of leading importance.

* * *

Municipal Electrical Association Convention.

The annual convention of the Incorporated Municipal Electrical Association, held in London, ended on Saturday last after a very successful week. There was a very good attendance, and the meetings and excursions were exceptionally interesting, though the papers submitted for discussion were few and on the whole below the average in merit. The opening address was written by the late president, Mr. C. E. C. Shawfield, who has recently retired from the post of chief electrical engineer to the Corporation of Wolverhampton in order to take up commercial work, and has thus become ineligible to act as president. Mr. J. E. Edgcome, a past-president of the Association, was appointed by the council to fill the office *pro tem.*, and, thanks to his genial pre-

sence and ready eloquence, a better chairman could not be desired. In the course of a few preliminary remarks, Mr. Edgcome made a timely protest against the practice of some municipalities of specifying an age limit for candidates when advertising vacant appointments. Obviously experience and age go hand in hand, and it is no less obvious that a council can always exercise their discretion with regard to age when making the final selection from the candidates interviewed.

Mr. Shawfield in his address referred to the illogical disability imposed upon municipal supply authorities, who, though invested by Parliament with obligatory powers to supply electricity, are in most cases forbidden to supply the necessary apparatus for its utilisation. Some municipalities have obtained full powers by means of private Acts, so that the principle has received the sanction of Parliament; but in this respect our rulers are inconsistent, for they often withhold the powers sought for. The Association are again promoting a Bill which, among other useful provisions, will confer wiring and hiring powers upon all local authorities supplying electricity; but, owing to the late introduction of the Bill and the opposition of the electrical contractors, it is highly improbable that the Bill will get through this session. Another point upon which Mr. Shawfield laid emphasis was what he regards as "the vicious practice of rate relief from the profits of electricity undertakings, a view with which we have many times expressed our agreement. Electricity supply nowadays is on a par with water supply and drainage—it is necessary to the welfare of the community, especially in industrial areas—and therefore it should be given at the lowest possible price and not regarded as a source of revenue. Surplus profits should first be applied to the establishment of an adequate reserve for renewals and the replacement of plant, which so rapidly grows obsolete in these days of constant improvement in design; any further surplus should be used for the repayment of loans and reduction of the price to consumers.

The annual report of the council showed that the association was in a satisfactory financial position, and that much useful work had been accomplished during the year. A feature of the convention, though not strictly part of the official proceedings, was an open meeting of the "Point Fives," a society of (at present) fifteen members, all chief engineers, whose qualification for membership is the adoption of a tariff of 0·5d. per unit for purposes other than lighting. This society was only formed last July, but has already done good work in popularising the use of electricity for heating and cooking.

* * *

Reservoir Storage.

The difficulties which have to be faced by the water engineer in coming to any satisfactory conclusion as to the proper size of a large storage reservoir are very great. Questions connected with rainfall, evaporation, percolation, run-off, and geology at once arise. Neither is the problem completely solved after accurate gaugings of the stream supplying the reservoir have been made during a prolonged period. The great need for a hydrological survey of this country has been frequently urged, notably by the Royal Commission on Canals. The Commissioners found their work much impeded by the lack of information as to the flow of streams, and it is generally supposed that the work must wait until the long-talked-of Central Authority and Rivers Board capable of dealing with the water-supply question as a whole come into existence. But the water engineer is not only faced with lack of information as to stream flow; with the exception of certain empirical formula such as Hawksley's he is left to his own resources in calculating the capacity of a storage reservoir. The question has yet to be dealt with scientifically, and any effort to bring new light on to this very difficult and important subject is therefore welcome.

At the recent meeting of the Institution of Water Engineers the question of reservoir storage in relation to stream flow was dealt with in a paper by Mr. William J. E. Binnie and Dr. Herbert Lapworth, who in a well-considered argument based upon a number of exact records certainly carried the knowledge of the engineer a step further. The paper in the first place shows the necessity of obtaining actual gaugings of any particular stream before any sound estimate can be made of the reservoir storage required to impound it. Actual gaugings of streams show that they differ widely as to the yield per acre of their drainage area, and also with regard to their minimum dry-weather flow, which bears no relation to the rainfall, a fact which is too obvious to need further comment. This extreme dry-weather flow is an essential factor in determining the capacity of a reservoir for the reason that the object of the reservoir is to store some of the wet-weather flow so as to be able to supply throughout the year a quantity of water in excess of the minimum stream flow. By an ingenious calculation and logical reasoning the authors show that the required reservoir storage must vary as the square of the difference between the required yield and the extreme dry-weather flow. There appears to be no flaw in this reasoning, and the conclusion is of considerable value. The authors, working on data obtained from the Derwent Valley, Redmires, Thames, Sudbury, Croton, and Severn, found that the quantity supplied and the minimum dry-weather flow were clearly connected in each case, and that the storage capacity of the reservoir was proportional to the square of the difference divided by the mean run-off. From this they have developed an empirical formula which is given tentatively but which may be of great use. Whether it will be found to be merely a temporary expedient or applicable to all cases is deserving of the careful attention of water engineers. With further data upon which to work it will be possible to prove the accuracy and applicability of the formula and to improve or modify it. The authors have at least provided a stepping-stone which will be of considerable assistance, and have directed attention to the method of solving one of the most important problems of engineering. They and the Institution of Water Engineers are to be congratulated upon the useful results of the investigations recorded.

* * *

The L.C.C. and Reinforced Concrete.

The process of bringing into force a code of regulations with respect to the construction of buildings wholly or partly of reinforced concrete appears to be rather a lengthy one, but it is satisfactory to be able to record the completion of another stage. It will be remembered that by the London County Council (General Powers) Act, 1909, that authority were empowered to make regulations subject to the approval of the Local Government Board. A code was duly drawn up, and now after prolonged negotiations with the board a revised draft has been prepared and was submitted to the council at their meeting on Tuesday last. The alterations which have been made in the original draft are somewhat numerous, but, as the Building Acts Committee point out in their report, they consist chiefly of changes in form only, though in some instances they render the regulations somewhat more onerous than those originally adopted by the council. Any increase in the standard of stability may evoke criticism, but as the use of reinforced concrete in building work is a modern development, it is no doubt expedient to accept the modifications made by the board so that the regulations may speedily come into force and ensure safety in the employment of this method of construction. If during the next few years experience shows that the regulations may with advantage be made less onerous there would appear to be no difficulty in modifying them. It is to be hoped that the remaining formalities may be got through without any unnecessary delay, and that the regulations will come into operation as soon as possible.

Tar-Spraying and Tar-Macadam in Situ.

By THOMAS AITKEN, M.INST.C.E., County Surveyor, Cupar Fife, Scotland.

(Conclusion.)

[The following are some observations on the results obtained from actual experience in the use of high pressure tar-spraying machines in surface treating macadamised roads and in making tar-macadam "in situ," with some remarks on kindred matters. This paper was prepared by Mr. Aitken with a view to its being submitted to the International Roads Congress, but unfortunately time did not permit of its completion early enough for its inclusion with the other communications.]

Making tar-macadam *in situ* may be carried out by hand labour or by high-pressure spraying machines. The great difficulty when the work is performed by hand grouting arises from the fact that it is practically impossible to obtain uniform results, in addition to its being a comparatively expensive method of procedure. Another factor in the case is, when using a highly bituminous binder in a very hot state, the material will not flow to the bottom of metalling spread to the usual depth, with the result that voids are left at the lower part of the coating, making very unsatisfactory work. Owing to this difficulty in carrying out the work, the method of double pitch grouting has been adopted to try if possible to overcome this inherent difficulty of working by antiquated methods of application which necessarily increases the initial cost of the operations.

The use of tar-mixing machines and tar-boilers on the roads, especially when the latter are narrow, causes great inconvenience to traffic; the process, however, is appreciated in certain quarters.

In using high-pressure spraying machines for making tar-macadam *in situ* the following operations are usually adopted: The road, previous to coating with metal in the usual way, is repaired in a superficial manner to make the surface fairly uniform, and approaching the contour which the new surface is intended to have when finished. All extraneous soft binding matter should be removed so as to present a clean, hard surface. When the moisture has dried out the surface, after sweeping, is sprayed with bituminous tar or other tar-compo, and ½-in. to ¾-in. whin or similar chippings applied so as to waterproof the old surface, and form a key on which the new crust is to be formed.

GAUGE OF METALLING.

The metalling, preferably 1½-in. to 2-in. gauge, free from extraneous matter, is then spread to the desired depth—3 in. to 4 in. generally—and when a stretch of 30 yds. to 50 yds. has been carried out, and without being rolled, the "tar-spraying machine," with the atomising nozzles placed at an angle, commences at outside and works in 6-ft. to 7-ft. breadths until the surface is all sprayed. The machine is then reversed, and the spraying is carried out in an opposite direction. This effectually covers all the road stone surfaces, especially in the lower parts, as, being left in a loose state, the great pressure used in forcing the binder into the body of the metal coating covers all with a film of tar. When this has been carried out, ½-in. to ¾-in. chippings are sprinkled over the surface and lightly rolled. The chippings work gradually down into the metal coating, practically filling, along with the binder, all the voids. Should any depressions appear, these are made good before the spraying machine again travels over the portion first treated and gives two other applications of binder. Chippings are applied, and further rolling finishes the work, and, if necessary, more chippings are sprinkled over the surface. This generally completes the operation, but if a very smooth asphaltic-like surface is desired an extra coating of binder may be applied. In all 1·25 to 1·50 gallons per square yard are sprayed, depending on the depth of the metal coating, and description of the road stone used.

Considering the principle on which this tar-sprayer works, a constant high pressure is maintained; consequently a uniform application of binder is attained, and in sufficient quantity to serve the purpose as a binder, and not to fill large open voids and form, in a measure, the actual road itself. A reduced number of turns of the machine may suffice in applying the above quantity of binder, or the quantity may be varied by simply altering the outlet levers, and so increase the volume of the atomised material per square yard at each turn.

Foundations of roads can be treated with this tar-sprayer, especially when the material composing these is of 3-in. to 4-in. cubes, the joints being filled up with large-gauge chippings.

One half of the road is generally carried out at a time, but if the road can be wholly given over to the operations on hand, much more satisfactory work is attainable and considerable time saved, which tends to promote economy in initial cost.

The writer finds from experience over Scotland generally that when tar-macadam *in situ* is carried out as described the results are uniformly good with few exceptions, which will be explained later on.

In carrying out this class of work, especially in the earlier stages, some curious results have been experienced, in so far that even when using the same road material and binder on a stretch of road of an apparently uniform nature certain small portions or patches became very unsatisfactory at varying periods after construction. These defects evidently pointed to bad subsoil drainage, but, as it turned out, it was invariably due to this combined with the presence of clay which apparently had not been specially treated when the road was originally made.

It has been the writer's practice when making new roads to separate any portion or even pockets or patches of clay from the road proper by laying a bed of hard engine ashes or clinkers, and, in some cases, gritty sand.

It is well known what bad effects a clay subsoil improperly drained and not specially treated has in the maintenance of an ordinary macadam road. It is doubly so with tar-macadam, as when the surface breaks up, even in isolated spots, the advent of rain permits of percolation, and the moisture spreading on top of clay with no possible means of escape except upwards by evaporation increases the area of the patches originally affected, and spreading practically ruins the whole surface.

The few exceptions mentioned previously were brought about by this cause. Roads which are to be made of tar-macadam, no matter by what process, should be carefully examined by making trial pits, and the nature of the subsoil recorded as a guide in carrying out the subsequent operations, so that uniform and satisfactory results may be attained. The most satisfactory work is obtainable when the formation is of sand or gravel, as the subsoil drainage under such conditions is practically perfect and cannot be improved upon.

NATURE OF ROAD STONE.

The character of the road stone is a factor in making tar-macadam. The writer, after many years' experience in using most kinds of igneous rocks, considers that the material which has a rough or coarse grain when broken into road metal gives the best results. This roughness gives a keying power and holds, along with the binder, the whole coating firmly together. It is a significant fact that less binder may be used and that less rolling is necessary, or, in other words, more work can be accomplished in the same time by using such materials.

Basalts, dolerites and gabbro generally, if the constituent minerals are in a fresh condition, prove satisfactory materials for tar-macadam, and along with these certain granites. Andesites, on the other hand, having a dense, fine-grained texture, and with other similar descriptions of stone, are not so good, and generally require a greater amount of binder to obtain good results. Further, should rolling operations be commenced immediately after the spraying is finished, the individual stones slide one upon another, and it is difficult to keep the road in proper section. Under these circumstances it is better to leave the tarred section for some time to permit of the binder partially setting before rolling is commenced. The writer has observed roads apparently left in good order become somewhat uneven during very hot weather, and this, undoubtedly, has been brought about by using too

much binder. In some cases this has, along with the use of road stones of the andesite family, prevented sufficient frictional resistance to maintain the road in a stable condition.

The density of a tar-macadam road is of value up to a certain point, and if the material composing it is of a hard, resisting nature, good results may follow.

In this connection it may be stated that for county roads, in contrast to city carriageways, the binder applied is acknowledged as such, whereas in suburban and city roads it practically becomes, combined with sand or other small material, the wearing surface. The cost of forming such a paving is prohibitive so far as county work is concerned unless under very exceptional circumstances.

The proportion of aggregate and matrix therefore forms an interesting factor in construction, initial cost and future maintenance entering largely into the matter. The voids in a coating of 1½-in. to 2-in. metal spread loose amount to practically 46 per cent, and when consolidated the total volume will be reduced, including, say, 10 per cent of chippings and the binder itself, to a density or solidity of from 86 to 90 per cent, the difference being taken up by air spaces.

It is the writer's opinion that if the proportions of aggregate and matrix are properly adjusted according to location and traffic conditions the tar-macadam crust should, providing all other circumstances are favourable, form a roadway capable of being looked upon as a foundation, and the actual wearing surface may be renewed from time to time by the application of a bituminous material of recognised quality, such as Trinidad asphalt. Therefore, according to traffic conditions, the road crust never need be renewed. It is understood this is possible providing the foundations do not give way, and that the subsoil drainage is kept in perfect working order—a matter, however, which requires constant examination and careful supervision.

SPECIFIC GRAVITY OF ROAD STONES.

In comparing the cost of tar-macadam in different centres the fact that the specific gravity of the stone is seldom mentioned when the amount of binder is stated at so much per ton of material applied is very misleading. This point should be very carefully kept in view when figuring out detailed particulars, as the following instances will show. In the county under the writer's jurisdiction the specific gravity of road stones varies from 2·49 to 2·99, the former being a felsite and the latter an ophitic dolerite. The respective covering power per ton of these two materials varies considerably, as in the former 1 cub. yd.= 20·61 cwt.; therefore, 1 ton will only cover 7·37 sq. yds. As the covering power of 1 cub. yd. of metalling at any given depth is the same under any circumstances, it follows that, in the case of a stone having a lighter specific gravity, the amount of binder per square yard would be, for a coating 4 in. in depth, 1·26 gallons, and in the case of the heavier stone 1·50 gallons per square yard—quite a significant difference when large areas are under consideration. In addition to the specific gravity being given, it is also desirable to state the amount of binder used per square yard for a given depth of metalling when spread loose, or if consolidated the gauge of the material used in the coating, as consolidation varies to an appreciable extent in coatings composed of different gauges of stones. Statements as to cost would then have some comparative value, and this would save considerable trouble in investigating work carried out in various centres throughout the country.

The price of making tar-macadam, apart from the cost of metal, spreading and rolling by the pneumatic tar-sprayer, varies somewhat in different localities according to the gauge of metalling used, the quantity available for spreading and consolidation each day, and the distance from which the bituminous binder is conveyed. Tank wagons are employed for railway transit, and these are provided with numerous steam heating coils for liquefying the material sufficiently to enable it being pumped into the tanks of tar-spraying machines. This arrangement saves time, and therefore economy is promoted in so far that the machine is at actual work spraying a longer proportion of time compared with the time occupied in loading. When the binder is in easy pumping condition the tar-sprayer tank of 800 gallons capacity can be filled in from twenty minutes to half an hour.

The price of the binder per gallon varies from 4d. to 6d. for ordinary county work, and to 1s. for the heavier and more highly classed compositions. At the former price the cost, allowing 1·25 gallons per square yard, including heating, haulage and application, runs about 9d. per square yard for a 3½-in. metal coating, consolidated to 3 in. The inclusive price, where the metalling and chippings cost 5s. per ton, is approximately 17·75d. per square yard. Where the metalling is more expensive, say 7s. per ton delivered, the inclusive cost runs approximately to 24·23d. per square yard. These prices are for about 60 tons per day, but when 100 to 120 tons can be provided the price per square yard for the binder and application is considerably less. In good weather and under favourable conditions Aitken's patent pneumatic tar-sprayer can treat without difficulty 100 tons of metal per day, and at the same time haul the necessary binder to the work from a railway depot within reasonable distance.

The cost per square yard at 1s. per gallon for the binder, under the conditions above mentioned, exclusive of metalling, would be from 1s. 8d. to 2s. per square yard; the heating of the more highly asphaltic compositions requiring longer time to liquefy for the proper application of these to the metal coating.

Tar-macadam carried out with ordinary bituminous tar and such-like compositions requires the wearing surface renewed every two to four years, according to the amount of traffic and the nature of the metalling employed when carrying out the work. In such operations coarse-grained stones will proportionately require to be treated every two to four years compared to one and two years when fine-grained stones are used.

The method of renewing such surfaces is very easily accomplished. First of all, should there be any serious depressions, these must be repaired by applying a suitable oil and filling in the pothole with a small quantity of bituminous tar, and level up with ¾-in. chippings. When these patches have set properly the whole surface must be thoroughly swept and then sprayed with a good coat of suitable binder, ½-in. to ¾-in. clean chippings being spread over the whole area treated and then rolled. A more effective method of performing this operation, especially if the weather is not very hot, is to spray a small quantity of oil on the surface and allow it time to soften or revivify the old binder material, and then apply a good coating of the bituminous or other suitable composition, apply the chippings and roll solid. These operations, as already mentioned, require to be carried out periodically, and by so doing the original tar-macadam road is effectively renewed for traffic at a comparatively cheap rate compared with reconstructing the whole road crust should it be allowed to get so far out of condition that such measures become necessary. Tar-macadam carried out as described in the preceding pages presents a smooth, uniform surface, which is waterproof and slightly resilient, very important factors in modern road construction.

EXPERIMENTAL WORK AT SIDCUP.

With a view to test the various road binders in general use on an admittedly heavily trafficked road the Imperial Road Board (Great Britain and Ireland), in conjunction with the Kent County Council, instituted trials at Sidcup in 1911. Reasons are given in the pamphlet issued in 1911 why the trials should take place there, heavy traffic being a leading factor in the selection. The scheme framed was intended to secure for all invited competitors equal conditions under normal service conditions.

It may be observed that the subsoil varies from flint gravel to clay. No indication is given on the plan issued if the portions of the road situated on the clay subsoil were treated to separate the roadway proper from the subsoil, and it may be assumed that no such protective work was carried out then or even previously. Under such circumstances one would naturally suppose that there will be weak spots in some of these trial sections, which must adversely affect even the best materials used as the binding agent.

Another matter calls for attention—namely, the volume of traffic, which in the First Edition of Pamphlet is stated to be 14·7 tons per yard of width per hour on an average. The width of this road, however, varies from 18 ft. to 26 ft., and in this respect many sections will be withstanding a much greater traffic weight than the average given, while other sections will be carrying considerably less. The actual weight borne by the portions of the road with a width of 18 ft. is approximately 18·66 tons, and on the 26-ft. section 12·93 tons per yard width per hour, a difference sufficiently great to account for very variable results in the amount of wear in a given period on one section compared with another.

The actual wear by measurement of the various trial sections gives a vague idea of the real facts of the case.

It is surprising how a rigid pavement such as "Durax" should have worn down by ¼in. in twelve months compared with some tar-macadam sections with the amount of wear against them of practically nil. The method adopted in measuring the wear appears quite satisfactory providing the recording apparatus was properly calibrated.

The reason may be found, so far as "Durax" is concerned, in the nature of the subsoil existing at the particular points where these measurements were taken. On the other hand the wear recorded on many of the tar-macadam sections was measured before and after these portions had been re-surface sprayed and chipped or generally repaired as a "renewal coating." This may have been absolutely necessary in many cases on account of the abnormal wear on some sections, so as to keep the road crust in proper repair, but, on the other hand, the small amount of wear, comparatively speaking, on these sections affords a fitting comment on the judicious measures adopted by some of the contracting parties in view of the testing which would take place per Road Board's Specification shortly after the renovation of the surface was carried out. No doubt the periodical measurements of these trial sections would show some peculiar diversities in regard to wear, and if these particulars were furnished a better knowledge of the wearing quality of the various materials used would be available, which would be of some actual service.

A visit to Sidcup clearly indicates that many inferior descriptions of material have been admitted considering the abnormal density of traffic and other circumstances. Probably some of these which have failed at Sidcup would be quite suitable at other centres, the cost being considered, and this brings one to the conclusion that what is wanted are trials on ordinary county roads with an average volume of traffic of from, approximately, 2 to 6 and 6 to 10 tons per yard width per hour. The writer has, on many occasions, expressed the opinion that compositions or binders of varying degrees of quality should be adopted or otherwise standardised to suit different classes of traffic, climatic and atmospheric conditions.

It is quite apparent similar trial sections to those carried out at Sidcup must be instituted in various parts of the country where the weather conditions are somewhat different than in the county of Kent. The changeable nature of the weather in Scotland, while the traffic density is much less than on the Sidcup road, makes it necessary to meet this, and also the severe and sometimes prolonged duration of frosts experienced. These are all factors to be considered in determining the proper description of binder to use, and which can be supplied at a reasonable price.

The situation of the road at Sidcup is very variable in regard to being brought under the beneficial influence of the sun and drying winds. The sections best situated in this respect are 1 to 6 and 15 to 16, and, in a lesser degree, 6 to 11 and 17. From 17 on to 23 the conditions are not at all favourable in a comparative sense, 22 and 23 being decidedly the worst in this respect, buildings being on either side, with only the footpaths intervening. On many portions of this road kerbing exists on one or either side, which is a distinct advantage, and assists in the retaining of tar-macadam in its position, preventing lateral displacement, more especially if the camber is pronounced. The latter condition is a weakness in tar-macadam construction, and can only be avoided by having good resisting shoulders and a diminished contour compared with ordinary macadam.

In these trials there are a few sections which may be expected to come through successfully, and certainly there are two of these sections which, from their present appearance, appeal to one as being the most suitable paving in regard to withstanding the volume of traffic on this road successfully.

The question, however, arises, Can such expensive binders be employed generally? For certain city and suburban roads, no doubt, these are admirable, but for county roads in general, carrying withal a considerable volume of traffic, a less expensive and, at the same time efficient, roadway can be constructed to satisfy the financial position of most county councils.

No doubt proprietary binders, in many instances, have given splendid results when the conditions were favourable and the quality of the binder delivered was of uniform consistency.

The pavement now laid on the Thames Embankment may be said to satisfy all necessary requirements of general traffic—No. 23 at Sidcup—and some of those at Fulham are samples of practically city roadways carried out with the same material. The Trinidad paving on the Thames Embankment has proved to be extremely good, and the only one which has withstood the heavy vehicular traffic on this thoroughfare successfully.

Mr. Marriot, who pioneered this method of construction in Scotland many years ago, is to be congratulated in his signal success on the Thames Embankment and at Fulham, &c.

The writer has seen many excellent roads in the United States made with a bituminous binder, and of these States the following may be mentioned: New York, Maryland and Massachusetts. The writer's inspection, though limited, showed that the roads in Maryland were being carried out on good principles, and the bituminous work was of a high order. Various methods seemed to be adopted in Massachusetts, with varying results and not a few failures. It is a significant fact that in a new country such as the U.S.A., in so far as road construction is concerned, the road engineers there are in a favourable position to make excellent roads if proper principles are adopted, as these are being made from the foundation compared with practically only resurfacing the roads in Great Britain and Ireland and in Continental countries.

Note.—In regard to these patent pneumatic (gold medal) spraying machines, it is considered necessary to put on record the following facts. In the year 1892 the writer commenced experimenting with tar on roads, and in 1895 made an experimental machine for spraying to supersede the slow manual process of carrying out the work. This machine had the air and tar in one contained tank, but when working the diminishing pressure between start and finish did not satisfy practical requirements. Further experiments were carried out, and a patent was applied for in 1904, the main feature in which, apart from forcing the tar into the voids of the road material, was an intermediate air receiver which entirely eliminated the previous defects. In its present form the machine applies tar or bitumen in a uniform manner and at a constant pressure throughout a day's work when surface spraying or making tar-macadam *in situ*—all important matters in present-day road construction. To be explicit, it may be mentioned what a tar-spraying machine really is, and so avoid much confusion. It is a machine using high-pressure (150-250 lb. per square inch) in forcing the tar or the viscous liquids in a highly diffused or atomised state into the crust of a road, and on to and around the stones comprising a 4-in. coat of metalling in forming tar-macadam *in situ*, and without unduly heating the binder to be applied.

Since the writer's patent tar-sprayer was introduced many imitations have naturally followed, which have been produced by the commercial man who saw business ahead, but had no technical knowledge of actual requirements. Consequently many impractical and crude machines are on the market, and, generally speaking, these will serve only for a season or two, and are for the most part an expensive investment.

London Tramways and Motor-Omnibus Competition.—The Highways Committee of the London County Council, in their annual report on the working of the tramways, record a falling off in the gross traffic receipts compared with the previous year. They point out that the council has seriously to reckon, in its efforts to maintain the tramway undertaking on a sound financial basis, with the great increase in the motor-omnibus competition.

Decimal Acreage Tables.—We have received the following communications with reference to the note on p. 956 of last week's issue inviting readers to suggest a suitable book of decimal acreage tables as used by surveyors, giving details from 1 to 1,000 acres, and reducing acres, roods, poles, &c., into acres and decimals of acres: "Winzar's 'Instanter Decimal Tables,' published by Messrs. Simpkin, Marshall, Hamilton, Kent & Co., Limited, at 1s. 6d. nett, contain a table of roods and perches in decimals of an acre. I think this table will be what your querist requires."—Wm. J. Kay, assistant surveyor, Ulverston. "'Ready Reckoner for Land,' by Arman & Norris—Weale's Rudimentary Series, would be a very useful book for the correspondent desiring acreage tables. The price is only 2s."—J. W. Thomas, Gwyrfai Council Offices, Carnarvon. We are greatly obliged to our correspondents for their kind assistance in the matter.

Institution of Water Engineers.

SUMMER GENERAL MEETING AT WAKEFIELD.—(3.)

On the second day of the recent summer meeting of the Institution of Water Engineers at Wakefield the following paper came up for discussion:—

RESERVOIR STORAGE IN RELATION TO STREAM FLOW.

By WILLIAM J. E. BINNIE, B.A.(CANTAB), F.G.S., M.INST.C.E., and HERBERT LAPWORTH, D.SC., M.INST.C.E., F.G.S.

The question of the amount of reservoir storage required to equalise the fluctuations in the run-off from any drainage area is one that has not received the attention it deserves. This has been very largely due to the fact that in arriving at an estimate of the required storage capacity, gaugings of the actual stream to be impounded are seldom available, and engineers have generally had no alternative but to estimate, or guess, the run-off from the average rainfall as measured by rain gauges. The authors have

DR. H. LAPWORTH, M.INST.C.E., F.G.S.

[From Photo by Maull & Fox, London, W.

[Dr. Lapworth was a pupil of the late Mr. James Mansergh, F.R.S., past-president of the Institution of Civil Engineers, was assistant resident engineer on the Pen-y-Gareg Dam and Aqueduct of the Birmingham Water Supply (Welsh Scheme), from 1894-9, and resident engineer on the Upper Neuadd Dam, Merthyr Tydfil Waterworks, under the late Mr. G. F. Deacon, M.INST.C.E., from 1899-1901. From 1901-10 he was assistant engineer on the Derwent Valley Water Scheme, under Mr. Edward Saudeman, M.INST.C.E., past-president of the Institution of Water Engineers, being engaged on surveys and designs, and ultimately as resident engineer on the Bamford Filters and Aqueduct. He has been engaged in private practice at Westminster as consulting engineer since 1910. He quickly realised in his early days on public works the profound importance of practical geology in relation to engineering construction, and has more or less specialised in this subject. Dr. Lapworth acted as geological adviser to the Derwent Valley Water Board during the construction of the works, carrying out extensive geological investigations in connection with the trenches of the Derwent and Howden dams, the opening out of quarries, and so forth. A contributor to engineering and geological literature, he is a "Telford" and "James Forrest" medallist of the Institution of Civil Engineers, the recipient of the "Murchison" award of the Geological Society and the "President's Premium" of the Institution of Water Engineers. He is a member of the council of the Geological Society, and an occasional examiner to the Institution of Civil Engineers and the Institution of Municipal Engineers. In addition to his private practice he is Lecturer in "Engineering Geology" at the Imperial College of Science and Technology.]

brought forward this paper in order to show the necessity of obtaining actual gaugings of the particular stream to be impounded before any really sound estimate of reservoir storage can be made.

The Hawksley Formula.—The first engineer who appears to have attempted to arrive at a solution of the problem was the late Mr. Thomas Hawksley, who devised the following empirical formula:—

$$N_3 = \sqrt[3]{\frac{1000}{R_3}}$$

where N_3 represents the number of days' storage and R_3 the mean annual rainfall of the three driest consecutive years. There is no doubt that, empirical though it may appear to be, this formula holds very well for many drainage areas, and has been of immense service to waterworks engineers. The formula assumes that the entire average flow of the stream during the three driest consecutive years is to be abstracted. A little consideration will show, however, that when only a portion of the average flow during that period is required the number of days' storage of the required supply must be less than when the full yield for the three-dry-year period is utilised; for, to take an extreme case, if the amount to be abstracted for supply were only equal to the extreme dry-weather flow of the stream, no storage would be required. The formula does not, therefore, help very much in those cases where it is intended only to abstract a portion of the mean flow during the three driest consecutive years, and it also takes no account of the losses due to evaporation, which we shall show must have considerable influence upon the amount of storage.

The Middleton Formula.—Another formula devised by Mr. R. E. Middleton is—

$$N_3 = \sqrt[3]{\frac{500}{r_3}}$$

In this case r_3 is the average annual run-off during the three driest consecutive years. This formula takes the evaporation into account, and is therefore more rational than the older rule.

The Deacon Diagram.—The most important addition to our knowledge of this subject was published by the late Dr. G. F. Deacon in his article on "Water Supply" in the "Encyclopædia Britannica." It is to be regretted that this valuable contribution is so little known to water engineers; probably it is because they would hardly be likely to refer to an encyclopædia for fresh light on this particular subject.

Dr. Deacon took the actual measured run-off from a particular drainage area during the year of most unfavourable distribution of flow, and plotted the figures so as to form a cumulative diagram, from which the necessary storage capacity of the reservoir was determined in the usual manner for any desired supply. This diagram was then extended so as to cover from two up to six consecutive dry years on the assumption that the extremely unfavourable distribution of annual rainfall was repeated in each year, taking into account, however, that whereas the mean rainfall of the driest year would be only 63 per cent of the average rainfall, the mean of the two consecutive driest years would be 75 per cent of the average, and therefore the second year in the series would have a rainfall of 87 per cent of the average. The actual gaugings taken in the one dry year were therefore proportionately increased for the second year, and by a similar method a cumulative diagram extending over three, four, five and six consecutive dry years was worked out. The results obtained in this manner are plotted on a diagram which gives curves showing the yield of the reservoir in relation to its storage capacity for any mean annual rainfall between 30 in. and 100 in., and also the number of consecutive dry years which that reservoir would equalise.

It is not clear from Dr. Deacon's article how the storage has been arrived at for drainage areas on which the mean annual rainfall differed from that contributing to the stream which was actually gauged, but the authors believe that the figures actually ascertained for this particular stream were increased or decreased in the same proportion as the annual rainfall. As far as the authors are aware, this was the first attempt to solve the problem so completely as to show the necessary storage for any proportion of the average run-off. The weakness in this diagram is, the authors believe, the assumption that results arrived at from the gauging of one particular stream could be made applicable to all cases. The assumption also that the annual distribution of rainfall would be similar in consecutive years and for wide variations of annual rainfall can hardly be correct, and there is little doubt that the amount of storage obtained by using this diagram would be in excess of what is actually required in many cases.

THEORETICAL CONSIDERATIONS.

Actual gaugings of various streams show that they differ widely from one another, not only with refer-

ence to the yield per acre of drainage area (which will depend, of course, on the rainfall and evaporation), but also with regard to the extreme dry-weather flow. This extreme dry-weather flow bears no relation to the rainfall, and may be very much lower on streams having a high rainfall than on streams with a low rainfall. Now, a little consideration will show that an essential factor in determining the necessary storage capacity of a reservoir is the extreme dry-weather flow.

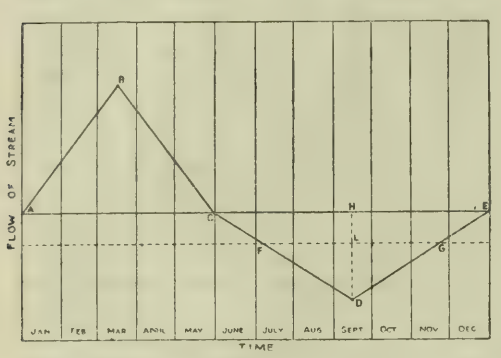


Fig. 1.

Assume that the average flow of any stream in any one year is represented by a horizontal line A E (see Fig. 1), and that the seasonal variations in the flow are such that they may be represented by two triangles A B C and C D E, one above and one below this line, on a diagram whose length represents one year, and on which variations in stream flow and water abstracted for supply are represented by vertical ordinates. Since A E is the average flow, the area of the triangle A B C is equal to that of the triangle C D E, the apex B of the triangle A B C representing the maximum flow, and the apex D of the triangle C D E representing the extreme dry-weather flow. Draw a horizontal line F G to represent the desired abstraction from the stream. Then the necessary storage to give the supply represented by the distance of the horizontal line F G from the base of the triangle would be represented by the triangle—

$$F D G = \frac{F G \times L D}{2} \quad \ldots \quad (1)$$

and $$F G = \frac{C E \times L D}{H D}$$

Substituting for F G in equation (1) the expression for the necessary storage becomes—

$$\frac{C E \times L D^2}{2 H D}$$

L D represents the difference between the required yield and the extreme dry-weather flow, and $\frac{C E}{2 H D}$ is a constant for this particular stream in this particular year.

The required reservoir storage should therefore vary as the square of the difference between the required yield and the extreme dry-weather flow. This we find to be approximately true in the examples given later.

DATA USED IN INVESTIGATIONS.

The data used in the following investigations are shown in seven tables at the end of the paper. Two of these—namely, the Derwent Valley and Talla storages—may be open to criticism, hence the methods by which the tables are prepared are given in each case. The other tables were calculated from actual gaugings over the driest periods of the last thirty years. The authors are of the opinion, however, that the percentage of error where estimates were made cannot be large. Time has not allowed them to deal with other examples than those shown in the tables, but these represent the most important and accurate of the river-gaugings yet published in this country and the United States of America. They cover a range extending from a previous watershed with a rainfall of less than 30 in. and a run-off of only 10 in., to an impervious watershed with a rainfall of over 60 in. and a run-off of 55 in. The result of the investigation shows that, so far as the data given are concerned, there is a definite relation between the storage required, the mean run-off, and the extreme dry-weather flow.

*The Derwent Valley.**—The records extend over a period of seven years from 1906 to 1912 inclusive. Both the rain and river gauging were carried out with great accuracy. The average rainfall was estimated by comparing the rainfall of the seven years with that of Redmires, an adjoining watershed in which rain-gauging has been carried on for a period of thirty years, and by proportion for the longer period. From this a deduction of the average annual loss in the Derwent watershed gave the average annual run-off. In calculating the storages a cumulative diagram was prepared for the two driest consecutive years (1887-8), of the last thirty years, the average distribution of stream flow being taken as typical of each year. The total run-off was estimated as above by comparison with the Redmires rainfall records. The extreme dry-weather flow occurring in September, 1911, was adopted as the minimum.

Redmires.†—The records given in the paper referred to extend over twenty-nine years, both the rainfall and the run-off being measured. A table in the paper gives the monthly flows during the driest year of this period—namely, 1887, from which the table of storages was prepared for the smaller volumes, and in the larger storages by a method similar to that described for the Derwent Valley. The minimum dry-weather flow may be a little high. The rainfall records may not be accurate, for the authors understand that only one rain gauge was used during the greater part of the period in question.

River Thames.‡—In calculating the storages here, the actual gaugings during the years 1889 and 1890, when the river fell to its lowest, were used. The records published in the pamphlet extend over the nine years 1883-1891. The average rainfall was estimated by comparisons with Dr. H. R. Mill's records (1881-1911),§ and the average run-off estimated by deducting the average annual loss. The minimum dry-weather flow was calculated from the least of the monthly flows in the period.

River Talla.||—The records in the paper extend over the seven-year period—1906-1912 inclusive. By comparison with Dr. Robert H. Mill's records for Scotland (1881-1911) the average annual rainfall was estimated, and from this the average run-off. The storages were calculated by the same method as that used in the Derwent Valley for the two dryest consecutive years, 1887-8. The extreme dry-weather flow occurring in June, 1911, was adopted as the minimum, but it is probably high. The rainfall records are probably too low.

River Severn.¶—The records mentioned extend over the ten-year period 1880-90. The storages were calculated from the actual gaugings in 1887-8, when the run-off was at a minimum. The average rainfall was estimated by comparison with Dr. H. R. Mill's records (1881-1911), and the average run-off by deducting from this the average annual loss. The minimum dry-weather flow adopted occurred on July 31, 1885.

River Sudbury, U.S.A.‡‡—The records extend over the twenty-three-year period 1875-97. The necessary storages were calculated and published by Mr. FitzGerald in 1892,** and Table No. 6 is merely a transposition of his figures. The dry-weather flow is taken from another paper by the same author, read in 1886 before the American Society of Civil Engineers.

River Croton.††—The records extend over the thirty-two-year period 1868-1899. The storages were calculated from the gaugings of the three driest years—1880-1-2. The minimum dry-weather flow occurred in September, 1881, when the total monthly flow was ·05 in.

ANALYSIS OF DATA.

The symbols used are:—

R = mean rainfall in inches per annum.
r = mean run-off in inches per annum.
d = minimum dry-weather flow in inches per annum.
n = number of inches per annum drawn for supply from the river.

* "Measurement of the Flow of the River Derwent, Derbyshire," by E. Sandeman, M.Inst.C.E., read at the Institution of Civil Engineers, April 1, 1913. (Published in advance-proof.)

† "Notes on the Sheffield Water Supply," by L. S. M Marsh, "Minutes of Proceedings," Institution of Civil Engineers. Vol. clxxxi. 1909-10.

‡ "The flow of the Thames." Sir A. R. Binnie, 1892.

§ "British Rainfall." Dr. H. R. Mill, 1911.

|| "The Yield of Various Catchment Areas in Scotland," by W. C. Read, Assoc.M.Inst.C.E., read at the Institution of Civil Engineers, April 1, 1913. (Published in advance-proof.)

¶ Private records in the possession of Sir Alex Binnie, Son & Deacon.

‡‡ Reports of the Boston Water Board and of the Metropolitan Water Board (Boston). Monthly data relating to the Sudbury, Cochituate, and Mystic.

** FitzGerald. "Rainfall, Flow of Streams, and Storage." "Transactions," American Society of Civil Engineers. 1892.

†† Report on New York's Water Supply. John R. Freeman, 1890.

s = inches of storage required to supply n inches per annum constantly from the river.

(For values of constants converting inches to gallons see Table 8 at end of paper.)

the rainfall, the storage and the factor $(n-d)$, the last two factors and the run-off were clearly connected.

After several trials the various values of term $\frac{(n-d)}{r}$

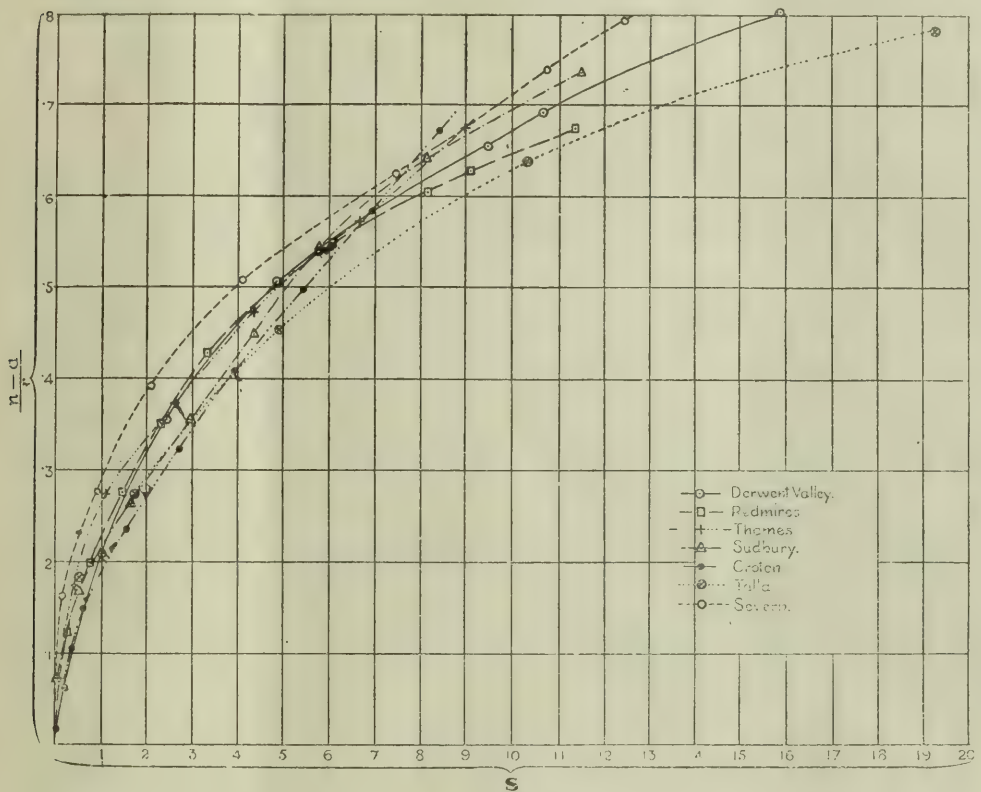


FIG. 2.
(Plate 1.)

It was obvious at the outset that, as no storage was required for an amount less than the dry-weather flow, the excess only of the supply above the dry-weather flow—*i.e.*, $(n-d)$ was the correct factor to be considered in relation to the storage. It was found that, while there was a rough relationship between

were plotted to the corresponding value of s as base, as in Fig. 2 (Plate 1). From this it appeared that s was proportional to $\frac{(n-d)^2}{r}$. An inspection of this diagram, however, showed that the figures for the streams with high run-off lay to the right, and those

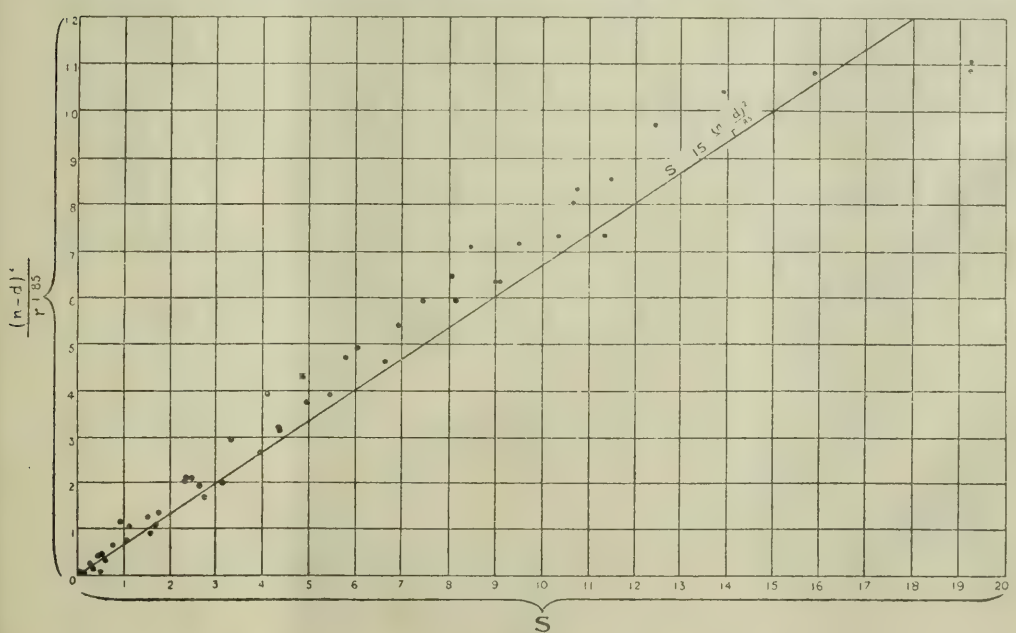


FIG. 3.

with low run-off to the left. In other words, some small correction for the value of r was required. Eventually the term $\frac{(n-d)^2}{r^{1\cdot85}}$ appeared to give the best result. The values of this term are shown in Tables Nos. 1 to 7, and are plotted in relation to s in Fig. 3. From this diagram the authors venture to suggest the formula—

$$s = 15\frac{(n-d)^2}{r^{1\cdot85}} \quad \ldots \quad (1)$$

as an approximate rule in determining the amount of storage for reservoirs up to, say, three-quarters of the total yield. The line representing the formula is shown in Fig. 3. The average value of the coefficient is more nearly 13½ or 14, but the line touching the extreme values shown has been considered safer. Whether one is justified with the present data in adopting the refinement of a somewhat lower index to the value of r is somewhat doubtful. For practical purposes the formula—

$$s = a\left(\frac{n-d}{r}\right)^2 \quad \ldots \quad (2)$$

is simpler, and gives results identical with (1) with the following values of a:—

< .... Range of Data. ....>										
r..	6·8	9·4	13	17	23	30	39	50	64	81	102
a.	20	21	22	23	24	25	26	27	28	29	30

It should be added, however, that the formula is only put forward tentatively, as a temporary expedient of an empirical nature. Whether it will be applicable to all cases, and especially to those outside the limits of the observations, remains to be seen. But it seems fairly clear that there is a definite relation between the average run-off, the supply or draft, and the extreme dry-weather flow, and with further and more accurate research it is probable that the true laws connecting these factors will be ultimately determined. The supreme importance of the subject leads us to emphasise what has been so frequently urged—namely, the necessity of establishing in this country a Government Hydrological Survey.

Table No. 1.

River Derwent Valley.

Mean rainfall ... ... R = 45·51 inches per annum.
Mean run-off ... ... r = 33·67 ,, ,,
Minimum dry-weather flow d = 3·00 ,, ,,

n Supply in inches per annum.	s Storage required in inches.	$\frac{(n-d)^2}{r^{1\cdot85}}$
10	1·01	·073
15	2·45	·214
20	4·83	·429
25	9·50	·719
26·23	10·62	·801
30	15·86	1·08

Table No. 2.

Redmires Watershed.

Mean rainfall ... ... R = 40·42 inches per annum.
Mean run-off ... ... r = 26·18 ,, ,,
Minimum dry-weather flow d = 2·8 ,, ,,

n Supply in inches per annum.	s Storage required in inches.	$\frac{(n-d)^2}{r^{1\cdot85}}$
6	·27	·024
8	·77	·064
10	1·47	·123
12	2·30	·201
14	3·34	·297
17·2	6·03	·491
18·6	8·15	·591
19·2	9·10	·637
20·4	11·35	·734

Table No. 3.

River Thames.

Mean rainfall ... ... R = 25·68 inches per annum.
Mean run-off ... ... r = 10·00 ,, ,,
Minimum dry-weather flow d = 2·28 ,, ,,

n Supply in inches per annum.	s Storage required in inches.	$\frac{(n-d)^2}{r^{1\cdot85}}$
3	·08	·007
4	·42	·042
5	1·10	·104
6	2·62	·194
7	4·38	·314
8	6·85	·461
9	9·00	·635

Table No. 4.

River Talla.

Mean rainfall .. .. R = 61 inches per annum.
Mean run-off ... ... r = 55 ,, ,,
Minimum dry-weather flow d = 5·0 ,, ,,

n Supply in inches per annum.	s Storage required in inches.	$\frac{(n-d)^2}{r^{1\cdot85}}$
15	·50	·096
20	1·75	·135
30	4·92	·375
40	10·34	·733
48	19·27	1·107

Table No. 5.

River Severn, Worcester.

Mean rainfall .. .. R = 37·10 inches per annum.
Mean run-off ... ... r = 17·33 ,, ,,
Minimum dry-weather flow d = 3·20 ,, ,,

n Supply in inches per annum.	s Storage required in inches.	$\frac{(n-d)^2}{r^{1\cdot85}}$
6	0·15	·040
8	0·92	·117
10	2·09	·235
12	4·09	·393
14	7·42	·593
16	10·75	·832
17	12·42	·968

Table No. 6.

River Sudbury (U.S.A.).

Mean rainfall .. .. R = 45·77 inches per annum.
Mean run-off ... ... r = 22·22 ,, ,,
Minimum dry-weather flow d = 0·49 ,, ,,

n Supply in inches per annum.	s Storage required in inches.	$\frac{(n-d)^2}{r^{1\cdot85}}$
2·1	0·018	·008
4·2	0·506	·044
6·3	1·64	·108
8·4	2·95	·201
10·5	4·36	·321
12·6	5·79	·471
14·7	8·05	·648
16·8	11·26	·854
16·9	13·22	1·088

Table No. 7.

Croton River (U.S.A.).

Mean rainfall .. .. R = 48 inches per annum.
Mean run-off ... ... r = 23 ,, ,,
Minimum dry-weather flow d = 0·6 ,, ,,

n Supply in inches per annum.	s Storage required in inches.	$\frac{(n-d)^2}{r^{1\cdot85}}$
1	0·033	·0005
2	0·21	·006
3	0·38	·017
4	0·60	·035
6	1·58	·088
8	2·75	·165
10	3·97	·265
12	5·43	·391
14	6·94	·540
16	8·43	·714

Table No. 8.

Miscellaneous Constants.

$$\text{Inches per annum} = \frac{\text{gallons per day per 1,000 acres}}{61{,}940}$$

$$= \frac{\text{gallons per day per square mile}}{39{,}640}$$

= Cusecs. per 1,000 acres × 8·69.

Storage required in gallons = Storage required in inches × area of gathering ground in acres × 22,610.

ADDENDA.

As a matter of mathematical interest, the data show that the index of the term $(n\text{-}d)$ alters constantly with change in the term $(n\text{-}d)$ itself, and that the relation between the storage and the supply is logarithmic. The accumulation of more data, extending in each river over more than one dry period, will probably show that the expression

$$S = e^{\frac{A\,(n\text{-}d)}{r} - \frac{B}{(n\text{-}d)}}$$

approaches a rational form, which should be applicable to extreme cases in which the average flow is very large or very

small, and in which the whole of the flow is utilised; or in simpler form

$$\log_{10} S = \frac{a\,(n-d)}{r} - \frac{b}{(n-d)}$$

The limited data show that an equation of this type more closely fits the records than any other, b being equal to 1, and a having an average value of about 1·55; or to write a general expression

$$\log_{10} S = 1{\cdot}55 - \frac{(n-d)}{r} - \frac{1}{(n-d)}$$

DISCUSSION OF MESSRS. BINNIE'S AND LAPWORTH'S PAPER.

Mr. C. P. HOGG (Glasgow), in opening the discussion, said he thought the authors were to be congratulated on having presented to the institution a paper on a subject which was of great interest to all engineers engaged in the construction of storage works, and a paper that was not without interest to those corporations and authorities which had to pay for those works. The authors had entirely disarmed criticism by presenting their formula as a temporary expedient and as of an empirical nature. He would not venture to criticise the paper without a much fuller and closer study of it than he had as yet been able to give it. There were, however, one or two observations he would like to make. With regard to the Hawksley formula, those who worked in Scotland did not regard it with any great favour, as they did not think it applicable to the conditions which obtained in that part of the kingdom. He would like to ask the authors a question upon the formula which they put forward. They stated that the required reservoir storage should vary as the square of the difference between the required yield and the extreme dry-weather flow, and they arrived at the expression $\left(\frac{nd}{r}\right)$. Afterwards they suggested a small correction for the value of the r, and they then proceeded to make that modification. It appeared to him (Mr. Hogg) that they had made a very considerable modification, and which did not quite agree with the words before. He would like to ask the authors whether that really was so. He thoroughly agreed with the authors that gaugings of the particular stream to be impounded were of the first importance, and, having ascertained those gaugings, he did not see why the authors did not follow them up by a proper cumulative diagram. He would have expected them to have laid greater stress upon the cumulative diagram than they had done. He quite understood why they seemed to criticise somewhat the method in which Dr. Deacon explained his diagram, but he (Mr. Hogg) would lay much greater stress upon the cumulative diagram than the authors had done.

Mr. C. H. ROBERTS (Aberdeen) said he thought with the previous speaker that water engineers were under an obligation to the authors for putting forward this formula. He was not sure whether he was right, but he believed this was the first formula to take into account the minimum flow of a stream, and also to take into account the supply required. As the authors properly remarked, those two factors were vitally important, for it appeared to him that without a due consideration of those two factors it was impossible to design the size of a reservoir correctly. He knew it was not the fault of the authors, but it was rather unfortunate that they did not seem to be very confident of the data on which they had based the formula. Thus, referring to the Redmires records, they said: "The minimum dry-weather flow may be a little high; and the rainfall records may not be accurate." The same sort of remark seemed to be running through their comments on all the records, with the exception of those from the United States. Two of the records—the Thames and the Severn—appeared to be taken from the flows of lowland rivers; the other records he believed referred to more upland streams, and he would like to ask the authors where the gaugings were taken from the Thames and the Severn. He presumed that the gaugings of the Thames were taken from the Thames Conservancy records. If that was so, the flow was of considerably sized rivers. As far as one could judge from the works, any excess of the minimum flows did not appear to have been taken into account in designing the size of reservoirs in a good many cases. The result of not taking into account the minimum flow, more especially where the minimum flows were high, and not taking into account the amount of water required for supply, had no doubt been that reservoirs had been constructed much larger than they were actually required. In the past, however, he did not think that had been a serious matter, because the population of the British Isles had increased at a very rapid rate, and therefore the demand had risen very rapidly, but in the last Census returns they were faced with the fact that the population was ceasing to increase. Certainly that was so in Scotland, and it behoved one to keep that fact in mind—that reservoirs should not be constructed larger than they would be required. He gathered from the paper that the authors did not suggest that their formula would do away with complete gaugings, nor did he gather that they suggested that the formula should take the place of the cumulative diagram. He presumed the use of such a formula—and there it would be very useful—would be to check the sizes already ascertained by constructing a cumulative diagram. In estimating new works it was not possible to obtain gaugings—in fact, there was very rarely the time to do so; but in estimating the costs of new works he thought it was possible to measure the minimum flows of a stream in the summer by inquiry in the neighbourhood among residents, and it was possible to obtain some more or less accurate information of the minimum flow, and to use the formula put forward by the authors it would be necessary to estimate in some way the average flow of a particular drainage area. The way the average flow would have to be obtained in a case of that sort would be to take the rainfall as at present and abstract an amount for losses. That would give an estimate of the average flow through the watershed, and the estimate of the minimum flow would be based on the gaugings. Of course, when the construction of the reservoir came to be commenced, there should have been time to take complete gaugings of the drainage area, and then a cumulative diagram should be properly drawn out and the reservoir constructed from the cumulative diagram alone. He noticed that Mr. Binnie, in reading the paper, referred in parentheses to the question as to whether Mr. Hawksley was the author of the original formula, and also as to whether Mr. Middleton was the author of the second formula, and in the paper they referred to the diagram given in the "Encyclopædia Britannica" as though the late Dr. Deacon was the originator of it. The authors might have information to that effect—he (Mr. Roberts) did not know whether it was so or not—but he did know that the secretary of the Institution of Civil Engineers in 1891 communicated to the Liverpool Engineering Society his method of obtaining the size of a reservoir, and his method was by a diagram exactly the same as given ten years afterwards by Dr. Deacon in the "Encyclopædia Britannica." Dr. Tudsbery, also, when he made a communication to the Civil Engineers Society, submitted a document which was almost the same as that given in the "Encyclopædia Britannica." It had been a common practice to take the rainfall from the flow over the three driest years. He thought the authors had made very clear the importance of not taking the three driest years as an arbitrary figure. They had drawn attention to the fact that if the supply was a small one compared with the run-off of a drainage area, the three driest years did not come in. That was shown very clearly on plotting out the cumulative diagram—in other words, if the amount required for the supply was less than the minimum flow during the driest year, of course, it was quite unnecessary to go into the question of the three driest years. He had used for a case where the supply had been less than the minimum flow in the driest year a simple flow diagram with a horizontal line showing the supply throughout the year, and the usual flow line of the stream throughout the year. The area bounded by the line of supply and the line of flow gave practically the capacity required of the reservoir in that particular case, when the supply was less than the flow in the minimum year. He had got a sketch of the diagram which was applied to a tropical stream, and which might be of interest to the members. In such a case, when the whole supply from the drainage area was not required, the problem was a simple one.

Prof. A. H. JAMESON (London) said he did not think there was any objection to be found with the authors for the way in which they had produced their formula. The method adopted by the authors was quite a common one in hydraulics. After all, the old adage that the proof of the pudding was in the eating was very true, and the authors got very nearly the same curve in seven widely different

watersheds. There was nothing irregular in what the authors had done—as he had said, it was a common practice in hydraulics. The formula was never intended to replace the cumulative diagram. The cumulative diagram required a number of years to produce, whereas in the formula given all one had to do was to take the gaugings of the minimum dry-weather flow in a particular year, apply a factor of safety for a still drier year which they might expect, and then make the estimation which they would have to make as to what the mean run-off would be, and what proportion it would bear to rainfall. The use of the formula was to clear their mind, and to simplify and render more accurate the estimation which they were making of the size of the reservoir. While the works were being constructed, he took it that a cumulative diagram would be prepared, and a more exact result obtained from actual gaugings. As to the data being uncertain, he would suggest that the authors did not mean that they were doubtful as to the result, but only that they wished to explain why they did not get one absolute curve for all the seven different watersheds. They got seven different curves very nearly the same, but not quite. There might be many different gaugings of different streams, but the law would remain constant.

Mr. Charles H. Priestley (Cardiff) congratulated the authors upon the valuable paper they had contributed, but he said he was not in a position to criticise any of the points dealt with. One thing that struck him which they might deduce from the paper was that there were a great many drainage areas in the country which were being wasted as against some, such as they saw the previous day, which were being utilised to their fullest extent. Generally speaking, in works of this kind he did not think they found that the best was made of the drainage areas. He assumed that the authors were assuming that the best use would be made in every case of the drainage area under consideration, and from that point of view he thought it would be very desirable indeed if they had what had been mentioned time after time at their meetings—some central authority which should see that the various drainage areas in the country were utilised to their fullest extent before small portions were allowed to be used and the rest practically wasted.

Mr. Edward Sandeman (London) remarked that, as he had come in late, he had not heard what previous speakers had said, and therefore if he repeated anything he hoped they would forgive him. He welcomed the paper as one of the first attempts to deal with the question of reservoir storage on scientific lines. The formula that had been referred to as one made by Mr. Thomas Hawksley took no notice of the dry-weather flow variation. That was a most important point. Many years ago, in dealing with a watershed which had a very high flow, he found it was quite useless to make a storage in accordance with that formula—in fact, in a dry-weather flow of, say, 1½ cub. ft. per season per 1,000 acres, he should think half the storage would be sufficient—that was to say, if the Hawksley formula required 160 days' storage possibly not more than 80 days would be required in a case of that kind. The reason was perfectly obvious, and it was, of course, that the dry-weather flow was quite a constant factor and required no storage. In arguing this question he had often given an experience of this kind: If they had a watershed which yielded, say, 50,000,000 gallons per day regularly, winter and summer, no storage would be required; but if it yielded 49,000,000 gallons in the summer and 51,000,000 gallons in the winter then they would require only a very small storage; and so, if they agreed on that proportion they would find as the dry-weather flow diminished so did the storage increase. The Hawksley formula was applicable only to storage required in a case where the whole flow of three dry years was to be taken, and the advantage of the new formula of the authors was that it was applicable to any proportion of the yield, from which they could find the storage requisite for any given number of inches taken from the watershed. The new formula was based upon results actually obtained from various watersheds during dry periods, and in regard to that two questions arose: First, with what accuracy were the results obtained? And, secondly, did the results extend over a sufficient number of years? With regard to the first question he was unable to say, and he did not suppose the authors would be able to answer that question very well; but with regard to the second, he thought it was very probable that, as the results were distributed over a greater number of years, it would be found that the formula would possibly require a little variation. The authors did not put forward the formula as final, but only in a tentative manner, until a larger number of gaugings and a greater number of years' records were available, when he presumed the formula would be considerably revised. He would like to suggest that they should err, if anything, on the side of providing a large storage by increasing their coefficient to some extent. The reason for that was very simple. In designing a reservoir the last foot put on the top of the dam meant a very great deal. It cost very little indeed, but it meant a great difference in the storage. It was really not worth while to cut down the last foot or two of the dam simply to make a very small saving. He congratulated the authors on having made a distinct advance in defining the relation between the storage required for the abstraction of a given proportion of the run-off of a watershed. Up till now they had been working somewhat in the dark, but this formula would be of very great assistance in the future. He presumed that in the table where the authors gave the storage required in inches, that meant that the storage required had been ascertained by actual results. He would be glad if the authors could clear up that point.

The President (Mr. C. Clemesha Smith) said he would like to congratulate the authors on having made an attempt, which apparently had been successful, in dealing with this question of a scientific formula with regard to the storage of water. It was quite impossible for him to criticise the formula, because he had had no opportunity of testing it, and he supposed the same remark applied to the bulk of those present. He thought it would be a very useful thing if as many of their members as possible would put the formula to the test, and either criticise or confirm it in the written discussion. Personally, he thought that a paper of this sort lent itself more to discussion in a written than in a verbal form, especially seeing it had only been before the members such a short time.

Dr. Lapworth, replying on the discussion, said he had to thank the members for their kindly reception of the paper, and considering that it showed rather a startling result, he thought they ought to be doubly grateful to the institution for the kind way in which they had received it. Mr. Hogg spoke about the modification of the figure in the formula. He (Dr. Lapworth) thought Mr. Hogg was under a slight misapprehension. The modification was really only one of r^{-} to $r^{1\cdot85}$ and not r to $r^{1\cdot85}$. As to why the cumulative diagram was not dealt with in detail, it was a point they had to consider when the paper was being written whether they should give an account of the cumulative diagram, but they thought it was familiar to waterworks engineers, and that they could take it for granted that that was the method generally used nowadays. Therefore they had merely mentioned it without going into a detailed description. Mr. Roberts spoke about the accuracy of the data. They had given an honest criticism, as far as they could, of the data on which their formula had been based, because, after all, he thought it was only fair when there was anything new of this kind to be presented that they should give the absolute facts on which their deductions were based, and for that reason they had given an absolutely honest criticism of the various gaugings. They had not criticised the United States records, but he had not the least doubt that they were quite as incorrect probably as the others, and probably more in fact. He might go as far as this: He believed that Mr. Freeman, from whose report they quoted, stated that his Croton records were 10 per cent out. However, they had to take the best they could, and the answer they gave to the question of the accuracy of the gaugings was that, considering the remarkable way in which all the curves lay within a narrow zone, he thought it was extremely likely that if the gaugings were accurate the width of the band would become very much narrower, showing that the law was a true one. He thought there was very little doubt, judging from the charts, that there was a scientific law. The extraordinary thing was that the same results seemed to apply to a river like the Thames, which consisted largely of a chalk watershed, in which the water was soaked up, and not given by the stream for several months later, and impervious watersheds from which the water ran off practically at once. When they started those investigations they had no idea that they would be able to get such remarkable results from rivers differing so widely not only in their run-off, but also in their geological character. The Severn gaugings were measured at Worcester, the Thames records

were those of the Thames Conservancy. Of course, as Mr. Roberts said, the formula could not do away with gaugings. It was necessary for everybody to be measured for a pair of boots, and it was just the same with a watershed. What the formula could do away with was the cumulative diagram, at any rate in the preliminary stages of the work. It seemed to him that the formula would give them approximate results. If they had two years' gaugings and the minimum dry-weather flow, at any rate it did give them, without having to draw any cumulative diagram, the amount of storage required for different draughts of the stream. Of course, the average flow would have to be done by the two years' gaugings in connection with the rainfall. The watershed would have to be accurately gauged, and the rainfall would have to be accurately gauged, and by taking the average annual loss they would get the average annual flow pretty closely. The formula really dispensed with the cumulative diagram partly because it took into account the minimum flow and the average flow and partly because it really did express the seasonal fluctuations of the stream. The three driest consecutive years they had taken no notice of. He thought that rule had been a rigid rule that worked extremely well in the early stages of waterworks engineering. What it amounted to was that in the early days reservoirs were made too small. As time went on the capacity had to be increased until they got somewhere near the right sort of thing, and that was found in some reservoirs to be generally about the three driest consecutive years' flow; but it was by no means a rule that should be applied everywhere. Mr. Hawksley himself said it was not to be applied rigorously everywhere. It certainly applied in a great many cases, particularly in the North of England, but certainly not everywhere. The Americans, for instance, took no notice of the three driest years. In cases where there was a large watershed, and one was going to put down several reservoirs one after the other, the formula might be of some use. Another sphere in which it seemed to him it might be useful was that it might be worth while sometimes working out what was the most economical size to make their reservoir. As to the number of years over which the gaugings extended they were given in each case in the paper under the various headings; but he quite agreed that longer records might show a difference, and that was thrown out as a hint in the addendum to their paper. After all, the formula had only been derived from gaugings over the last thirty years. No doubt, if they had gaugings over centuries they would find that the storage would be different. They must, however, realise that it would be impossible to get accurate results even if they had the records of a century, and the gaugings which they had were quite enough for practical purposes. As to the modification of the formula, in time, of course, that was inevitable; nothing was permanent anywhere. They were as fully prepared to be massacred in another ten or twenty years' time as everybody must be who made the slightest step forward; their formula was only put forward as a means to an end. The storage given in the middle columns of the table at the end of the paper was measured from plotting the accumulated diagram of the river gauge. Taking the Redmires, the figures given as the storage actually required were measured from a cumulative diagram, plotting 1887 and 1888, two dry years, and measuring from that. The same applied to the Thames and the Severn and the Croton. That would be the storage required on those rivers to tide over the various amounts of drought during those dry periods. He would like to say in conclusion that it would be exceedingly interesting if there was a written criticism of the paper. He very much doubted whether the formula could be applied to all cases, particularly in small watersheds. They thought that in small watersheds it probably would not be found so applicable. In the cases given by them they were large watersheds. They would be very glad if those members who had actual gaugings of streams, particularly over small watersheds, would work them out. As to the co-efficient number 1 and 2, they had not taken the average of all the spots on the diagram, so that even if they worked out the tables and compared them with the formula they would not find them agree well; but they had taken what they considered the safe line. He wished to make it perfectly clear that with regard to the Hawksley formula their position was that they did not say definitely it was the formula of the late Mr. Thomas Hawksley, but that it was attributed to him.

(To be concluded.)

A STATE HIGHWAY IN CALIFORNIA.

AN ASPHALT CARPET ON A CONCRETE CRUST.

Reference was recently made in these pages to the planning of a system of State highways for California, and to the fact that work has already begun. One of the first of the State roads to be constructed is of unusual design, and the following particulars from the California Highway Bulletin, and published by our contemporary *Engineering and Contracting*, may be of interest to highway engineers who are watching developments in the design of crusts and surfaces for main roads.

The road bed is made 40 ft. wide, and consists of an old broken stone crust and a sand-clay mixture "resembling hardpan." After rolling it is sufficiently firm to allow of the new crust being made without the use of planking. The middle width of 24 ft. is provided with a concrete crust 5 in. thick, and a 1-in. asphalt carpet, and the shoulders, each 8 ft. wide, are made of earth containing gravel and material from the old crust. The camber of the middle portion is 4 in., or $\frac{1}{72}$ of the width, and the crossfall of the shoulders is $1\frac{1}{4}$ in. to the foot. The reason for the adoption of this steep slope of about 1 in 10 is probably not evident to British engineers, but the type of cross-section is not unusual in the United States. The concrete crust is laid between timber headers 6 in. by 2 in., which protect its edges while the shoulders are being consolidated by traffic, and make it possible to bring the concrete to a true and uniform surface. The concrete is a 1, 3, 6 mixture, somewhat wet, put into place by means of a swinging spout. It is given a rough finish by cross sweeping with a stiff "house broom or warehouse broom," and in dry weather is watered daily for about five days. When the concrete is dry, and is quite a week old, it is thoroughly swept and the "binder coat" is applied. This is a term used in the United States of a coat of adhesive material intended to glue down the wearing carpet to the strength crust. In this case it consists of one part by volume of molten asphaltic cement, and two parts by volume of "engine distillate." The former is heated in a "small portable kettle" (? a portable cauldron) to a temperature between 200 deg. (? 300 deg.) and 325 deg. A measured quantity is taken to the spreading pail, at a safe distance from the fire, and allowed to cool to about 250 deg. The distillate is then added and stirred for about one minute, the temperature falling to about 100 deg. The binder liquid is then poured on to the concrete, and spread with stiff house brooms until there is an even film, and no excess in holes or depressions in the concrete surface. A second sweeping after a few minutes helps in the attainment of this result, and in about one and a-half to two hours the surface should have a black, glossy appearance. Two men can mix and apply this coat on 12,000 sq. ft. (1,333 sq. yds.) in one day. An area of 100 sq. ft. required 0·856 gallons of engine distillate (0·713 British gallons), and $3\frac{1}{2}$ lb. of asphaltic cement. The cost was about 18 cents per 100 sq. ft., or about 0·8 penny per square yard. This coat was applied only sufficiently in advance of the asphalt carpet to allow of its becoming hard through the evaporation of the distillate.

The asphalt carpet consists of 1 in. of sheet asphalt, and it was found that when it was being put down it did not move or welt up in front of the roller, "as is noted when rolling asphalt on plain concrete." As a test, a few hundred feet of the concrete was left without the binder (or varnish) coat, but in spite of this "the surface remains in first-class condition after one month of heavy traffic," and it is believed that good results may be obtained without the use of the binder. But its cost is small, and it is expected that it will prolong the life of the pavement.

Clare's Bi-Tarco.—In regard to the notice given in last week's issue of the stand of Messrs. R. S. Clare & Co., Limited, Stanhope-street, Liverpool, at the Road Congress Exhibition, it should be made clear that the work which is being carried out by Messrs. Gregg & Sons in Ireland is improved tar-macadam prepared with Bi-Tarco. The Tarcolene hand-cleansing solution is an antiseptic preparation for the use of tar workers which the firm are bringing to the attention of visitors to the exhibition. The solution is claimed to remove tar, pitch and asphalt stains instantly without injury to the skin.

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THIRD INTERNATIONAL ROAD CONGRESS

CHANCELLOR'S INAUGURAL ADDRESS.

SIR GEORGE GIBB ON STATE MANAGEMENT AND ADEQUATE PAY FOR ENGINEERS.

WORK OF THE SECTIONS.

EXHIBITION OPENED.

Delegates from no fewer than thirty-nine Governments were present on Monday when Mr. Lloyd George opened the proceedings in connection with the Third International Road Congress

In the morning a meeting of the Permanent International Committee of the Congress was held at the Institution of Mechanical Engineers for the purpose of considering the report of the Executive Committee. The meeting was presided over by M. Preaudeau (France). After the report had been read, M. Albert Mahieu (France) suggested that the number of papers to be read at the present congress should be reduced from 140 to 100. The Chairman expressed his approval of the proposition. His Excellency V. E. de Timonoff (Russia) also agreed, and remarked that the number submitted was really too large for anybody to discuss in sufficient detail. On one point, however, he laid a great deal of stress—namely, that the subjects for the papers at the next congress should be settled at this congress. M. Mahieu pointed out that the proposal was against the regulations of the Permanent Commission, according to which papers had to be settled with the local organising council of the next congress. Dr. Lewald (Germany) next extended a cordial invitation on behalf of the German Government for the next congress to be held in Germany. It was suggested by one delegate that the time had come when, in connection with the International Road Congress, a committee should be formed to settle the standardising of road materials. M. Mahieu next reported that the International Road Congress had been invited by the Committee of the Panama Canal to hold the next congress at San Francisco in 1915. He suggested that the invitation should be declined for three reasons. Firstly, because Dr. Lewald at the last meeting informed them that an invitation from Germany would be forthcoming; secondly, because 1915 was a little too early; and thirdly, because the United States Government had not extended an official invitation. M. Mahieu, speaking of the financial position of the congress, remarked that there was a surplus of 108,000 francs. Congratulations were extended to Sir George Gibb on the organisation of the congress. A meeting of the Permanent Council to appoint the officers of the congress and of the sections followed.

Both the floor and the spacious galleries of the Central Hall, Westminster, where the opening sitting of the congress took place, were thronged, and those on the platform included Mrs. Lloyd George, Lord Montagu of Beaulieu, and Sir George Gibb, chairman of the Road Board. Behind the chairman's table sat representatives of foreign nations, one of the most conspicuous of these being a swarthy Eastern delegate, wearing a fez. At the outset a telegram was sent to the King conveying the loyal and respectful greetings of the congress to His Majesty, and thanks for the gracious invitation to visit Windsor Castle. His Majesty's reply, received later in the afternoon, expressed cordial wishes for the success of the congress and pleasure at the visit of the delegates to Windsor.

MR. LLOYD GEORGE'S SPEECH.

Mr. Lloyd George said: It is now my pleasing task, on behalf of His Majesty's Government, to welcome the delegates to this International Congress. They are here considering problems of first-class importance to every civilised community, problems affecting the convenience, the comfort, the needs, and even the lives of the people. There are no more important questions to any civilised community than the improvement of the communications in every country. It is difficult for us to realise how backward even the United Kingdom was in the matter of road communication up to the very end of the eighteenth century. Abroad, military exigencies had forced Governments to face the problem of improved road communication, but almost up to the end of the eighteenth century there was hardly a road in the modern sense of the term throughout the whole of this country. There were bridle paths, with deep and dangerous ruts, during the rainy season mere mud baths. They were so narrow that two vehicles could not pass, so low that the rain could not be drained off, and the metalling was so rotten that they were quite impassable if there was any rain. There were hardly any bridges, so that whenever there was a flood communications between two great cities were completely broken off. It took, even in summer, two whole days to get from London to Birmingham, and in winter it took three or four days. That was almost as late as the end of the eighteenth century. Now you have 231,000 miles of about the best roads in the whole of the civilised world. Telford, Macadam, and other men to whom we owe a great debt of gratitude, undertook to lay down some of the most magnificent roads in the world. Then came railroads, and many of our roads appeared to fall into desuetude. I am sure those who were taking carriage drives twenty or thirty years ago must have been impressed by the fact that the moment they left a great town, when they got 10 or 15 miles from a great centre of habitation, they found hardly anybody on the road at all.

DUST AND DELIGHT.

Then came the great revolution effected by the pneumatic tyre, and the whole of the roads were filled with dust and delight once more. (Laughter.) Then came motors. I do not know whether you have read the very remarkable report circulated to this conference. I read it with very great interest. There is nothing more striking in it than the passage showing what has happened even to one secondary arterial road out of London. Twenty or twenty-five years ago, if you had been in that spot, you would probably have found a few light vehicles and one or two heavy carts; ten years ago, perhaps a long stream of bicycles. But on a Sunday morning they took the statistics of that road in a single hour, and really the figures are so remarkable that I need not apolo-

gase for calling attention to them—100 bicycles, 50 motor bicycles, 50 motor 'buses, 300 motors, and 15 horse-drawn vehicles. If you went there on Monday morning, in addition to that, we should find a number of heavy motor delivery vans. That is a revolution in the roads of this country, and the result has been that you have got in this country now 220,000 motor vehicles. I think that is twice as high as the nearest country in Europe, but only one-third of the number in the United States. What has been the effect? That the question of road making has once more become an important economic and financial question for the consideration of the country, especially financial. (Laughter.) And it urgently presses upon engineers, presses upon municipalities, presses upon Governments, and presses especially upon ratepayers. (Laughter.) In 1892 the roads of England and Wales cost to maintain £8,500,000. Twenty years later they cost £15,500,000, practically double. That gives you an idea what a revolution has taken place in the question of road maintenance in the course of twenty years in this country. And it is not merely because of pleasure motors. There are heavy motors for the conveying of passengers and goods. The road is now being used more and more for the conveyance of goods, and I do not know that is a matter to be deplored. The more you improve communications the less you spend on distribution, and the less you spend on distribution the more is left for production, and that is a very important consideration for any country. Bad roads mean that a horse is taken away from the plough and attached to a cart. From the point of view of wealth-making, that in itself is a bad thing. You have a great problem to consider, surface, dust, width, and I think especially, exits from great towns.

MAINTENANCE OF ROADS.

I am very glad to see that the Road Board has made grants, during the last few years, since it was formed in 1910, for the purpose of improving the roads of this country to the extent of over £3,000,000; and I am very glad, in spite of all temptations to the contrary, that that money has been spent, not on maintenance, but on improvement. If the money had been spent merely in maintenance you would never have effected the improvement that has been effected very largely owing to the inducement afforded by that colossal grant of £2,300,000 for improving the roads. I am very glad they have got a little balance at the bank, and I hope some part of that balance will be spent on improving the exits from the great cities. I am very glad to hear that an arrangement has been effected between the Road Board and the Middlesex County Council for a new exit out of London, very sadly needed. I believe it will cost something under £500,000, the Road Board undertaking three-quarters, and the Middlesex County Council one-quarter. It will be an enormous convenience, not merely for those who have got motors, but for those who have business to transact. Even in the solving of a question like the housing problem a good deal depends upon taking people out of congested areas in towns to live in the more refreshing air of the country. The town will become the mart, the shop, the entertainment centre, and the country will be the home, the dwelling-place, the nursery, and the resting place. These are the things which go to the very root of the condition of every civilised country. These are the problems you are considering during the next few days, and I am delighted that some of the ablest men, representing thirty-nine Governments, are here. There is not a civilised community in the world that is not represented in this hall to-day. (Cheers.) I cannot recall a conference which represented such a vast area of interest and population and influence as that which is assembled here to-day, and I cannot recall a conference which had to settle down to the practical consideration of more important problems, and on behalf of the British Government I bid you all welcome.

SIR GEORGE GIBB'S ADDRESS.

Sir GEORGE GIBB said: I thank you for the great honour conferred on me by election as president of the Third International Road Congress, and I have now the privilege of addressing you in the dual capacity of president of the congress and chairman of the Local Organising Council.

No congress ever entered upon its labours under happier auspices. We have been honoured by the patronage of His Majesty the King and by the gracious invitation of His Majesty to visit Windsor Castle. We have received encouragement and support from His Majesty's Government, at whose invitation we are holding our meeting in London, and we know that the work on which we are engaged deeply concerns the future welfare of the people, not of one country only, but of all countries in the world.

My first duty as your president is to express on your behalf most sincere and grateful thanks to the Chancellor of the Exchequer for the cordial welcome which he, on behalf of the Government, has given to the members of the congress. The personal interest which he has taken in questions affecting roads is well known, and it is to him that we, in this country, owe the measure which was the first step taken by Parliament to secure the double aim of improvement of roads and relief to ratepayers. The presence of Mr. Lloyd George at our inaugural meeting is a matter of special gratification to members of the congress, and in your name I tender him our best thanks for his address, and for all that he has done for roads as well as for all that we hope he will do.

I wish, also, at the outset of our proceedings to tender our most cordial thanks to all who have co-operated in the arrangements for the congress work. The papers, reports and communications, which have been prepared by most eminent road experts, contain a vast amount of original thought and research. For all the labour devoted to the preparation of these papers, which constitute our main contribution to the cause of road improvement and our enduring record, I tender our best thanks to the writers. To the Executive of the Permanent Association in Paris, whose experience and guidance in the work of organisation have been of incalculable value, a special acknowledgment from the London Organising Council is due, and I am glad to have the pleasure of tendering this acknowledgment personally to the president of the association, M. de. Preaudeau, whose fame as a road engineer is everywhere known, and to the secretary, M. Mahieu, who is the life and soul of every movement to which he devotes his abundant energy. The work of local organisation has been very pleasant owing to the universal and ready support which has been given to it throughout the United Kingdom. The Organising Council is fully representative of local authorities, professional and technical institutions, traders' associations, and private associations of persons interested in roads, from all of whom valuable support has been received. The duties of the committees among whom the work has been divided has been performed with ungrudging devotion. The programme of inspections, excursions and entertainments is before you, and you will realise that such a programme could not have been arranged without most generous help from many willing helpers. To all who have helped in any capacity I tender our thanks, and especially to the Lord Mayor and Corporation of the City of London, the Institution of Civil Engineers, the Surveyors' Institution, the Institution of Mechanical Engineers and the Royal Automobile Club, to all of whom we are indebted for the provision of hospitality which will be greatly appreciated by the members of the congress. Much hospitality has also been offered—a great deal more than we have been able to accept—by mayors of the cities and towns we propose to visit, and many others whom we will be able to thank individually later on; but I would like to include these prospective hosts in my general acknowledgment of the great kindness and assistance which we have received on every side in connection with the organisation of the congress meeting.

The execution of all the details of the organisation has been in the charge of our able and experienced general secretary and deputy secretary, and it is a great personal pleasure to me to express to Mr. Rees Jeffreys and Mr. Montagu Harris, and to the staff who have aided them, my sense of the zeal and efficiency with which their work has been done, and to tender to them the thanks of the congress.

UNSETTLED QUESTIONS.

One of the most remarkable features of the existing situation in regard to roads is the number and the scope of the unsettled questions. The cause of this state of general unsettlement and uncertainty is the rapid development of motor vehicles, which have, with startling suddenness, revolutionised the use of roads, and completely altered the conditions on which existing systems of road administration and practices of road engineers were based. Outside large cities and towns, which have their own special problems, the road question is the motor question. Roads require to be adapted to motor traffic. The old roads can no longer satisfy the new needs.

Who is to bear the burden of the necessary expenditure on reconstructions and improvements and more costly maintenance, and in what manner and in what proportion is it to be spread over the various interests concerned? It seems to me that this financial question, with which the question of administration is closely connected, is one of first importance, and I trust that the deliberations of the congress will result in material of great value being provided towards the solution of the problem of placing on a practical and equitable basis the relations between finance and road improvement.

I will not attempt, in speaking to you this afternoon, to refer in detail to questions which will occupy us at the sectional meetings. The requirements of roads are so numerous and diverse as to baffle condensation, and it is no part of my duty as president, even if time were available for the purpose, to attempt to suggest to you the conclusions at which you will arrive.

In the engineering sections you will pursue your search for the ideal road adapted to each different set of conditions. It is waste of money to maintain a road either above or below the standard required for its traffic.

STATE MANAGEMENT OF ROADS.

In the sections concerned with administration and finance you will have before you most valuable papers describing in full detail the systems in vogue in many countries; and you will find, as we should expect, great differences of opinion as to the respective advantages and disadvantages of centralisation and devolution, and of State administration as compared with local administration.

The general trend of opinion is undoubtedly in the direction of State management of all important roads in which there may be said to be a predominantly national interest. We have no experience of State-managed roads in this country, and although there is a widely held opinion that the State should make larger grants in aid of the maintenance of a considerable mileage of roads of national importance, with the necessary result of introducing more State control or supervision in regard to the maintenance of these roads, I do not see any considerable movement of British opinion towards the direct administration of any roads by a central department of State. The area of highway administration has been constantly enlarged until it has grown, as regards main roads, from the parish to the county, and no doubt the county jurisdiction, which has in many counties proved most efficient and excellent, will be extended to cover a still greater mileage of roads within each county. Small areas, too small to provide adequate finance or sufficient skilled engineering supervision, may tend to disappear, and to be absorbed in larger areas. But highway administration will, I think, in Great Britain remain what it has always been—a function of local government. We will not readily part with the great advantages of local responsibility, local knowledge and local interest.

But even in this country local administration would be in peril if highway authorities did not recognise, as I believe most of them do recognise, that modern road work must be in charge of thoroughly trained, competent, skilful and adequately paid engineers with adequate technical and accounting staffs. On this point I have no doubt the congress will speak with no uncertain voice.

THE PASSING OF WATER-BOUND MACADAM.

Great improvements in road making have been achieved since the Brussels Congress. Dust has been conquered; it does not exist to any appreciable extent on roads which have been properly treated with tar or bitumen. In Great Britain the general trend of engineering opinion is undoubtedly in favour of the use of tarry or bituminous substances in road making, and in England, perhaps, to a greater extent than in any other country, macadam treated with tar or bitumen has, not only experimentally, but definitely and practically taken the place of water-bound macadam for roads of any importance. I do not, of course, refer to city streets carrying intense and heavy traffic, for which other forms of pavement are more suitable. The extension of the use of tar and bitumen in road-making depends now on financing the initial extra cost more than on any uncertainty in engineering opinion. But the choice of method still depends, as it should do, on individual selection in view of the actual requirements and conditions of the road. We must patiently try every promising method and material for many years before attempting to arrive at definite or final opinions.

You will see and judge for yourselves on the inspection tours what has been done in the way of improvement on the roads you will visit, and you will hear about other improvements. I hope and believe that your judgment will be that there is now a very large and a rapidly increasing mileage of good roads in this country. Anyone who studies what has been done within a very short period of time will, I think, be impressed with the practical manner in which the difficulties have been faced, and will give great credit to the members and technical officers of our highway authorities, who have, not universally, but in numerous cases, dealt with the situation in a business-like manner, and promptly adopted the improved methods and materials which engineering science indicated as the most likely to yield good results.

WORK OF VOLUNTARY SOCIETIES.

I think it is also right to mention the indebtedness of the public to the voluntary societies who have interested themselves in the improvement of roads, and who are well represented at this congress. The situation was quite a delicate one. Too much activity or misdirected activity on the part of these societies, especially those directly representing the interests of motorists might have hindered the object they had in view; but so sensible and useful have been the activities and operations of our voluntary helpers under the generally sagacious leadership of the Royal Automobile Club and other leading automobile associations, and practical suggestions of the Roads Improvement Association and other similar societies that highway officials generally acknowledge, as far as my experience goes, the advantages that have been gained from the assistance and the efforts of the voluntary associations.

I believe that the same may be said of many voluntary associations in other countries, such as the automobile associations in the United States of America and the touring clubs in France and Belgium, and, no doubt, of many others with whose operations I am not personally acquainted.

Our efforts to improve are being continued with accelerated pace. You will see at the exhibition abundant evidence of what private manufacturers are doing. The enterprise of these manufacturers aided by their professional advisers has initiated and developed improved methods and materials which, in conjunction with the work of many able engineers in official charge of public roads, have contributed to the great advance in the art and science of road making which has taken place within the last few years.

Gentlemen, I will conclude by expressing, on behalf of the Local Organising Committee, a hearty welcome to all the delegates and members, both those from our own country and those who have come from over the seas, our fellow-workers for the improvement of roads, and also to the ladies who have graced the congress with their presence.

At the close of Sir George Gibb's address Mr. Lloyd George left for the House of Commons, and Sir George took the chair.

THE 1916 CONGRESS.

Many of the foreign delegates then delivered short speeches, and Dr. Lewald, chief delegate from Germany, invited the congress in the name of the Imperial German Government to hold their next meeting in 1916 at Munich. He was followed by Herr Wand, who, on behalf of the Bavarian Government, seconded this invitation.

Sir George Gibb, amid the plaudits of the delegates, accepted the invitation.

Mr. W. de Herburn Washington, representing the United States, remarked that every good American felt at home in London; they were proud of their Mother Country. "Since we have taken our place with the brotherhood of nations," he added, "we feel at home amid delegates from the peoples of all the nations of the world. We love to be the big brother of our neighbours, the enemy of no man, and of no nation on the face of the globe." He brought the invitation of the Governor of the State of New York for the congress to hold its next convention in the United States of America, and would also have brought the invitation to the president but for the fact that some active member of congress had inserted, unknown even to the Cabinet, a little rider in a Bill which forbade the President of the United States appointing delegates to any international convention without a special Act of Congress. He supposed they would have to yield this time to

Germany, but promised the delegates a hearty welcome when they visited America. He added that whereas 100 years ago the United States contained a few roads little better than Indian trails, to-day the highways extended over 2,200,000 miles.

The Italian delegate (Signor LUIGGI) said that from what he had seen of the roads in Kent and Sussex he felt convinced that the delegates had come to the right place to learn the art of road making, and the representative of Monaco (Dr. GUGLIELMINETTI) observed that England led the world in the matter of macadamised roads.

His Excellency Dr. TIMONOFF (Russia), remarking that the congress met upon a memorable date—the birthday of the Prince of Wales—asked the president on behalf of the delegates to present to His Majesty King George, Queen Mary, Queen Alexandra, and the Prince of Wales their most heartfelt congratulations and respectful good wishes.

The representatives of Canada, Austria, Hungary, Belgium, Spain, Norway, Holland, Roumania and Switzerland also offered greetings on behalf of their respective Governments, and the conference shortly afterwards adjourned until Tuesday morning, when the meetings of sections for the consideration of papers and reports began.

ROAD EXHIBITION: OPENING BY LORD BEAUCHAMP.

The opening ceremony in connection with the exhibition of road-making materials and appliances at the Horticultural Hall—fully described in last week's issue of THE SURVEYOR—was performed shortly after five o'clock by Lord Beauchamp, First Commissioner of Works, in the presence of a very large gathering. Speaking from the gallery, Lord BEAUCHAMP said he was very glad that the International Road Congress accepted the invitation of His Majesty's Government to hold the present year's meeting in London. On behalf of the Government he had much pleasure in wishing the congress, and especially that section of it—the exhibition—which co-ordinated the researches and inventions of the engineering and chemical sciences, every success, and he was sure he might warmly congratulate the Executive Committee and the Local Organising Committee on the results of their efforts. The work of road engineers had been very important for many years, and was more important to-day than ever before. Our roads were used more and more for pleasure and business as years went on. With that increased use of the highways the public increased their requirements, and it was in order to meet those demands that there were gathered there that day all that could be shown of modern appliances and materials for the manufacture of roads. Inventors, manufacturers, traders and highway authorities had combined to make the exhibition of value, and he thought that many of the general public who had not previously taken any specialised interest in the question would be astonished to find how much capital was involved and how intricate was the plant necessary to-day for the manufacture and improvement of our roads. It was a commonplace with them all that these roads had improved very considerably during the last year or two. The small, and yet very important, matter of dust had received the attention of many inventors and engineers, and it was satisfactory to know that that annoyance—an annoyance both to the occupiers of houses and to those who used the roads—could be practically eliminated. They had brought together all that modern science and knowledge had discovered with regard to roads; in that respect the exhibition which he had to open that day was a unique one, and he thought they were entitled to congratulate Sir Maurice Fitzmaurice and Mr. Maybury, the chairman and vice-chairman and hon. secretary respectively of the Exhibition Committee, and Sir Herbert Praed and Mr. Herbert Beadle and Mr. H. L. Wettern, the chairman and hon. secretaries of the Traders' Committee, on the results of their labours. The thanks of the congress were especially due to those gentlemen for the trouble they had taken to make the exhibition of interest; his hope was that it would be a success, and it was with a very real pleasure that he declared it open.

It was announced by M. Mahieu that a letter had been received from the President of the French Republic stating that while M. Poincaré was unable during his stay in England to be present at the congress and exhibition, he desired to express his great interest in the problems under consideration, and to wish the proceedings every success.

A vote of thanks was accorded to Lord Beauchamp on the proposition of Sir Maurice Fitzmaurice, seconded by Mr. H. P. Maybury.

RECEPTION AT THE GUILDHALL.

In the evening the delegates were received at the Guildhall by the Lord Mayor, the occasion being a conversazione given in their honour by the City Corporation. There were considerably over 2,000 guests. The band of the Royal Artillery performed in the gallery of the Great Hall. A concert was given in the new council chamber, while there was dancing in the library.

SECTION I.

FIRST QUESTION: THE PLANNING OF NEW STREETS AND ROADS.

Capt. G. SWINTON (Chairman of the Delhi Town Planning Commission) presided at the combined meetings of sub-sections A and B of the Congress, held at Caxton Hall, Westminster, on Tuesday. These sections deal with the construction and maintenance of roads outside and in towns, and appended are abstracts of the several papers and communications which came under consideration.

THE PLANNING OF NEW STREETS AND ROADS IN TOWNS.

By Mr. SCHMIDT, Beigeordneter of the Town of Essen.

The author considers that in the science of town planning the Germans are far in advance of other countries. He recognises two classes of streets in which, respectively, the requirements of traffic and those of health and social politics preponderate. In fixing the position of new residential streets the position of the sun as regards the fronts and backs of buildings should be taken into account. As regards the alignment of traffic routes, straight lines are usually the best, but they may, if necessary, be replaced by flat curves which do not interfere with the outlook for about 200 metres.

In the suburbs it will often be possible to make the route more direct. The cross-section should be so arranged that the fast traffic and all other kinds of traffic should interfere with each other as little as possible, and to avoid disturbance of the road, underground and overhead conduits of every kind should be provided. Special tracks should be provided for vehicles travelling at medium and fast speeds. In the interior of old towns, curves should, as a rule, have radii of not less than 500 metres, which, with a width of 26 metres, gives a free outlook of about 200 metres. In towns built on hillsides a minimum radius of 30 metres may be adopted, and the convex side of the road may be slightly set back. As the roadway is the most expensive part of the road both to make and to maintain, it is advisable to keep down its width to the minimum required for traffic. It should never be less than 5 metres. In wide streets a central strip of 5 metres for tramways, or 6 metres if there be central standards, should not be contained in the roadway width. In residential streets the width may be 5 metres in every case, if there be street crossings in wider bays at least every 100 metres apart. In the suburbs it is recommended as a fundamental principle that special tracks should be prepared apart from the road for fast traffic, and crossing other tracks on the level should be avoided altogether.

In laying out the road system of a town, crossings can only be properly designed if they are "borne in mind long before they are reached," so that several routes may be joined, or crossings can be arranged for at different levels. A division of the roads for different kinds of traffic is desirable, and in the suburbs the lines for fast travelling tramcars should be placed outside the road whenever possible.

In laying out new streets in new towns, the network of tramways should be so arranged as to assume the character of a fast line in suitable localities. These lines must not cross each other on the level. The tramway traffic should be kept off the public roads altogether, and taken off them as much as possible after the lines leave the inner town, and the service can then be accelerated without the passengers having to change cars. A diagram is appended to the report showing a proposed plan for

a new town. The industrial area lying in a segment between N.E. and N.W. of the centre, the prevailing wind being assumed to be at S.W.

THE PLANNING OF NEW COUNTRY ROADS.

By Mr. NESSENIUS, Landes und Geheimer Baurat, Hanover, and Mr. GREULING, Koniglicher Bauamtmann, Augsburg.

The authors discuss alignment on the basis of a study of the work done by a horse drawing a vehicle, and express the opinion that in the case of a motor wagon sufficiently accurate results will be obtained by the same formula. They lay it down as an axiom that in the alignment of a road the new development in the means of locomotion has not introduced any new feature that would lead to a radical alteration in the treatment of the problem. The financial aspect of transport by motor wagon and of motor omnibus traffic will have to be considered, but a consideration of pleasure motor traffic need not enter into such calculations. In Prussia an official ordinance of 1871 fixes the following maximum gradients: In mountainous country, 5 per cent; in hilly country, 4 per cent; in flat country, 2½ per cent. In Bavaria a rule made in 1907 recommends a maximum of 3 per cent for places where traffic is heavy, but in difficult country, State and district roads may be laid out with gradients of 5 per cent, and communal roads at 7 per cent. Motor traffic does not, as a matter of principle, require flatter gradients than those set forth in existing regulations. But gradients should be made less when it can be done at a reasonable cost. The resolution of the Congress of 1908 was that the radii of curves should not be less than 50 metres, but even quite recently roads have been laid out with curves of much smaller radii. A radius of 30 metres is seldom possible on mountain roads. The Jochberg incline has curves of 30 metres, and in some cases 20 metres; but in curves of less than 30 metres the normal width of 5·7 metres is increased to 7·7 metres.

As regards cross-section and width, a feature of North German roads which is worth attention is the provision of a "summer track," usually left unmetalled, and used by the lighter traffic. In such cases the width of the metalled roadway may be somewhat reduced.

In Bavaria, State roads have carriageways of a minimum width of 4·7 metres, with two bankings, each 0·9 metres, and the total width of district roads is nearly always less than 6 metres. In Prussia the most usual widths are: for roads with summer tracks, 4 metres; and 4·5 to 5·6 metres for other roads; but special decrees have been issued by most of the provinces of Prussia. In Schleswig-Holstein the permissible minimum width of metalled carriageway is 4 metres for provincial roads and 3 metres for by-roads.

In Hanover there is almost always a summer track, and the prescribed width are 3·5 metres for main roads and communal roads, and 3 metres, under certain conditions, for subordinate communal roads.

The authors draw attention to the important principle that if a road is too narrow the cost of maintenance will be increased out of all proportion. As regards crossfall, customary average crossfalls on German roads are: on the level, 7 per cent for macadam, 5 per cent for stone setts, 4 per cent for wood blocks, and 3 per cent for clinkers. These are all much reduced on gradients. The authors suggest that a crossfall one way only may be recommended for modern roads at every sharp curve, the amount of crossfall being calculated on the same principle as the super-elevation of the outer rails on railway curves.

Tramways and light railways should be kept off the roads as far as possible; they increase the cost of upkeep and interfere with traffic. As regards motor wagons, extensive road systems which have been built up for light traffic only cannot be reconstructed within a reasonable time to carry motor wagons. A few important roads should be reconstructed and the wagons prohibited from using other roads.

PLANNING OF NEW STREETS AND ROADS.

By EMIL MASIK, Engineer, Professor at the Bohemian Technical "Hochschule," Brunn.

This paper of sixty-six pages, and including sixty-nine illustrations, amounts to a treatise on the survey, alignment and setting out of roads.

The author points out that in drawing up his report he has made use of writings and lectures by Profs. Bukovsky, Velflik, Hrasky, Cervinka and Spacek.

A study of hygienic conditions is of importance in setting out roads, and the author expresses the opinion that one of the demands of the modern construction of roads, in the country as well as in towns, is that it should be possible to water and wash the roads by means of specially provided gutters and tanks. The direction of streets will depend on the direction of prevailing winds, and they should be fixed with due regard to orientation. The choice of a route will depend upon which offers the lowest cost of transport per ton-kilometre or passenger-kilometre (so the author puts it), and with due regard to costs of upkeep. A formula intended to express total expenses is given. Ruling gradients of 3 per cent for flat country and 6 per cent for hilly country are recommended. On Austrian Government roads 4·7 per cent is allowed, and for lengths not more than 300 metres 5·5 per cent, and since 1843 as much as 8·33 per cent, in order to keep down capital expenditure. District roads may have 5 per cent and 6½ per cent in mountainous districts, or, with permission of the Provincial Government, may be made with gradients of 8·33 per cent.

The author explains at length, and with many diagrams, how curves are set out; describes the setting out of a centre line with contour maps, and gives directions for the choice of scales and the keeping of necessary books and records. He also describes the method of photogrammetric surveys. Ditches should have such falls that velocities do not exceed in overgrown ground, 0·075 metres per second; in loamy soil, 0·15 metres per second; in sand, 0·30; in gravel, 0·60; over broken stone, 1·20, and over rock, 1·50 to 3·00.

Data relating to cross-sections of six classes of Austrian roads are given, with a table. It is recommended that on sharp curves the crossfall should be to one side only, and not more than 1 in 15. Sidewalks should have a crossfall of not more than 1 in 50 to 1 in 100.

As regards the radius of curves, the author gives formulæ for calculating the minimum radius necessary in order that a vehicle of given length and width can pass round a bend without encroaching on the road margins. In one calculation there are seven quantities and three equations.

As regards the maximum speeds allowable for curves of given radii, these depend on the coefficient of friction, which may be taken as about ⅛ in summer and at $\frac{1}{10}$ in winter with snow on the ground. The crossfall in the direction favourable to stability is assumed to be 1 in 15, and on these data two tables are given—one for summer and one for winter. In order to avoid tearing of the road crust by centrifugal force at curves the road should be paved with firmly set stones.

To avoid dangerous shocks, due to the suddenly felt effects of centrifugal force, transition curves are necessary, the author considers, and he gives formulæ for the setting out of such curves. The legal limits of speed for motor cars are 45 kilometres (28 miles) an hour on the open road, and 15 kilometres (9·3 miles) per hour through villages, &c.

On Government roads the minimum width of bridges is 6 metres, and on district roads 4 metres. The strength of every bridge must be calculated by Government rules.

PLANNING OF ROADS IN OLD OR NEW TOWNS.

By R. VERSTRAETE, Ingénieur principal des Ponts et Chaussées at Bruges.

The author points out that the most important of works relating to the embellishment of cities are of comparatively recent date, and that they are mostly the work of art enthusiasts, engineers appearing to take little interest in the subject. "If their apparent indifference continues much longer they will find that this natural branch of their profession will pass into other hands. . . ."

As regards systems of street planning, the chessboard or rectangular system, and the spider's web or radiating system are equally at fault. The former does not offer the shortest route between any two points, and the latter has serious disadvantages. The "mixed system," which is practically the rectangular system with the addition of diagonals, is now generally preferred. But the solution is not yet logically settled, and the author of a general plan for buildings covering a large site must not be tied by any fancy not logically deduced from a minute analysis of the conditions. Streets must not be so arranged that they will be continually swept by winds,

nor be without shade in the hottest part of the day. Long, straight roads are to be condemned, and closed spaces should be sought for. Long streets which seem to require to be built in straight lines should be given a certain amount of sinuosity. The limitation of the visual field will render the eye more attentive and the rapidly moving traffic less dangerous.

As regards alignment, the only direction in which a street should never run is due north and south. In a curving street the convex rather than the concave side should usually set back. In main arteries the maximum gradient should be 3 per cent. and in shopping and residential streets 5 per cent is the absolute limit. In considering traffic regulations, it must be remembered that the most crowded moment is not always the moment at which the greatest number of vehicles pass.

The author treats of cross traffic at some length, with numerous diagrams, and specially considers the angle at which traffic enters a street.

STREET DESIGN FROM A PURELY ARTISTIC POINT OF VIEW.

By M. DE VAERE, Ingénieur Architecte, Conducteur des Ponts et Chaussées, Ghent.

In the author's opinion it was not luck, but a deeply rooted and sure artistic sense which guided the hand of the builders of olden times. We admire their work, but nothing of their art survives in modern methods of town planning. Modern conditions do not allow of our planning streets and squares like those of old cities; but we need not look at such matters purely from a technical point of view. The artistic value of "systems" such as the rectangular or triangular systems is *nil*, and even from a technical point of view their inefficiency is often flagrant.

The important point is not the planning of the network of streets, but the planning of the streets themselves.

The author gives a number of rules generally accepted by leading art critics, and including the rule that a long, straight road should never be laid out with a convex longitudinal section. The great beauty of certain streets is not due to the appearance of the houses, or very little, the houses being very simple in design. A long line of unbroken frontage is very objectionable, and a number of methods of treating such a line have been suggested. One of these consists in forming the frontage line into a series of isosceles triangles giving each house a double frontage to the street, and increasing the lighted surface in the ratio $2 : \sqrt{2}$.

Front gardens are not always advantageous; they hinder the builder, render the space unavailable to commerce, and considerably reduce the interior empty space. The last consideration alone is sufficient to condemn them. Streets planned with too pronounced a curve are objectionable, Regent-street being a case in point.

As regards junctions, the designs of Mr. R. Unwin are to be preferred to the ordinary method. The "turbine system," where both streets are deviated, is specially mentioned.

Prevailing winds must be specially considered, and streets which run parallel to the direction of the prevailing winds must be so arranged as not to be swept by them.

NEW ROADS.

By J. B. EVERARD, Conducteur Principal des Ponts et Chaussées, Rochefort.

The author begins by stating that when it has been decided that a road shall be built to link up two important centres, it should be as much as possible a straight line between the two points. He mentions a number of reasons which may be sufficient to render desirable a deviation from a straight line.

A road should be so aligned and built that it should never have a gradient less than 1 per cent, or even 2 per cent, if possible. Under modern conditions the formulæ which give the most economical section have no longer any weight. The author proceeds to explain with some care, and with the use of a number of diagrams, how undulations should be linked by vertical junction curves. As regards cross-sections, he makes a special point of the importance in many cases of making the best use of the surface soil obtained in cutting and embanking. It should be used for the ground in which roadside trees are planted, and for the margins and slopes which are to be turfed. A simple method of setting out curves by means of offsets is described.

CYCLING PATHS IN COPENHAGEN.

By W. NOHR, Engineer-in-Chief of Roads and Sewers, Copenhagen.

The number of cycles in Copenhagen is estimated as 800,000, the conditions for cycling in and around that city being unusually favourable. In some streets the number of cyclists passing in a day approaches 20,000. Cycling paths, separate from the carriageway and the footways, are found in almost all streets which exceed 22 metres in width, and in some of less width.

The author classifies cycle paths as single paths, taking two cyclists abreast, and double cycling paths taking four abreast. The best arrangement is to have a single cycling path outside each of the footways, with the traffic in one direction only on each path. The width depends upon various factors, 1·60 to 2·15 metres for single paths, and 3·60 to 4·15 metres for double paths. The cycling paths are made in the same manner as footpaths, and, with a single exception, all are tarred. The best blinding material is cleaned stone-crushed refuse. Paths which are much used are tarred once a year, but less used paths need only be tarred once in two or three years. Many of the double paths are visually divided by bands of paint to assist cyclists in keeping to the proper sides.

In Copenhagen, cycle paths, separate from the carriageway and footways, have a total length of 40 kilometres. There are also a few kilometres of cycle paths in the carriageway proper, having a width of 60 to 80 centimetres, being laid alongside each kerb.

PLANNING OF SYSTEMS OF STREETS AND ROADS.

By N. P. LEWIS, M.AM.SOC.C.E., Chief Engineer, Board of Estimate and Apportionment, New York City.

The subject is discussed mainly with reference to conditions in the United States, and includes sketch plans of the roads of New York State, the road system of Montgomery County, Ohio, and a sketch plan of the roads leading out of Philadelphia.

The author considers that any intelligent plan for the improvement and extension of an existing system of roads, or the development of a new system, should include the correction of the alignment of existing roads and the provision for direct routes between important centres. It is a mistake to treat a city and a contiguous rural system of highways independently of each other.

The motor car has placed the city in close relation with the rural districts surrounding it, and the road system must be considered as a whole. An excellent illustration of the provision of a system of rural highways articulated with the streets of a large city is afforded by the plan of Philadelphia and its vicinity. The provision of diagonal streets in the older parts of the city will require time and involve great expense. Philadelphia has suffered from a rigid rectangular street system, imposed upon it by the whim of its founder, and not by its topography.

The author discusses the relations between the present cost of making wide streets sufficient for possible and future requirements, and the future very great cost of widening, should that be necessary. He points to the main streets of certain New England cities, 100 ft. wide, and planted with the graceful American elm, as exceptionally beautiful and useful highways, which in some instances connect one town with another. Inter-urban tramways are being constructed quite generally in the United States, and are sometimes located within the lines of existing highways, and even immediately adjoining the metalled roadway, a very objectionable practice. As regards city tramways, these must be in the streets. In New York the minimum width for two tracks is 40 ft. between kerbs, for a single track 30 ft. When the width is between 30 ft. and 40 ft. the return track must be placed in another street. In New Orleans the prevailing practice is to place the tramway tracks in separate spaces, which is very desirable when the streets are wide enough. It is successfully done in certain European cities. As regards longitudinal division, there is a difference of opinion as to the effect upon the capacity of the highways. If there be a preponderance of traffic one way during a part of the day and the other way during another part, the division into two equal parts may be a disadvantage. Yet the greater orderliness of movement and its effective control leads the author to believe that such a subdivision of broad streets is advantageous.

PLANNING OF NEW STREETS AND ROADS.

By A. STOCLET, Ingénieur en Chef des Ponts et Chaussées. Agent Voyer en Chef du Department du Nord, Lille.

The author begins by discussing the general lay-out of a new thoroughfare, taking financial and commercial considerations into account, and illustrating his points with reference to particular routes. He considers that the straight line should be adopted when the surface slope allows it. As regards minimum gradient, he recommends 1 in 250 for a paved or asphalted road, and 1 in 200 for a metalled road. In parts of the town which are not hilly the maximum gradient should be 1 in 100 to 1 in 83. Outside the city 1 in 20 should be the maximum, except in special cases. For the cross-section of a street he proposes three cariageways and two footways, all in a typical case, 6 metres wide, the central carriageway for fast traffic both ways, and the carriageway at each side for slow and local traffic. With two strips of 1 metre each dividing the carriageways the total width is 32 metres. The use of subways at some of the crossings is a necessity, and such streets should not be crossed by foot passengers at times of intense traffic. For less important thoroughfares two roadways of 6 metres and two footways of 5½ metres will suffice—24 metres in all; or a width of 20 metres allows of two 5½-metre roadways and two 4-metre footways. Generally, public roads should not be made of a less width than 40 ft. to allow of future developments. The author is in favour of the policy of constructing by-pass roads, and points out that in the North of France the dismantling of fortifications has made this possible in most of the old towns, and a number of such by-pass roads have been made. But the practice should not be pushed too far, and up to the present such roads must be considered as exceptional. Under the head of "New Streets in New Towns" the author discusses an ideal case, and considers the allotment of space and disposition of his roads for a riverside town. The road connecting the quays, the stations and the centre of the town should have a width of 100 metres (330 ft.) in the most important part, and 65 metres (213 ft.) in the other part. This road should have a central planted street and the following divisions: A bicycle track, 9¾ ft.; a roadway of 20 ft. for fast traffic; two lines of tramway, 26 ft.; a roadway of 26 ft. for slow traffic; two footways of 33 ft. The planning of roads in rural districts is next discussed in the case of slightly hilly country, and separately in the case of quite hilly country. The author favours the straight road. Special reference is made to the new road connecting Lille, Roubaix, and Tourcoing. The widths suitable for different classes of secondary roads are set forth; the type suggested for villages of little importance having a central portion 10 ft. wide and 8 in. to 10 in. thick, with shoulders 2½ ft. wide, 4 in. to 6 in. thick, the total width being about 26 ft. More important roads will have carriageways of about 20 ft. in width.

The report is accompanied by a plan of an ideal riverside town.

PLANNING OF NEW STREETS AND ROADS.

A Joint Report by T. ADAMS, Local Government Board; W. E. RILEY, Architect, London County Council; W. T. LANCASHIRE, City Engineer, Leeds; H. E. STILGOE, City Engineer, Birmingham.

The report begins with an allusion to the "awakened sense of serious public responsibility" for greater adequacy and convenience in the development of our cities; a reference is made to the planning of the Federal Capital of Australia and the new seat of Government of the Indian Empire. The change of attitude is connected with problems to be discussed in connection with the planning of new roads. The development of motor traction has created new conditions which have to be faced. In addition to the very speedy traffic there is a large volume of exceedingly slow traffic, necessitating ample room for passing. In the old streets of central areas it is not feasible to provide special tracks for fast and slow traffic, and the only remedy seems to be to secure as great a width as possible. In rural districts there is no serious congestion, but there is danger, and improvement is necessary in several directions.

The authors then treat of this difficulty by dealing with central areas, with some account of the position at Leeds. The increased value of central sites and the removal of population to places outside the great centres leads to a demand for more and wider arterial outlets. A comparison is then made between the widening of existing streets and the provision of new streets, with examples of the actual cost of both classes of improvement in Leeds. The subject of provision for expansion is then discussed, the authors being in favour of the policy of creating ring roads, which should be arranged for before the town covers the area through which they will run. As regards curves, it should always be possible to obtain an uninterrupted view for 100 yds., and abrupt changes of direction should be avoided. A curved road may make it possible to change the direction gradually, and may be necessary for other reasons. In straight streets the picturesque can be secured by breaking the line of frontage by satisfactory grouping of important buildings, and by the disposition of open spaces.

Reference is made to the controversial nature of the subject of street widths, and a practical suggestion is made as follows: ". . . we must consider first whether, on the one hand, the width required in local by-laws is not inadequate to the needs of modern main thoroughfares, and whether on the other certain circumstances would not justify narrower streets to be authorised if complementary wider streets could be insisted on where they are required."

In London the present minimum is 40 ft., and the maximum 60 ft. In the districts round London the minimum varies from 36 ft. to 40 ft., except in a few places, where it is 50 ft. As regards provision for tramways, the authors consider that new main roads should be so designed that a separate space may be allotted for tramway tracks. In dealing with the subject of cross traffic the opinion is expressed that experience in London has shown that congestion of traffic, although aggravated by the mixture of slow and fast vehicles, is even more certainly caused by cross traffic. Reference is made to gyratory traffic regulation, the comments on this point being somewhat non-committal. The authors take the view that a continuous line of refuges and posts in the centre of a street create an obstruction, and in many cases turn one good road into two bad ones; but the meaning of the word "continuous" is not defined.

Crossfalls recommended as the most suitable are: For granite, hardwood and asphalt roads, 1 in 45; for softwood, 1 in 36; pitch-grouted macadam and tar-macadam, 1 in 30; water-bound macadam, 1 in 25; and as regards the last-named it is recommended that the crossfall should be slightly increased on steep gradients.

The Housing and Town Planning Act is considered with reference to undeveloped urban areas, and a useful effect of the Public Health Act of 1907 is also referred to.

The complete planning and building of new towns or villages has been carried out in a number of cases, and formal designs have been followed in the development of certain suburban areas. Reference is made to the garden city of Letchworth, to the Knebworth estate, and to a scheme for a population of 35,000 at Alkrington, near Manchester.

As regards rural areas, it is suggested that before any large expenditure is incurred in improving existing roads consideration should be given to the advantages of adopting alternate routes of better alignment and gradient. Stress is laid upon the need for co-operation among different authorities. The report is accompanied by eight plates.

PLANNING OF NEW STREETS AND ROADS.

By J. MIHALYFI, Chief Technical Adviser to the Town of Buda-Pest.

In this report attention is concentrated on a few points, which are very carefully considered, and some data are presented relating to the city of Buda-Pest. New streets made since the rearrangement and expansion of the city have been given a width of 48 ft. and the new boulevards a width of 120 ft. These dimensions were only in accordance with the orders and requirements of the period before tramways and bicycles were introduced, and the development of motor cars has created a difficult situation. The author discusses the question of the best position for tramways, and considers that the advantages of a central position far outweigh the arguments in favour of placing the tramway near the side of the road. He points out that the central tramways, by dividing the other traffic, make it far safer for pedestrians to cross the road, since they do not meet vehicles coming from opposite directions in the same part of the road. Another advantage of the central position is that the curves by which the tramways turn into side streets may be easier. The author

thinks that it is by no means impossible that the motor omnibus will replace the tramcar and even the district railways.

As regards the direction taken by traffic, it is suggested that the universal rule of the road should be adopted. The usual rule is to keep to the right, but in Buda-Pest, and generally throughout Hungary, the rule is to keep to the left. The author recommends that when new districts are being opened up, and the plan of a town altered, parallel streets should be provided near main streets, not necessarily of so great a width as for the whole length.

PLANNING OF NEW STREETS AND ROADS.

By V. CINQUE, Chief Engineer of the Province of Brescia.

The author refers to a number of separate reports made by members of the Second National Road Congress of Florence, and reproduces a summary of these and other opinions and observations, which was submitted to the congress.

Mr. Frosali, chief engineer of the Province of Florence, considered that the development of motor traffic calls for organic changes to conditions similar to those of railways. He recommends the adoption of very low gradients, as far as possible confined to a maximum of 2 per cent, though for mountain roads he would accept 7 per cent. On curves centrifugal force should be taken into consideration.

Mr. A. Albertini, chief engineer of the Province of Modena, also considers that the new tramway requires as few gradients as possible. On main roads tramways, motor vehicles and ordinary vehicles should run on different tracks; on secondary roads motor vehicles and ordinary vehicles could use the same track, the width being 6 metres, except at bends, where it should be increased by taking about 2 metres off the inside of the bend. On main roads the three tracks and the footway should together have a width of not less than 16 metres.

Mr. N. Cinelli, engineer and chief of department of public works of Rome, and Mr. U. Conte, an engineer of the same department, made a report dealing with conditions in Rome. They recommended the gyratory regulation of traffic at crossings with a central island and expressed the opinion that in a large city the construction of parallel routes may give better results than the widening of existing roads, which is not permissible when the road has an artistic appearance. Mr. Cinque's own report deals with the planning of new streets and roads in old towns, in new towns, and in the open country. He points out that the essential thing in designing large thoroughfares is to provide proper drainage for rain water and for house drains. For town streets he recommends a convex curve for the cross-section, the camber being between 1·5 to 2 per cent of the width for paved roads and 2·5 to 3 per cent for macadam roads. The radii of curves should be not less than 50 metres, or for zig-zag roads in hilly country not less than 9 metres. He is in favour of a policy of constructing by-pass roads.

RULING PRINCIPLES FOR THE PLANNING OF NEW STREETS.

By G. D. DOUBELIR, Professor at the Polytechnic School of the Emperor Alexander II., Kiev.

Since the year 1912 the population of Russian towns has increased from 1,650,000 to 22,000,000 (census of 1907). Between 1869 and 1911 the population of St. Petersburg and its suburbs has risen from 668,000 to 1,907,000, and between 1871 and 1912 that of Moscow has increased from 600,000 to 1,579,000. Kieff has now a population of about 500,000 and Lodz 385,000. The towns of Russia are notable for the large area per head of population—St. Petersburg 77 square metres, Moscow 83 square metres, Poltava 223 square metres, Orel 240 square metres, but Odessa only 41 square metres and Warsaw 39 square metres. In most provincial towns the figures are higher, and vary from 100 to 500. The number of carriages per 1,000 inhabitants is usually very high—in Moscow 18·8, in St. Petersburg 10·4, in Kharkoff 8·8, and Kieff 7·8. These figures compare with Berlin 4·3, Paris 4·4, Hamburg 1·4, and Leipzic 1·1.

As regards the alignment of streets, the author points out the importance of considering drainage. The gradients of the streets should suit those of drain pipes, and be between 1 per cent and 3 per cent. In very undulating ground the streets with secondary drains may have slopes of 5 per cent and main streets not more than 3 per cent.

DISCUSSION.

The CHAIRMAN said on this question of roads the thing they had to consider always was everlasting foresight. The two points they had to remember—and he had studied the matter for some years—was always to keep back their building frontages; and wherever they had cross-roads and wherever they had the possibility of cross-traffic in the future, to see that they had plenty of space there. Thus, when dealing with country roads they would get pleasant country roads, and if they became village roads they would be pleasant village roads, while if they developed into town roads, they would become equally pleasant town streets. The speaker recalled the outcry when Regent Street and Oxford Circus were laid down on their present dimensions, the ground of the protest being waste of money and waste of space. Those who lived in London to-day wished that Regent Street was as wide again and that the Circuses were four times as large.

Prof. ADSHEAD submitted a series of resolutions dealing with the planning of new streets and roads. He urged that roads must follow the enormous increase of traffic and the altered conditions required by motor traffic. The recent interest in town planning taken by different nationalities was giving an interest to roads and had brought out the need for greater changes and diversity of arrangements therein, such as had not been seen until quite recently. These two points were, he thought, the ones to which most of the papers devoted themselves. The first resolution was as follows: "As a general principle it is better that new main roads be constructed to pass outside rather than through towns, and that where an existing main road passing through a town is unsatisfactory it is better to construct a new by-pass route in preference to widening an existing narrow main road through the centre of a town." They must remember that their old streets were not constructed for the new conditions of their traffic except to a very limited extent. Many of their old thoroughfares in towns were as much congested shopping streets and to a large extent promenades as they were through traffic roads, and they must remember that in considering this question of by-pass roads, as was well pointed out by M. Stoclet, it was much better where possible to have an entirely new thoroughfare with branches connecting it with the old town than to disturb the vested interests in the old towns themselves. The second resolution was: "Wherever possible gradients on new roads should be limited to 5 per cent and that they should be less where there are curves, trams or a preponderance of heavy traffic." To this the French delegation had moved an amendment as follows: "For new roads it is desirable that the gradients should not exceed 3 per cent but in hilly countries gradients ought to be 5 or even 6 per cent, etc." They must remember in connection with gradients that there could be no greater question of dispute. Opinions corresponded very largely to the character of the country in which the expert happened to have had his experience. In this country they had a very great diversity of gradients. We had no very high mountains as in some parts of Germany, and no great extent of flat country such as could be found in France. Therefore the 5 per cent. as suggested by him on reading the various reports was put forward as a limit, but he thought the amendment was probably better and he suggested that it should be adopted. The third resolution was as follows: "The radii of curves in roads used by fast traffic should, where practicable, provide an unobstructed view of 100 yards ahead and that where this is not possible, the curves being of too short a radius, means should be provided whereby the approach thereto is in some way clearly indicated." Various authorities decided on different systems in dealing with curves with a view, of course, to safety for rapid traffic. The English authorities and some cities of America suggested that there should be a non-obstructed view of 300 ft., which seemed to be the simplest way of settling this question. The fourth resolution was: "Except where it is possible to provide reserved spaces tram tracks are best placed in the centre of the roads and that where so placed it is desirable to provide space on either side for two tracks for vehicles." The advantages of placing tram tracks in the centre of a roadway were very ably advanced by various authorities and prominent amongst the arguments seemed to him to stand this: That the central tramway as opposed to trams on each side of the roadway was cheaper in construction. It was also safer for the general public as offering a refuge in the centre of the road to pedestrians

crossing. In the third place it gave a better curve for trams entering side streets. Of course, there were occasions when tramways might with advantage be placed on side tracks, and it had been shown that this, so far as the laying of the tracks was concerned, was far and away the most economical method, but they had to remember again that that meant a greater need for width in road spaces, as the tram tracks laid on separate sides could not be utilised by the road traffic as well as by the tram traffic, which was the case where the trams were in the centre of the roads. The fifth resolution read: "The main traffic roads should be so designed that spaces are provided for tram tracks, fast and slow traffic and standing vehicles; and in such a way that they can proceed without intermixing. In fixing building lines along what may ultimately become main roads regard should be paid to ultimate requirements. Adequate space should be provided between the buildings, and powers for enforcing this should be held by all authorities who decide the widths of the roads." He need hardly press the argument in favour of a resolution of that kind. He might point out at that stage that the widening of streets for greater traffic was very often more a question of widening the pavements, for many of our streets were more congested on the pavements than they were in the roads. That especially applied to many of our streets leading out of large towns. The sixth and last resolution was: "That the planning of main road communication is a matter of national importance in regard to which some initiative should rest with a Central State Authority and the action of local authorities should to some extent be regulated or supervised by Central State Authorities." This probably was felt to be one of the greatest needs in this country—the need of a central authority. We had, of course, the Local Government Board to control the local roads and we had various other authorities who controlled the various parts of the system. But we seemed to have no central authority responsible for the main roads which were to-day of such enormous importance.

Mr. J. A. Brodie, city engineer of Liverpool, observed that in towns there were two sets of conditions applicable to main thoroughfares. Leaving the centre of a large city they first of all found the portion of the roadway or main line of communication which was closely built on. The conditions there differed quite from the conditions attaching to the portion of the thoroughfare in the outlying area. In the one case they had buildings close together. In the other they probably had little or nothing in the way of building. As a result of considerable experience in developing main lines of communication, he had come to the conclusion that at any rate in this country we were too much inclined to narrow roads. His view was that even in the built-up portions of cities the roads should be at least 80 ft. wide. In the case of the areas where the houses were not yet built, the conditions were very different, and as the result of his experience he recommended roads of not less than 120 ft. in width. He recommended that because he found it possible to construct such roads at a cheaper rate than narrower roads under certain conditions. If they had a road, as had been suggested, in which tramways were required, they could by cheapening the cost of construction pay for extra width of street surface, and in a road which he was about to construct he had recommended his authority to carry it out in that way, and they were proposing to adopt it. In this country we suffered very severely from the want of proper powers for the widening of roads, and if the result of a conference such as that enabled the Government and the authorities to arrange proper powers, then good work would have been done.

Mr. J. Walker Smith, Local Government Board of Scotland, said it seemed to him that in the first resolution undue notice was given to the desirability or the necessity of the construction of by-pass roads, without setting forth the character, size and description of the town or village which it was desirable to by-pass. He had no objection to the execution of works for by-pass traffic through small and uninteresting villages where such work could be easily and economically carried out and where there was an obvious desirability for it on the ground of narrow and congested streets and bye-lanes and gradients. But one did not in the same way wish to by-pass traffic of one kind through such places as London, Liverpool and Edinburgh. On the contrary they wished to get to them. Even then he had no objection to by-pass roads being constructed, but he should call them not by-pass roads but ring roads. He supported that because he remembered that what might be on the outskirts of a city to-day might become more or less the centre of the city. Even more important and urgent than the construction of these ring or by-pass roads was the control of the existing big arteries. There was machinery existing for the control of such main arterial roads, and he could see no reason at all why that machinery should not be put in motion. The requisite width could be predetermined and laid down and confirmed under the town planning powers of the present day. The exercise of such powers was not a particularly expensive matter, as it could be spread over a considerable number of years. He had no doubt that the initial expense would be very well incurred indeed. Then he had no objection whatever to the exercise of a reasonable amount of power of initiation by a central authority. In his experience of local authorities he did not think that they would take a too parochial view of this question. They would be only too pleased if they could reconcile local requirements with national needs. But the local authority was the guardian of the local purse and needed to see that the measure of the local improvement was commensurate with the local cost. Anything over and above the needs of the locality were no doubt national needs, and as such should be paid for out of the national purse. He thought that the local authorities would not really object to their actions being to some extent regulated and supervised by a central authority, but that supervision should be accompanied by assistance, financial and otherwise.

Herr Franz Krejei (Austria) said he was of the opinion that the percentage of gradient should not be settled at that conference. In Austria the gradient varied from 7 to 8, and he thought it was beyond the power of the conference to lay down any fixed rule on this point.

Mr. H. E. Stilgoe, city engineer of Birmingham, said the planning of new streets and roads was bound up with town planning and town development, and that, he took it, was one of the main features of the first resolution. Perhaps he might be permitted to give a little information on the difficulty which he met with himself in preparing town-planning schemes for the city of Birmingham. They began with a small scheme embracing about 2,000 acres, and even in that small scheme they found it most difficult to plan the arterial roads over that district alone. And when they came to consider the subject of the arterial roads in the greater district covering some 43,000 acres, he was sure the Congress would appreciate that the first thing they had to do was to prepare a plan of the whole city area and to lay out the great arterial roads before they could think of allocating a portion of the arterial road to any specific district. He might be wrong, but it appeared to him that having regard to the importance of this question there should have been some resolution more strongly defined than resolution No. 6. There was no doubt about it that no arterial road could be considered without regard to the whole area. Then with regard to resolution 4, this did not appear to him to read quite in the same spirit that Prof. Adshead expressed himself in his opening remarks. He said that because he understood him to say that tramways were cheaper when constructed in the centre of the roads. What he would enquire was this: Did he mean on a separate space in the centre of the road, or did he mean in the centre of the ordinary carriage way, because on the meaning of his expression was determined whether it was cheaper or whether it was dearer? He thought it was well understood that where there was a separate tramway track in the centre of the street, that was a space where the tramway was laid perhaps in a different form of construction—perhaps on sleeper track or otherwise—it meant that there must be a carriage way on each side, for that carriage way as a general rule must be provided with two sets of kerbs and channels, two underground surface water sewers and all the extra street gullies and so forth. He had prepared several scores of streets and had an estimate in connection with each one, and he thought, generally speaking, it would be found that in the laying out of a new street in an entirely new area, where space could be obtained at the side of the carriage way, it was better to have the tramway track constructed on the ground reserved by the side of the carriage way. It minimised the cost of upkeep, which in his city was found to be about £400 per single track per mile per annum, the running could be much faster and it was much easier.

M. Arthur Stoclet (Lille) expressed the opinion that to limit the gradient would be going too far. He added that in places where development was taking place

roads should be as wide as possible, but in towns where there was no development wide roads were a wasted expenditure. He agreed in a general way with the resolutions, but of course everybody would understand that in applying the principles they would have to have regard to the particular circumstances of the place.

Mr. Thos. Adams (Local Government Board) agreed with the resolutions. With regard to the question of gradient he suggested that the matter would be better covered by something more general than was contained in that particular resolution. He suggested that it should read: "Wherever possible gradients to new roads should be as easy as practicable having regard to the physical character of the country through which it passes and that they should be less where there are curves, trams, or a preponderance of heavy traffic." He thought that would meet the whole of the points which had been raised by foreign delegates. As engineers they had to consider principally how to save posterity from the blunders from which we were suffering to-day, and very often this was only to be done through suburbs and in the frontages of our great cities. London at the present moment was not only suffering from the congestion of Westminster streets, but also from the lack of attention to the leading thoroughfares out into the country. There was a need for more co-operation between central authorities and local authorities. He suggested that the responsibility of owners should be such as could be imposed upon them by the bye-laws. The local authority's responsibility was what was necessary for local traffic, taking in a fairly wide district, of course; and then the State should come on and say: "In addition to what is necessary for local traffic, we consider that the national needs will only be met by a road 20 ft. or 30 ft. wider than you propose, and if you provide the necessary road we will find the means of carrying it out."

M. Elie Radu (General Inspector and Director of Roads and Bridges in Roumania) also urged that the question of gradients should not be limited by the Congress. They could lay down the general principle that it should be a comparatively slight incline. In Roumania, on the old roads there were gradients going up to 20 per cent., but on the new roads endeavour was made to have nothing more than 8 to 10 per cent.

Dr. P. C. Cowan, Chief Engineering inspector to the Local Government Board of Ireland, said wide roads were a necessity, although they need not be finely finished all over. They were a glory and a good possession. Wide streets were not needed for shopping streets, but for main thoroughfares he urged them to keep the width. If they liked they could give householders a great portion of it for gardens and lawns, but he advised them to keep the buildings back.

Sir George Gibb, Chairman of the Road Board, said it seemed to him that this question could be divided into two heads—what should be done, and how it should be done. He did not think there was very much difference on the question of what should be done. They wanted to improve the main roads of communication in the neighbourhood of towns and also for inter-urban traffic. As regarded built-up areas inside cities, he confessed he thought there was a great deal in the view that planning streets in these built-up areas often did more harm than good. They wanted first of all to know what money was available for improvements inside cities and then planning could be done comparatively easily, but in the unbuilt areas round towns the planning was most urgent and it was not very difficult. All that was wanted were ample, practical, legal powers. Mr. Walker Smith suggested that the last resolution should be strengthened, and he did not know whether there was any objection to these words: "The planning of main road communication outside towns to a distance of 15 miles should be at once undertaken. It is a matter of national importance," and so on. That, no doubt, gave point to the resolution, and they all agreed that the planning outside towns was of great urgency. With regard to the authority that should plan, that must depend upon the system in operation in any particular country. If the State undertook the provision of roads then clearly the State must take charge of the planning. In England, local authorities were entrusted with a great deal of power and what they wanted in England was more co-ordination, more power given to local authorities with some central initiative to plan out the roads that were to be improved in the unbuilt areas. Mr. Brodie had addressed them as to the advantage of wide roads, and he quite shared Mr. Brodie's view. Of course, one must distinguish between width for æsthetic purposes and width for practical purposes. There was a good deal to be said for having two roads of lesser width rather than one road of greater width in some cases. If they had two roads they got possibly greater width than they would probably get with one road, and got an opportunity of dividing the traffic—which was a great advantage. A great deal had been said about the necessity for a comprehensive plan, and he was sure they all agreed that the main requirements at present were first of all that some authority should be put on to the practical task of planning out the roads of main communication on the vacant land round cities, so that they might avoid a repetition of the terrible scandal which existed in the narrow and overcrowded and tortuous streets they saw around them; secondly, that that planning authority should not take too local a view, but should look ahead and have infinite foresight, as the Chairman said, and plan roads for the main communication in the future.

The resolutions were then put to the meeting. The first was amended to read: "New town roads should be built according to the principles of town planning, etc.," and was carried. The second was agreed to as amended, as was the third, with a verbal alteration. The fifth was agreed to as it stood. Sir George Gibb's amendment to the sixth was lost, and it was finally altered to read: "Planning of main road communication outside towns should be at once undertaken," etc.

SECTION II.

FIFTH QUESTION: METHODS OF LIGHTING PUBLIC HIGHWAYS AND VEHICLES.

The second section (sub-sections C and D) held its meetings at the Institution of Mechanical Engineers, on Tuesday, under the chairmanship of Mr. S. F. Edge, who welcomed the delegates on behalf of the body he represented, the Society of Motor Manufacturers and Traders. Referring to the subject of discussion, the lighting of the highways and vehicles, Mr. Edge said, speaking as a user, it was quite clear that the country villages and urban districts could not possibly light the roads in a way that was adequate for modern road traffic. The road user himself must, except for the large cities, carry his light with him, but in addition to that they must expect and call upon the local authorities in every country throughout the world to see that unexpected obstructions should be lighted in a clear and universal way. He was referring not only to permanent obstructions of the road, excavations, road repairs, but also things being moved upon the highway like cattle. They should be adequately lighted to conform with modern road conditions. In addition he thought the lights of the motorist should be proportionate to his speed and should be of such magnitude as to show up an obstruction at least twice as far ahead as the distance in which he could stop. That was the minimum margin of safety that could be allowed for the lighting of vehicles.

Abstracts are appended of the papers and communications submitted for consideration by the Section:

LIGHTING STREETS AND VEHICLES.

By G. FLECK, Stadtbaurat, Dresden.

By far the greatest number of ninety-three German towns of more than 50,000 inhabitants employ "coal water gas" in one or another of its many modifications. Electric light holds a subordinate position, and is chiefly used for lighting open spaces and broad main thoroughfares. In a few towns, especially the smaller ones, electricity has gained the upper hand, but the ratio is that electricity prevails in four towns and gas in the other eighty-nine. Petroleum, methylated spirit and air gas are used to a small extent. Most towns manage their own gas and electricity works; in the case of gasworks owned by companies these are usually English.

In numbers as well as in total illuminating power arc lamps are principally used in the larger towns, and incandescent lamps in the smaller towns. In the case of gas lighting the upright Welsbach mantle holds by far the largest field. Fishtail burners are still in use in isolated instances or in unimportant places.

In the case of gas the candle power varies between 60 and 4,000, and with electric lamps between 25 and

4,000. The number of lamps kept burning all night is between one-quarter and one-half of the total number. As regards the cost of lighting a rough estimate is that on the average the rate is 10 pfennigs per square metre of area in the smaller towns, and 12 to 14 pfennigs in the larger towns, a pfennig being the equivalent of a tenth of a penny.

The author refers to regulations for the lighting of tramcars and other vehicles. Every motor vehicle must carry two powerful lamps which will light up the road to a distance of 20 metres ahead, and must have in addition a lamp at the rear which will illuminate the distinguishing marks of the vehicle. As regards other vehicles there is at present no regulation to compel them to carry rear lights, but the author considers that in face of the increase in fast motor traffic it may be desirable that all vehicles should be compelled to carry tail lights.

METHODS OF LIGHTING PUBLIC ROADS AND VEHICLES.

By LEO. STRANSKY, Vienna.

The author favours the method of lighting a road by means of two-armed masts in the centre of the road "not at too great a height from the road, so that the illuminating effect, which apart from the power of the source of light is directly proportionate to the sine of the angle formed by the incident rays of light with the horizontal, should be as large as possible." Where the road is not wide enough for this it is advisable to suspend the lamps from wire ropes stretched across the road. The author considers that the motorist is hampered by clause 5 of the International Agreement, which forbids the use of very powerful and dazzling lights in places of an urban character. He considers that all obstructions, temporary or permanent, on public roads should be marked with lights during the night, and classes dangerous bends with permanent obstructions. He makes the suggestion that yellow lights should be used for caution signals to avoid confusion with the red danger signals of railways. As regards the lights which should be carried by vehicles, the author considers that at least two white lights should be carried, indicating the width of the vehicle including the load. He suggests that every vehicle should have a lamp showing a coloured light behind.

The paper is accompanied by a plate showing types of proposed warning signals which can be illuminated at night.

METHODS OF LIGHTING PUBLIC HIGHWAYS AND VEHICLES.

By J. HANSEZ, Barrister at the Court of Appeal, Provincial Councillor and President of the Commission of the Touring and Royal Automobile Club of Belgium, Brussels.

The author begins by making the statement that the question of the lighting of public thoroughfares has not yet been dealt with from a general point of view, and he makes the important observation that from the point of view of illumination of public thoroughfares globes of transparent glass are less effective than those of ground glass, because the light is not so well diffused. He does not consider that it is necessary that roads in the open country should be lighted, except as regards certain places such as railway crossings.

Referring to the consideration that blinding lights carried on vehicles are dangerous, he suggests that the use of electric lights has a great advantage in this respect, since it enables the driver to put out his head lamps and light up the smaller lamps not only when passing through a town but also when meeting another vehicle. He points out that the more powerful the head lights are the more dangerous it is for motor cars to pass one another. If motor cars are often provided with lights which are too powerful, other vehicles have often insufficient lights, and it is recommended that a light should be carried by every person in charge of flocks and herds upon the public highways.

ROAD LIGHTING.

By Dr. CLAYTON H. SHARP, New York City.

The author points out that there is an essential difference between the cities and villages of America and those of Europe. His description of American conditions considered from this point of view may perhaps be summed up as amounting to this: The urban area proper is smaller, the suburban area larger, and this suburban area is usually of the scattered or outer suburban character. High pressure gas lighting has not at present been introduced into America on a practical scale, and most of the gas lighting is done with single mantle upright burners. For use in outlying districts a naphtha lamp has been introduced in many localities. The author discusses, in an interesting manner not lending itself to quotation, various methods of distributing the electric current, and he goes on to consider the characteristics of electric illuminants. The metallic flame arc lamp (magnetic lamp) is largely used for street lighting. The author discusses different types of lamp from the point of view of maintenance and deterioration.

Referring to a recent development, the author describes the illumination of thoroughfares by ornamental posts carrying as many as four or five Tungsten lamps apiece, and spaced from 50 to 100 ft. apart, serving to illuminate the building fronts as well as the roadway, and to give a general festive appearance to the street for the purpose of attracting the public during the evening hours. He considers that as street lighting units they are very inefficient, and, being mounted very low, are often an annoyance rather than a help to drivers of fast moving vehicles. In some instances powerful arc lamps are similarly used with results which are extremely garish and unpleasant from the point of view of good illumination. Dealing with the principles of street illumination, the author discusses the question whether good street lighting consists primarily in the illumination of the surface of the street, or whether it is more important to illuminate objects in the street or at the sides of the street, and he comes to the conclusion that the proportion of vertical rays in street illumination should be as high as practical considerations permit. As regards the effects of glare it is pointed out that if street lights are hung in such a way that they shine in the observer's eyes when he is trying to discern some faint object, the effect is most disturbing, and such effects are not confined to arc lamps hung low and the head lights of motor vehicles; distant lights, perhaps as much as a kilometre away, may cause a very objectionable glare effect. It is further pointed out that glare is dependent upon the specific brightness per unit area of the light as well as upon the amount of light received by the eye. The glare effect produced by an arc lamp may be largely mitigated by the use of a diffusing globe which, while diminishing the actual illumination, in many cases causes an increase in the seeing power of the eye and a far greater increase in the comfort of the observer. The author concludes that lamps should be hung well above the field of vision, that the horizontal rays should be suppressed or diverted, and that suitable diffusing media should be employed in order to reduce the specific brightness of the lamps.

The remainder of this interesting report is well worth attention, but demands treatment in the nature of comment rather than the selection of particular passages which would fail to give a satisfactory impression of the nature of the subject-matter. The subjects dealt with are: Illumination values required; height, spacing and arrangement of lamps; globes and reflectors; computation of illumination; effect of reflection from buildings; measurement of illumination; choice of plane of measurement; and illumination diagrams.

THE LIGHTING OF PUBLIC HIGHWAYS.

By P. TUR, Ingénieur en Chef des Ponts et Chaussées, Paris.

In the course of a brief introduction the author touches upon an aspect of public lighting which has received very little attention, pointing out that the weak lamps, spaced far apart, which were provided in the early days of public lighting acted similarly to lighthouses at sea, marking out the direction of the road and so assisting the traffic. Over a length of 38,230 kilometres of national roads in France the total expenditure on lighting is at the most 6,000 francs per annum, and does not extend over a length of more than 7 kilometres. In the last few years, owing to the employment of water power in the production of electrical energy, one sometimes finds small villages in very poor districts sufficiently illuminated to render night travelling safe and easy.

At the end of the year 1911 there were in the streets of Paris the following lamps: Gas lamps, 2,082 burners using from 20 to 200 litres ("cubic litres") of gas per hour; 51,627 incandescent burners using from 40 to 1,000 of such units; and 362 compressed gas burners using from 12,000 to 24,000 "cubic litres." Electric light, 189 incandescent lamps and 1,719 arc lamps. Lusol and mineral oil lamps, 102 of various types. The area of public thoroughfares thus lit up amounts

to 9,350,000 square metres of carriageway, and 7,300,000 square metres of footway.

It is pointed out that the road from Nice to Monaco is lighted throughout by the various parishes through which it passes, and the author is in favour of an extension of the practice to other places where it would be of special advantage. He makes a number of recommendations, especially with respect to level-crossings, and he points out that the use of red lamps at such crossings, which is strongly objected to by the railway companies, has not been attended by any of the feared disadvantages in those cases where such lamps have been employed.

LIGHTS ON VEHICLES.

By E. CHAIX, President of the Touring Committee of the Automobile Club of France.

The author considers that all vehicles should carry lights on roads where the public safety renders it necessary, but he does not consider that such a regulation need be enforced in the case of vehicles on country or agricultural roads which are not used by general traffic. He discusses the question of the best means to ensure that the light of the lantern shall always be visible from behind as well as from in front, and points out that only a few of the more expensive lamps are well designed in the latter respect. If the rear light were coloured, and if coloured lights were not permitted in front, it would always be possible to know in which direction the vehicle was proceeding. In certain cases it is difficult, on account of the nature of the road, to arrange the lamps in a satisfactory manner, and the author proposes to exempt hay carts from the requirement that a rear light should be shown. It is important, the author considers, to insist on moderation as regards the forward ray, but only where the road is otherwise suitably lighted.

METHODS OF LIGHTING THE PUBLIC HIGHWAY.

By J. S. BRODIE, M.INST.C.E., Borough Engineer, Blackpool.

The author points out that there is no statutory duty placed upon highway authorities to light the roads under their charge, but that since the duty is undertaken by practically all (urban?) local authorities, the sufficiency of this lighting is a subject of great importance.

The English unit is a "foot-candle," equivalent to 10·76 of the French unit, the "lux" or "metre-candle."

The author considers that Mr. Trotter's moonlight standard—one-eightieth of a foot-candle—is only suitable for rural highways where the amount of traffic is comparatively small. Absence of glare must be secured by the use of shades, which, the author considers, largely increases the cost, and a due proportion should be preserved between the height of the lamps and their distance apart. Uniformity of colour is also, he considers, a matter of importance. Central control of the lighting and extinguishing of lamps is obtained by the use of pressure waves in the gas mains, or the individual lamp may be lighted at any given hour by means of a clockwork lamp-lighter. In both cases the pilot flame, fed by a by-pass, consumes about $\frac{1}{10}$ cub. ft. of gas per hour.

Electric lighting has made great strides in competition with gas lighting. Compared with the carbon filament the metallic filament gives about three times the quantity of light for the same amount of electric energy, and the life of the lamp is 3,000 hours compared with 1,000 hours for the carbon filament lamp. Similarly the "flame" arc lamp is four or five times as efficient as the enclosed arc.

Lighting by incandescent gas lamps, spaced at 91·7 yds., and giving an average illumination of 5 foot-candles, and with gas at 1s. 5½d. per 1,000 cub. ft., costs about £52·6 per mile of street per annum. Electric lamps, 62 yds. apart, will give the same illumination for about £98 per mile per annum, with current at 4d. per unit. Appendix No. 1 gives particulars relating to the lighting of twenty English towns by gas, and Appendix No. 2 gives particulars of the lighting of ten comparatively small English towns wholly by electricity.

METHODS OF LIGHTING VEHICLES.

By G. W. WATSON, M.I.MECH.E.

The information furnished is based upon the author's experience in the design, construction and operation of motor vehicles, supplemented by data from similar sources.

The author points out that the lighting of motor vehicles should be such as will enable the driver to see far enough ahead for safety and comfort, and will at the same time define the position and approximate size of the car. As regards head lamps, they should be placed as high as possible, since, if the axis of the beam of light is nearly parallel to the surface of the road, it will cause black shadows to show up in the small hollows of the surface, and it is difficult to distinguish these hollows from deep and dangerous holes. Head lamps should, moreover, be attached to the front axle, so that they may always shine in the direction in which the vehicle is proceeding; Article 11 of the Motor-car Act (Use and Construction Order) is not, the author believes, directed against such a device, but against the use of lamps which can be moved horizontally at the will of the driver. As regards tail lamps, the author considers that, apart from the illumination of the number plate, they are not needed, "because, being the fastest type of vehicle on the road," the motor car "is not likely to be overtaken by horse-drawn conveyances." He does not refer to the case of a motor car which is running slowly or is stationary. There is now no excuse for excessive glare from motor lamps, there being many excellent devices for the better direction of the light and its diffusion at the place where needed.

A careful and well-illustrated description of acetylene generators is followed by a similar description of electric lighting systems, and some suggestions as to future developments.

As regards costs, the author takes as typical examples taxicab and motor-'bus lighting sets, and finds that the lighting of the former costs about 0·045d. per vehicle mile with paraffin oil, and that of the latter 0·087d. per vehicle mile with acetylene.

ARTIFICIAL LIGHTING OF COUNTRY ROADS.

By H. MERCZYNG, Professor, Councillor of State, Member of the Russian Council of Engineers, St. Petersburg.

The author points out that in the lighting of country roads there are considerations which do not apply in towns. The problem is to light a long, narrow strip so that traffic can be carried on in safety. The installation should be inexpensive, and should require but little attention. Electric lighting seems to be the best system for country roads, and the author discussed the features of several kinds of lamps with regard to their use in such situations. On account of the high cost of other conductors, overhead naked conductors must be used. For moderate heights creosoted timber may be employed, and for greater heights the use of reinforced concrete is suggested.

DISCUSSION.

The following resolutions were moved by Col. Holden (Royal Automobile Club), and were carried without opposition:—

(1) For the purpose of general determination of methods of lighting, highways may conveniently be divided into three classes as follows:—

(1) Important streets in cities, towns, or other urban areas in which traffic after dark is considerable in volume.

(2) Important suburban roads in the vicinity of large towns.

(3) Rural roads,

and having regard to modern conditions of traffic it is essential that adequate lighting by means of fixed lights should be provided in classes (1) and (2).

(2) As a general principle in the lighting of all highways which require to be lighted by means of fixed lights, the method of lighting to be adopted should be such as will provide an illumination as uniform and free from glare as possible. The amount of illumination and the position of the lamps must be determined with reference to local circumstances.

(3) It would be impracticable that the lighting of rural roads generally by similar methods to those adopted in urban streets or suburban roads, and the lighting of vehicles using rural roads at night is therefore of the highest importance.

Col. HOLDEN (general reporter) submitted his report and resolutions and said that on such an interesting subject it was not surprising that so many papers had been received. There was one from Austria, one from Belgium, two from France, one from Germany, two from Great Britain, one from Russia, and one from the United States. The papers dealt not only with the lighting of the highways themselves by fixed illumination, but they also dealt with the lighting of vehicles using the highways, the illumination produced, and the methods of producing

that illumination. He moved resolution (4*a*), of which notice had been given—viz., "All vehicles, whether standing or moving on the road, shall be compelled by law to carry suitable lights in front and in the rear, or lighted lanterns so constructed and fixed that the beam shall as far as practicable be visible both from the front and the rear."

Mr. H. Gilbert Whyatt (Grimsby) seconded.

M. Mahieu, Directeur du Personnel et de la Comptabilite au Ministere des Travaux Publics, moved, and M. E. Chaix, President de la Commission de Tourisme et de Circulation Générale de l'Automobile Club de France, Paris, seconded the following as an amendment: "All vehicles, whether standing or moving, should carry a light of sufficient power at night, which can as far as possible be seen from the rear as well as from the front of the vehicle."

The Chairman pointed out that the resolution covered exactly what the French delegates wished to move.

Mr. Scott Plummer (County Councils Association of Scotland) moved as an amendment that the resolution read "All springed vehicles," instead of "All vehicles." His reason, he said, was that the County Councils of Scotland had for a long time had the opportunity of making bye-laws for the regulation of traffic, and all of them, without exception, had excluded farm carts and agricultural vehicles, the reason being that in sparsely populated countries like that it was quite unnecessary to have lights upon such vehicles, which were perhaps moving across the road or just a few hundred yards perhaps. Looked at from the point of view of the safety of the public was the resolution likely to have that effect? The motorist should have sufficient lights to enable him to see anything on the road, and he thought if the onus was placed upon the motorist he would see that he did not run into anything which was unlighted.

Sir Archibald Buchan Hepburn seconded this amendment.

The Chairman said he thought Mr. Plummer had overlooked a large class of road-user whom they must consider—the ordinary cyclist—who could not carry the powerful lights carried by the motorist, but who was using the roads to an increasing extent. As an agriculturist, he thought the use of roads at night by farm carts had been exaggerated. He did not think they should pander to people who had not got the intelligence to move with the times. (Hear, hear.)

Sir John Macdonald (Road Board) said surely the carrying of a stable lantern in the case of farm carts crossing the road or going a couple of hundred yards would not be a very great burden on the carter? They could not arrange those things on the basis of having one class of the community treated differently from another. He felt strongly that proper lighting of the roads and vehicles was a matter of vast importance to the community.

Sir Geo. S. Gibb (Chairman of the Road Board) said the whole aim of the resolution was to secure the public safety, and he did not think that would be advanced by carts having no lights. In future the bulk of traffic on the roads at nights would be motor traffic, and danger would arise from the occasional agricultural cart being unlighted. Was there any serious cost or trouble involved by the driver of the cart carrying a lantern?

Mr. Scott Plummer said he was convinced that if the resolution was passed it would not meet with the approval of the Scottish County Councils. He would withdraw the amendment, however, having stated his case.

The resolution was eventually carried, amended as follows:—"Every vehicle, whether standing or moving, shall carry or show a light of sufficient power at night which can, except where specially authorised, be seen from the rear as well as from the front of the vehicle."

The next resolution, moved by Col. Holden, was as follows:—"Every motor-car must carry after nightfall two lighted lamps in front and one at the back. If it is able to move at a high speed it must also be fitted in front with a headlight of sufficient illuminating power to light up the road or path for at least 50 yards to the front. In inhabited places where an ordinary lamp is sufficient to allow the motorists to see their way and be easily seen, the light of the headlight must be limited to that of the ordinary lamp."

An amendment was put forward on behalf of the French delegation to delete the word "also" (which it was explained would mean that three lights would have to be carried in front), and also to substitute "shall be limited" for "must be limited."

Col. Holden pointed out that the use of strong headlights was unnecessary, in addition to being a disadvantage, and was a danger.

The Chairman referred to the increasing use of electric headlights and said motor-cars having to travel more slowly in inhabited places, sufficient power for the headlight was not generated, and motorists preferred to switch them off to save their accumulators. He thought the subject was one that would right itself automatically.

The resolution was carried as amended.

Col. Holden's next resolution was as follows:—"It is desirable that all obstructions across roads, such as gates, and particularly gates at level crossings, shall be painted white and should be clearly lighted at night by means of fixed lights preferably of a red colour to indicate danger."

This was carried amended, on the suggestion of the French delegation, by the deletion of the passage "preferably of a red colour," and the addition after "white" of the words, "and alternate colour of equal sections."

A further resolution carried without amendment read as follows:—"That it is desirable to paint white or indicate by some other method all danger signal posts, direction posts, and other posts, milestones, wheel kerbs, bridge abutments, etc., or other special device, the indication of which would aid travellers or conduce to safety."

Notice of an amendment had been given by the French delegation for the deletion of resolution (*b*), moved by Col. Holden, which was, "that red should be universally adopted as the colour for danger signals."

Col. Holden said it seemed to him a matter of considerable importance that one universal colour for danger signals should be adopted, and the subject should not be allowed to drop out of the proceedings. As there were difficulties in the way of France adopting "red" as a danger signal, he would suggest the resolution be modified to read as follows:—"One and the same colour should be universally adopted as the colour for danger signals."

The conference agreed to the resolution in this form.

M. Chaix, on behalf of the French delegation, moved:—"That it is desirable that each Government should decide as soon as possible on the suppression of the regulation enforcing specially coloured lights for motor-cars," and the conference agreed to this resolution as well as a further one, recommending that drivers of animals on the road should signal their presence at night.

Regarding the last resolution, the Chairman said although the time might not be ripe for such a proposal, the conference might pass the resolution and leave it to subsequent discussion as to how the signal should be made.

This concluded the business at the morning session.

(To be continued.)

Street Lighting in London.—St. Pancras Borough Council have decided to replace the present flame arc lamps in Tottenham Court-road by arc lamps of the latest type, which, it is expected, will materially improve the lighting of the street. The question of improving the lighting of Hampstead-road has been referred to a committee.

Bradford Improvements Bill.—The Bradford Corporation Bill to carry out the large replanning scheme in the centre of Bradford, and make clear the right of the corporation to supply the outside districts with water, came before the Local Legislation Committee of the House of Commons on Tuesday last, when it was announced that the preamble had been proved.

Water Supply in Cornwall.—New waterworks for Phillack, Hayle, Cornwall, were opened on Tuesday last. The cost of the scheme is about £7,500. Water has been brought into the district from a disused adit at Herland Mine, Gwinear, just above Nanspusker. At present the yield is more than 1,000,000 gallons per twenty-four hours; it will never be less than 300,000 gallons, which is more than double the quantity required for the consumers, who now number 3,500. At the source there have been installed two three-throw electrically driven ram pumps with a capacity of 10,000 gallons per hour. These appliances will pump the water to a service reservoir holding 114,000 gallons. Hitherto the public have been supplied from wells and pumps, and in many instances water had to be carried considerable distances. The contractor was Mr. C. L. Duke, of Plymouth.

Office Conversations.

MORE OR LESS IMAGINARY.

[*Contributed.*]

XVI.—A Cycling Retrospect.

No, I don't. In the popular vernacular of these days of universal education I've had some. Car, yes, if my salary 'd allow me to keep it up. Motor cycle—well, doubtful. I get quite enough exercise without pushing a quarter of a ton (or thereabouts) along dusty highways. You don't push them? They take you along? They're supposed to anyhow, I'll allow that; but there are such things as breakdowns. They seldom happen? Well, once a year 'd be quite enough for me. It's alright if a fellow's a bit of a mechanician and handy with the half-hundredweight of tools he carries with him wrapped in a long leather roll. But there, I'm not a mechanician, and as for tools—well, you ask the wife the next time you see her. Ask her to relate to you the very true and particular history of the shelves I put up in one of the bedrooms. Language? Oh, no—at least not loud. Never swear before a woman. But I can call to mind now the relief of a stroll or two round the garden "during the progress of the works." Absolutely wilted up a clump of arum lilies!

* * * *

It comes, then, to the old push bike, and I've made a stern vow never to mount one again. Ride? Oh, yes, I can ride well enough. That's the trouble—I've had too much of it. Some twenty years ago I held the combined office under a rural authority. There was a road mileage of about a hundred, and the district contained a number of scattered villages and hamlets, some of the former rapidly evolving towards urbanity. There was absolutely no means of conveyance in any part of the district, the only railways going through it merely cutting off a corner. My predecessor had gone in largely for trap hire, and the council (it was, of course, a rural sanitary authority then) gave me to understand that it was a practice they didn't particularly care for. I pointed out that I couldn't very well foot it, and that my salary didn't permit of my keeping a conveyance of my own. Available self-propelled vehicles consisted of road rollers and traction engines. There was nothing for it but a push bike, and the council very handsomely offered to pay for the upkeep of one if I would fit myself up. Pneumatic tyres were then in their infancy, and half-a-dozen punctures a day might reasonably be expected. So I plumped for a cushion-tyred machine, and purchased a spanker (as I thought) second-hand, but as good as new, for some £16. It was not exactly a racing machine, weighing as it did just about half a hundredweight, but it looked strong and well built, especially about the spokes, which were direct and nearly as thick as a lead pencil.

* * * *

Picture me now setting off on my day's round. There would, of course, be the usual inspectorial work to do, and certain roads to visit where works were going on, or where some complaint or another had arisen. But this was by the way. In my pocket-book I would have a list of the calls that had to be made during the day, say eleven cases of measles, nine cases of scarlet fever, two cases of diphtheria—it was a shockingly insanitary district—then there would be seven trench bottoms, five foundation concretes, twelve drains, three dampcourses, and three completions to visit. Besides this—— My assistant? No, my boy, not in those days. I did the lot off my own bat. Now? Oh, my old district's carved up into four urban and a rural, and each has a staff of three or four. Soft jobs? No, it's not that they're soft so much as that mine was d——d hard. Well, to continue. Then there'd be special appointments here and special appointments there, and the M.O.H. to call on (and possibly kick my heels in his surgery for an hour), and councillors to propitiate, and—— But there, I think you've gathered enough to understand that my job was no sinecure. And the whole of the work had to be done, winter and summer, on the old jigger—when it wasn't in hospital. Friday and Saturday were spent invariably in paying wages, the men wasting hours in tramping to meet me at convenient points in order to save 7s. 6d. trap hire. Why didn't I cycle? I didn't dare to on those days—I had to walk. You see the men wanted their money—it wasn't much when they got it—and a breakdown 'd have spelt disaster for them and their families.

* * * *

Picture me, then, sweating along on, say, a broiling summer's day, against the head wind that invariably prevails in cycling. Half-a-dozen miles and I was just about knocked, with three or four more stretches of the same length to do before I reached home. In winter it was cooler certainly, but oh, the roads! Made 'em myself? Yes, but not as I'd have wished. Bituminous binders were unknown, and what with dust in summer and mud and ruts and side slips in the winter—there, words won't express it. Then there were the wet days, when the chain would mysteriously tighten, and creak and strain to such an extent that I had to get off and loosen it. And the direct spokes! Five a week was my average of breaks, and each break meant a visit to a repair shop to have the beggar drilled out and a new one put in. The tyres, too! Used to go at the rim—great cuts 9 in. and 10 in. long! No, don't talk to me of cycling. It's a nightmare to me still, and sure as I have Welsh rarebit for supper I spend the night on the old jigger again, smashing spokes, splitting tyres, and pushing up 1 and 1 gradients against typhoons and wild tornadoes. That cycle, sir, cost the council just £22 9s. 3d. in repairs the first year! Object? No, because they didn't know the total. The bills used to go in from month to month, you see. The second year? Thank heaven, there wasn't a second year, or I'd never have been alive to tell the tale. I obtained a nice little urban appointment, at two-thirds the salary, it's true, but with only 6½ miles of roads, and that mostly in side streets off the main road.

* * * *

Never cycled again? Yes, once. On a pneumatic-tyred machine. Had eleven punctures in an hour and three-quarters! In the early days? Quite so. But it was enough for me. Why, a thorn 'd puncture then, and with the roads full of hedge clippings at certain seasons of the year how could a man keep his appointments? No, I've done with it—for ever. It makes me miserable when I think of the number of poor surveyors still push-biking their daily round. Not many left now? That just shows all you know. I could take you to a score of districts not many miles from here where the surveyor spends his day almost like a Prudential death-hunter—call, call, call, the day through, and all his booking and reports done in the evening with the overplus left for the Sabbath. And the wage—it can't be called a salary—about equal to that earned by a very mediocre mechanic. Not educated men? Well, it all depends upon what you mean by educated. Surely a man who can, and does, conscientiously carry out the work he is engaged for is educated so far as that work goes. I was in a little mixed company the other day, and one of the members had at one time in his life been a groom. He left us after a few minutes' conversation, and the talk turned upon him. "A bit of cheek," said one of the company, "for a fellow like that to force himself upon us. Why, he's only a groom." There was silence for a moment. We all felt a bit ashamed of ourselves, some for having mixed with the chap, and others (I am glad to say) for listening to the bounder who had just spoken. "Assuming that the gentleman has been a groom," I said at last, "the only question remaining is: Was he a good groom?"

* * * *

That seems to me to sum up the situation as regards a surveyor. If he's a good surveyor there's no more to be said, to my thinking. Ruskin said, I believe, that a man who knew Latin could break stones better than a man who didn't. And it would be just as sensible to say—Ruskin didn't say this—that a man who could break stones could have written Ruskin's works better than Ruskin, who couldn't break stones. There was a fool once—I have

the pleasure of his acquaintance—who criticised a brother surveyor because he wrote "different to" instead of "different from." As though that had the slightest bearing upon the ability of a man as a surveyor. Don't believe in education? Oh, don't I—but before we argue that point I should like your definition of the word. Argument is not worth twopence when the disputants haven't first arrived at a basis upon which to argue.

ROAD MAINTENANCE IN STAFFORDSHIRE.*

By James Moncur, Assoc.M.Inst.C.E.,
County Surveyor.

The year just closed has been an exceptionally trying one for roads. Last summer was the very opposite of its immediate predecessor—one being extremely wet while the other was unprecedentedly dry. In fact, there was scarcely a month within the financial year that had a single redeeming feature so far as the well-being of roads was concerned, and when such disastrous weather conditions were coupled with increased traffic, and especially heavy motor traffic, it spelt absolute ruin to many of our leading lines of road. Such adverse conditions increased the surface work, and on some sections it was with difficulty that the lengthsmen were able at times to cope with the mud, which was largely due to the abnormal wear. The effect of the traffic on many of the roads was to form depressions or "cups" sufficiently deep to hold water, but not of sufficient depth to take metal, with the result that the road appears worse than it really is. The unfortunate thing, however, is that the fact of water lying in these depressions has a rotting effect, thereby hastening and increasing deterioration of the surface. To fill up such depressions with small chippings is worse than useless, as the fast-moving traffic forces them out and scatters them over the surface. Where depressions were sufficiently deep, patching was resorted to as far as possible, and, as a matter of fact, more was done in this way than the public really cared for, or one would naturally wish, but to aid the patch material in setting, rammers were obtained and used on the more frequented roads with good results.

MOTOR TRAFFIC.

Prior to the advent of self-propelled vehicles it was, as a rule, a comparatively simple matter to build roads of sufficient strength and width to carry the traffic, and to calculate and provide for the annual wastage, as the traffic on most roads varied very little, taking one year with another. This modern traffic has, however, upset all such calculations, and it has also this peculiarity, that neither distance nor gradients restrict or limit it in any way, and the result is that it is passing through the entire length and breadth of the county. Many roads which were built for comparatively light traffic are now being subjected to traffic which is not only heavier than the roads were originally made to carry, but is of a nature entirely foreign to the district through which it passes. This traffic is not confined to light motors, but applies, more or less, to heavy motors and traction-engine traffic as well. The change in the character of the traffic not only means increased cost in the maintenance of the present surface, but also increased cost in widening the metal beds or carriageways to suit it.

TAR-SPRAYING.

Owing to the wet weather, the benefit of tar-spraying as a dust-layer was not appreciated to the same extent as in the previous year. Some surveyors, I understand, contend that the application of tar to the surface of a road prolongs its life, and that from a maintenance point of view the cost of tarring is more than saved, and, if this is so, one would have expected to find a reduction in the cost of roads. The expenditure, however, in most counties is going up by leaps and bounds. This increase, of course, is chiefly due to the changed nature of the traffic, and its increased volume, but when all allowance is made for this I cannot conceive how it is possible, by spending £45 per mile in tarring, to save this amount out of £95 per mile, which is the average cost of the roads that have been so treated in Staffordshire.

As stated in my last annual report, I then failed to see that there was any perceptible difference between the parts that were treated and the adjoining lengths which were not treated, and this during an exceptionally dry season; and now, at the close of an exceptionally wet one, I am bound to say there is not the slightest sign that the tarred lengths will outlive the adjoining lengths which were not so treated. Even assuming that I may be mistaken in this, I think it is obvious that roads now costing us £95 per mile cannot ultimately be maintained at £50 per mile. The total cost, exclusive of £167 for two tar-spraying machines, amounted to £2,222, towards which the Road Board contributed £1,812. The actual cost of the work is somewhat higher than it was last year, which is entirely due to (*a*) increased cost of tar, and (*b*) the repeated interruptions to the work by the wet weather.

BITUMINOUS BINDING.

The Road Board having again agreed to contribute 50 per cent of the cost of binding the macadam with Tarvia over and above that which it would have cost if dealt with in the ordinary way, eighteen different lengths were selected throughout the county on which this bituminous binding was used. The quantity dealt with in this way was 2,276 tons, at a total extra cost of £519. This is equal to an average of 4s. 7d. per ton, and 5½d. per square yard covered. With one or two exceptions the lengths were in every way satisfactory, and have stood remarkably well. I cannot help thinking that the reason some lengths did not prove altogether satisfactory was due to the inclement weather, the metal not being thoroughly dry, while in other cases the temperature was too cold, causing the Tarvia to set too quickly, with the result that some difficulty was experienced when consolidating with the roller in getting the upper interstices of the metal properly closed so as to form a close and compact surface. The work done during the previous year has, however, stood remarkably well, and is showing comparatively little signs of wear, but the conditions during the summer were such as to preclude observations as to its dustlessness.

The outstanding features in favour of Tarvia are—(*a*) it can be used with the best class of road metal, and, consequently, the most durable macadam surface is obtained; (*b*) the coatings are never in a "green" state, as is the case with water-bound macadam, and, consequently, the traffic can almost immediately be turned on to them without any risk of injury being caused by even the fastest traffic; (*c*) atmospheric conditions do not appear to seriously affect it, only that the surface inclines to be a little more slippery during frost. Under ordinary conditions it gives a splendid foothold. It has, however, one drawback, and that is the metal must be perfectly dry when being laid down, which means, of course, that the work must be carried out in fine weather. The metal used varied in cost from 8s. 4d. to 13s. per ton lying on the roadside, and the cost per superficial yard of a 3-in. coating, including rolling and everything, will vary from 1s. 5½d. to 2s. 1d. The same material consolidated with ordinary water binding would cost from 1s. to 1s. 7½d. per superficial yard.

GROUTING PATCHING MATERIAL WITH TARVIA.

Part of the patch metal used on some of the important motoring roads was grouted with Tarvia by way of experiment. The weather, unfortunately, was much against the work being carried out in the best and most expeditious manner, but that which was undertaken was far preferable to patching with tarred material, as it set much more quickly, with the result that the fast-moving traffic did not adversely affect it. It has not, however, been a complete success, as, notwithstanding the fact that care was exercised in laying the material as nearly as possible level with the old surface, it did not remain long so. The patches proved more durable, in some instances, than the remainder of the road, with the result that the traffic in passing over them created depressions on each side of the patches, thus forming two depressions in place of one. This result, no doubt, was accentuated by the abnormally wet weather. I have, however, again set apart £100 in the estimate for the ensuing year to enable similar work to be carried out, and it is to be hoped that the weather may prove more favourable.

COUNTY BRIDGES.

Traction engines and heavy motor cars are also adversely affecting the county bridges. The spandril and wing walls, in many cases, are being pushed out and shaken. Where the damage has not gone too far, iron rods laid across under the road with iron plates on the outside of the walls will probably be sufficient

* Extracts from annual report for year ended March 31st last.

to prevent the damage extending. In some cases, however, buttresses will require to be built, while in others nothing short of taking down the walls and rebuilding them much stronger will suffice.

The cost of maintaining the present wooden fences of bridges, taking one year with another, amounts to a good deal. I would therefore recommend, in cases where the entire fence is to be renewed, that reinforced-concrete posts of a standard pattern be used with three 1½-in. galvanised tubes placed through them. This, in my opinion, will not only be a stronger fence, but a more durable one, besides costing much less in painting, as only the tubes will require to be done every few years. The initial cost will, however, be a little more.

CORRESPONDENCE.

For every ill beneath the sun
There is some remedy or none;
If there be one, resolve to find it;
If not, submit, and never mind it.
—Anon., *circa* 1843.

ROADS IMPROVEMENT IN SCOTLAND.

To the Editor of The Surveyor.

Sir,—In your report of the meeting of the Institution of Municipal and County Engineers held at Dundee on the 6th inst. I regret to find that there are a few inaccuracies in the summary of the remarks made by me after Mr. Roberton's paper was read, which the following observations may help to rectify:—

In the second sentence I am represented to have said that my district had received a grant of £3,000 from the Road Board. The £3,000 which I then referred to was the sum stated in Mr. Roberton's paper as the grant from the Imperial Road Board towards the total expenditure of £7,500 in the Dundee district. The grant intimated for my district this year is £1,000, being 50 per cent of the total cost of the work to be carried out; the previous grant was 87 per cent of the cost of the work then executed, leaving only 13 per cent to be provided from the rates. This year, however, £1,000 must be found by the ratepayers, which, if paid off in one year, would mean an increase of 4½d. per £ on the road rate. The feeling in various parts of Scotland is that many of the improvements to be carried out are really not necessary for local traffic, and consequently that those for whom the improvements are made should bear the expense, not only of carrying out the works themselves, but also the cost of supervision, &c., which in many cases and for various reasons is considerable.

With regard to the filling up of Form 8, I think it only fair to state that under the heading "Other Expenses" I simply entered preparation of plans, sections, and schedules, and supervision without giving the details applicable to watching, lighting, assistance in the office and in the field, supervision and travelling expenses, which in this case were very heavy, as each visit to the works (frequently thrice weekly) involved a journey by road of from 52 to 56 miles.

These being extraneous to the ordinary charges of a surveyor's work, should therefore, I consider, be defrayed by the Imperial Road Board, and a portion of the grants given ear-marked for that purpose.—Yours, &c.,

M. B. McBeth.

Lochgilphead, Argyll.
June 18, 1913.

SURVEYORS' INSTITUTION EXAMINATIONS.

To the Editor of The Surveyor.

Sir,—I have been sufficiently interested in the correspondence recently published in The Surveyor to feel tempted to ask the further indulgence of your columns.

At the examination held in March last I was successful in passing the intermediate examination, and shall therefore be eligible for election to the professional associateship without the necessity of passing the final examination. This fact is simply mentioned to ensure myself against any suggestion of personal bias, for I wish heartily to endorse the sentiments expressed by "Typicus," and to wish him and similarly placed candidates every success in their request for a further test in the typical subject. While complimenting "Asking no Favours" upon the aptness of his cognomen, one can only deplore his sentiments, which seem to be somewhat lacking in that *esprit de corps* which usually characterises the relations of members of the surveying profession. One of his remarks is to the effect that notice of the intended change was given five years ago. Certainly; but this fact has no bearing upon the matter, since it does not make the present position less of a hardship, or more endurable for those who are now feeling the result of this change.

He talks of a cheaply earned P.A.S.I. I believe that my ambition to become a Fellow of the institute is shared by the bulk of those who were candidates at the last examination; but may I suggest to "Asking no Favours" that the two years' waiting to obtain the P.A.S.I. may vitally affect the prospects of many a young assistant?

I trust that, in the interests of the members who have been "referred back" in their typical, the council will give them a further opportunity of qualifying before the October election.—Yours, &c.,

Cedric.

To the Editor of The Surveyor.

Sir,—Your correspondent "Asking no Favours" surely misses the point. What valid objection can be offered to men seeking the intermediate examination in their typical subject who intend to process to the examination for the F.S.I. degree? "Asking no Favours" may know of individual cases such as he quotes, but there are many cases of men who, similarly placed to myself, are out for playing the game, and who desire to see the P.A.S.I. and F.S.I. diploma kept at as high a standard as possible.—Yours, &c.,

Beta.

June 25, 1913.

COUNCILLOR AND SURVEYOR FINED.

CONVICTED OF BRIBERY AND DEBARRED FROM OFFICE.

The trial took place at Kent Assizes on Monday, the *Daily Chronicle* reports, of William Richmond Warlow, engineer and surveyor to the Milton Regis Urban District Council, for corruptly giving to Charles Downey Richardson, then a member of the Whitstable Urban District Council, two sums of £10. Richardson was charged with corruptly receiving the money.

The case was a sequel to an action heard in Sittingbourne County Court. According to Mr. Travers Humphreys, who appeared for the Treasury, the Whitstable Council decided in 1911 that engineers should be invited to send in competitive schemes for drainage. These were to be sent in under a nom-de-plume, the idea being that members of the council would not know the names of the competing engineers. Six schemes were received, including one bearing the nom-de-plume "W. Richmond." This was accepted, and it was subsequently announced that the sender was the defendant Warlow. A month later a cheque for £10 was sent by Warlow to Richardson.

Difficulties arose in connection with the site, and an amended scheme was found necessary. On February 13, 1912, Richardson received a further cheque for £10 from Warlow. On that date, also, Warlow's amended scheme came up for consideration, but was postponed. At a special meeting of the council, when the chairman ruled that it was out of order, Richardson protested very strongly, and at a subsequent meeting moved, unsuccessfully, that the ruling should be rescinded.

Warlow brought an action for the return of the £10, and Richardson alleged that it was given as a thank-offering.

Richardson now said, answering Mr. Thorn Drury, his counsel, that Warlow said that if witness interested himself in getting him out of the difficulty with regard to the site he would send the second £10, which had been promised after the scheme was accepted.

Warlow said the money was advanced to Richardson as a loan.

Defendants were convicted in respect of the second sum of £10. Richardson was fined £10 and ordered to refund the £10 paid to him. The Judge declared him incapable of holding public office for seven years. Warlow was fined the £20 paid, and ordered to forfeit the office of surveyor to the Milton Council. He was also declared to be incapable of holding any public office.

Roads Improvement Association.

CONFERENCE IN LONDON.

The first conference of the Roads Improvement Association took place at the Royal Automobile Club, Pall Mall, London, on Saturday afternoon last, when two papers, "The Trend of Modern Road Construction," by Colonel R. E. Crompton, C.B., M.INST.C.E., and Mr. H. Percy Boulnois, M.INST.C.E. (vice-chairmen), and "The Organisation and Work of the Branches of the Roads Improvement Association," by Messrs. E. S. Shrapnell-Smith (hon. treasurer) and Wallace E. Riche (general secretary), were read and discussed. Mr. Robert Todd presided over the gathering.

THE TREND OF MODERN ROAD CONSTRUCTION.

In the course of their paper Colonel Crompton and Mr. Boulnois remarked that the days of neglect of our roads were over: a new era had begun. The First International Road Congress, which was held in Paris in 1908, demonstrated the enormous interest taken in the subject by people from all parts of the civilised world, and the results of that congress had been far-reaching in their influence and effect. The Third International Road Congress would be no less useful than its predecessors, and the papers and reports submitted would show the rapid and remarkable progress which had been made in scientific and practical applications to the construction of roads since the year 1908. The Roads Improvement Association had been well forward in this movement. It had watched over the interests of road users, and it had, by judicious interference, frequently prevented mistakes being made, and by making use of its influence on many occasions had been the means of assisting in many improvements which had been carried out.

What of the roads of the future? In what directions would the improvements in their construction and maintenance develop? In these days of mechanical transport of passengers as well as of goods we heard on all sides of the immense damage done to our roads by this new form of locomotion. It had been suggested that all mechanically propelled vehicles should be heavily taxed in order to pay for this damage, but the unfairness of confining this taxation to only one class of vehicle was obvious, and could only have the effect of retarding the progress of modern development and crippling the industries of the country.

It would appear from the fact that such suggestions were made in the columns of the daily press that the public had insufficiently studied the real difficulty of the subject. This difficulty was that whereas on a railway one authority controlled not only the railway track but the vehicle which rolled over it, in the case of the ordinary road the vehicles were owned and maintained by various persons, and the roads were owned and maintained by another authority with very little, if any, control over the vehicles; and, unfortunately, hitherto the two interests had been considered antagonistic.

WHEEL WIDTHS.

That should not be: the mechanically driven vehicle had come to stay, and it should be to the interest of the road owner and constructor to make the roads suitable for the altered conditions of the traffic, and for the road user to take all the care he could not to injure unnecessarily the surface of the roads. In this connection it had been frequently urged that wheels of larger diameter should be used for the heavier class of motor wagon than that generally adopted, which was only about 41 in. The effect of steel wheels of this small diameter was disastrous to a road, and an increase in this diameter appeared to be most desirable. What then should be the method of construction of the road of the future?

It had been stated that the bicycle required a road as smooth as a billiard table; a traction engine or motor wagon required a solid stone causeway; a horse required a soft and easy foothold; and a pleasure motor a straight track all to itself.

In addition to this the pedestrian required a footpath for safety and an absence of dust, and the occupiers of the adjoining premises shared in this latter requirement, and also that there should be the minimum of noise. The ratepayer, who paid for the road, required the construction and maintenance to be as cheap as possible. These are some of the numerous problems that confronted the modern road engineer. How were these problems to be solved?

The earliest endeavours to meet some of these difficulties were by tar painting or tar spraying the existing road surfaces, and in most cases with remarkably good results. The dust was diminished, and the surface of the road was in a great measure improved and preserved. There had been, and were still, failures in this direction; but, on the whole, the successes had been greater than the failures, and as a palliative there could be no doubt that this process was a step in the right direction if proper precautions were taken in the selection of the tar and its application.

But, of course, useful as such road treatment had been, something more is required than mere surface tarring of the existing water-bound "macadam" roads, and a very large number of special methods of construction had been introduced during the past five years. It would be impossible in a short paper to give a list of these various methods; suffice it to say that mainly all of them were on the lines of the introduction of a bituminous material to bind the stones together which form the road, instead of the now old-fashioned method of binding them with sand, dirt and water.

INTERSTITIAL WEAR.

It had been found that the traffic not only wore the surface or crust of the road, but produced a movement among the stones themselves at some depth below the surface, causing a rocking action of the stones and producing an inter-attrition or rubbing which gradually wore off the angles of the stones until they were of a rounded shape and had no interlocking or power to resist movement among themselves. This was the main cause of the excessive mud on an ordinary water-bound road, and was also the chief cause of the destruction of such roads.

It was to meet this interstitial wear and to confine it so far as possible to the upper surface that the bituminous-bound road had been introduced. The various methods that had been adopted might be divided into the following groups:—

(1) The ordinary water-bound macadam road with surface tarring or painting, already referred to, and the introduction of various patented preparations to take the place of ordinary tar for this purpose.

(2) Tar-macadam, which consists of broken stones of various sizes, thoroughly dried, then coated with tar or other bituminous mixture (either by machinery or by hand), and then laid in the road and rolled into place.

(3) Tar slag, where slag from blast furnaces is used instead of stone, the tar being applied when the slag is at great heat, thus ensuring penetration.

(4) Tar grouting, where the tar or bituminous mixture is poured on to and into freshly laid dry macadam after it has been laid and rolled.

(5) A modification of the above where a special standardised pitch or bituminous mixture is used instead of tar.

(6) A further modification of the above where a layer of very fine "tar concrete" is laid, and dry macadam is spread on the top and rolled into the tar concrete.

Some of the above processes had been very successful, and many variations of these had been, and were being, tried with varying success.

Another point also arose in connection with road construction, and that was the desirability of adding a slight elasticity or resilient action in our roads. It was well known that the elasticity of the modern wheel had played a very important part in helping forward the introduction of mechanical transport, and a similar elasticity or resilience of its surface was necessary for the roadway of the future if it were to be able to stand up against the destructive forces which led otherwise to its permanent distortion, deterioration and destruction. In addition to this, it was evidently desirable that the vehicle using the road should not be subjected to the violent reaction

of an improperly constructed road surface. Here we saw the interests of the road maker and the road user were identical.

THE IDEAL ROAD.

It has been suggested that the ideal road of the future should resemble, if possible, the carriageway under the entrance to Euston Station, where, for many years past, thick rubber sheets had constituted the road surface, primarily, no doubt, to deaden the sound of passing vehicles. Such a roadway would be ideal as being thoroughly resilient, absolutely waterproof, noiseless, non-slipping, and of excellent wearing capacity; but, of course, the price would be prohibitive, even if the price of rubber fell to 6d. a pound, of which there seemed to be no possibility at the present moment. We must therefore look elsewhere for some material which could be substituted for rubber, and the nearest approach, apart from slipperiness, to such a pavement would be sheet asphalt composed of the natural rock asphalt.

Such a material had been likened to a macadam road in which the particles of stone were of an extremely minute size, and were prevented from rocking and consequent interstitial wear by the interposition between such particles of a very thin film of bituminous cementing matter, and as water was unable to penetrate it did not suffer in the same way as ordinary macadam by the "wet grinding" of the particles of stone of which it was composed. Such a road surface appeared to be almost ideal, but the cost of this material would be too great for general use, and the surface had been often condemned as unduly slippery for horse traffic under certain climatic conditions.

Attempts had, however, recently been made in this country and America to introduce a sort of artificial asphalt or sheeting by binding together mixtures of graded sand with a small proportion of limey matter and with the purer bitumens found in various parts of the world, notably Trinidad, California, Venezuela and Mexico. A further improvement on these lines was introduced by an English company about five years ago, and had been tried with considerable success on the Thames Embankment and elsewhere.

The points to be aimed at in producing a road surface which shall be durable, sufficiently resilient, non-slippery, waterproof, and not excessive in cost, were that the road should be built up on a foundation or "strength crust" sufficiently strong to carry the weight of the traffic, and to distribute the weight of the wheels over the subsoil so as to avoid any depression or sinkages. On this "strength crust" a wearing surface or crust must be laid which should, if possible, resemble sheet asphalt. In other words, we should aim at making the "strength crust" or foundation capable of supporting the weight of the traffic, and the surface or wearing crust should be capable, so far as possible, of resisting the abrasive action of the traffic and of keeping out the water.

The originators of this system claimed that this street pavement must consist of sand, so graded and interlocked that when continued and cemented together by a "bituminous cementing binder," combined with a fine lime powder called by our American friends a "filler," the surface resembled a natural gritty rock of a nature sufficiently resilient to enable it to recover the temporary deformations caused by the wheels rolling over it, and that this condition was best obtained when the grading of the sand was so contrived that the grains approached one another so closely that the interposed elastic film of bitumen and filler combined formed from 20 per cent to 30 per cent of the whole mass. It was claimed that such a road surface or carpet could be laid at a reasonable cost, and that the surface was sufficiently gritty to prevent undue slipperiness.

The authors, in conclusion, stated that in their paper they had not attempted to deal with roadways applicable to streets of heavy traffic, where wood pavements, stone setts, or similar descriptions of materials were necessary. There had been considerable improvements in these directions, but the paper had endeavoured to deal only with the trend of the movement for improved roads suitable for rural and suburban traffic. It was evident that considerable advances had been made in the improvement of road construction, and it could not be denied that the Roads Improvement Association had been to the forefront in assisting in this direction.

In a further statement Colonel CROMPTON remarked that the problem of dealing with the roads in and about the large towns was not a difficult one, and had, he thought, already been worked out; the real problem was, What was to be done with the country roads? In the past he had been accused of being unduly optimistic, but as time had gone on it had been found that the materials at their disposal for road work had been largely supplemented by products of an insoluble nature, which, made use of as a binder, had been found of greater suitability than the tar which they had been obliged previously to employ. It would be impossible to say what eventually would be the cost of the road surfacing to which attention had just been drawn in the paper; with the creation of a demand it was, of course, likely that the price would rise, but the supply was such that the probability was it would continue to be as cheap as coal-tar pitch for many years to come. It was a material that could be put down by the ordinary tar-laying appliances, and it seemed to him, without being too sanguine, that what he proposed could be accomplished at a cost little in excess of that of surface tarring. The surveyor at Epping—where an experimental stretch of the carpeting had been laid—had raised the objection that the process involved the use of twice the quantity of sand required with tar, but his (Colonel Crompton's) contention was that if it took twice as much sand, it was going to last twice as long, and that it was probable the use of four times the quantity of sand would result in a proportionately longer life for the material. He claimed that the carpeting could be put down anywhere at one-half the cost of wood paving, and that being so he thought they might look forward with confidence to its adoption on long lengths of road in the very near future.

DISCUSSION.

Mr. W. WORBY BEAUMONT spoke of the necessity for insisting on larger diameter wheels on vehicles carrying heavy loads. An increase of tyre width, he suggested, did not overcome the difficulty, because on some of the newer roads the camber was so great that only a part of the width of the wheel came into actual use. Colonel Crompton had alluded to the extra quantity of sand that could be absorbed by a material such as he had described, and on that point he would like to know why, when roads were being made near London, gravel, made up partly of large pebbles, was used instead of a sand, which was more likely to combine with the tar used in the operations. Effective absorption of the tar was prevented, for the pebbles were seldom crushed by the traffic, but were pushed aside, each one taking with it a lump of the tar. It seemed a pity that materials of that kind were used to the detriment of the object in view. Concluding his observations, Mr. Worby Beaumont directed attention to the importance of maintaining roads following the process of construction, this, in his view, being too often forgotten or neglected. Now that they had roads which admitted of easy patching, it seemed to him that more men should be employed on the work, and arrangements made that as soon as a small depression occurred in the surface it should be dealt with. The cost per year of a road—however well made it might be—was enormously increased by the neglect of that simple precaution, and it could be correspondingly reduced by the policy of immediately carrying out repairs as they became necessary.

Mr. T. WINN, chairman of the Highways Committee, Leeds, stated that the whole of the 550 miles of road under the control of his council were until quite recently water-bound. Now, however, their methods were based on the specification of the Road Board, with results which had been so far satisfactory. He admitted that the initial cost was high, but he believed that there would be compensating benefits in the future. For dust prevention they had used calcium chloride with success; the treatment was effective for about two months, and the cost had worked out at only about ¼d. per yard.

Captain H. P. DEASY observed that Colonel Crompton's statement that the town roads problem was solved was interesting. But he would like to have a little information as to why granite setts had been discarded by him in his ideas. His reason for asking for that was because he had seen in London and in Germany and Austria some excellent stretches of road paved with granite setts. The initial outlay was, he realised, greater, but he felt there must be advantages attached to their use; for example, their life must be considerably greater, and they could

not be so slippery for horses in frosty weather. There was an experimental section in Holborn, and he had repeatedly gone along that thoroughfare without looking for the paving in question and had been unable to detect any difference in the running of vehicles at any point. While public attention had been constantly directed to tar and bituminous construction, this particular class of paving had been neglected.

Dr. H. Vallance (Lewes) asked what would be the cost per yard of Colonel Crompton's material, and whether a foundation would be required if it were adopted for a road which, owing to its low-lying situation, was waterlogged.

Mr. A. Lyle Rathbone (Manchester) said he had no hesitation in asserting that in towns like Liverpool and Manchester nothing short of granite setts would stand the enormous loads put on the roads. In the neighbourhood of the docks at Liverpool loads of 50 tons per axle were common, and only granite setts, properly founded on concrete, would hold together for any length of time. The length of a road on the line of docks built in that way was estimated at eighteen years, but constant attention was necessary. The cost was 10s. per super. yard, excluding the concrete foundation. On other roads where the traffic was not so heavy a 4-in. cube was used, these being founded in a similar manner on 6 in. of concrete. The life of these depended very largely, of course, on the traffic, but they had granite sett roads in Liverpool that were apparently as good now as when they were put down forty years ago. He knew Mr. Boulnois had a very intimate knowledge of Liverpool roads, so he preferred to be excused from giving a definite figure. [Mr. Boulnois: You are perfectly correct, so far.] The main difficulty in Lancashire and Cheshire was that the different authorities, while they had the same heavy traffic to deal with, had not the same funds at their disposal for the reconstruction of roads. The smaller authorities, in particular, were at a disadvantage in the matter of borrowing money as compared with the large cities, and even if they were able to obtain the necessary loans, the sinking fund and interest would be too much for them. It was they, more than the great cities, who required the assistance of the Road Board, and it was to the needs of such bodies that the Roads Improvement Association should direct their special attention and bring to bear what influence they were able in helping to secure the improvement of the roads controlled by these authorities.

Mr. E. Shrapnell Smith asked Colonel Crompton what steps were being taken to get the proper measure of heavy traffic. He was in agreement as to the necessity for an increase of wheel dimensions; at the same time he pointed out that with the advent of smooth roads one of the elements of destruction—namely, the pounding of the wheels—would disappear, and the relatively small diameter wheels would do no damage.

Colonel Crompton, in replying upon the discussion, remarked that the introduction of new ideas was very often resented by those who had done very well for years with the methods at their disposal. But these new ideas had to be considered. As to the use of gravel, he found no fault with a man for using that, but his view was that it would be far better not to use it, and that nine out of every ten surveyors would not use it from choice. He would prefer that Mr. Boulnois should answer the questions as to granite setts. He (the speaker) had just returned from Madrid, a city which was largely paved with granite setts, and he had found that a short drive over the roads there in a horse-drawn vehicle was anything but a pleasurable experience. He thought they associated granite setts with great durability, but it was durability at the expense of one's personal comfort, and he had always considered that the proper place for the adoption of such paving was in cities like Liverpool and Manchester. As to the definitions of traffic, it was easy enough to talk about "light" or "heavy" traffic; heavy traffic might mean the passage of a few extremely heavy vehicles or of a large number of comparatively light vehicles. "Intense" might more suitably meet the case of continuous heavy traffic, and the French word "circulation" a stream of lighter traffic. As to the system of road surfacing which he had advocated, the cost of that was going to be very small, and so well within the reach of every authority that it promised to be extensively adopted.

Mr. Boulnois stated that the Holborn and Tottenham Court-road paving was Grey Royal granite, a particularly good class of granite, as little slippery as granite could be. The reason for the good surface it presented was simply that each block of stone was tooled and laid chock-a-block. It was expensive, of course, owing to the labour put on it; but what was the actual cost he could not say. His experience at Liverpool had shown him that nothing but granite was capable of withstanding the traffic on the line of docks and in the principal streets there. The granite used was of a peculiarly hard description—a syenite in fact—and yet he had had brought to him setts which had been absolutely split in two by the traffic. In considering traffic the French had a way of counting collars. The only satisfactory way, however, was to place against each vehicle an approximate estimate of its weight, and then calculate from that the weight per yard. In Liverpool, on the line of docks, they ascertained that the amount of traffic was no less than 350,000 tons per yard width per annum.

THE ASSOCIATION'S BRANCHES.

The organisation and work of the association's branches were discussed by the meeting, following the presentation of the paper by Messrs. Shrapnell Smith and Wallace Riche. These branches are being established throughout the country, so far as the resources of the association admit, and ten are already in existence in the chief centres of England and Wales. The branches are maintained from headquarters, and all routine work, so far as possible, is done from the head office, leaving the various branches to undertake such work as can be done efficiently by local representatives, and to formulate the constructive programme of the local road-users' requirements.

CONFERENCE DINNER.

At a dinner in connection with the conference at which the guest of the evening was Mr. W. Rees Jeffreys, formerly hon. secretary of the association, and now secretary to the Road Board, Mr. Robert Todd presided, supported by Colonel R. E. Crompton, C.B. (consulting engineer to the Road Board), Mr. H. Percy Boulnois, M.INST.C.E., Dr. H. Vallance, Dr. J. G. McLanahan, Mr. E. S. Shrapnell Smith, Mr. A. Lyle Rathbone, J.P., C.C. (Manchester), Councillor T. Winn (chairman of the Highways Committee, Leeds), Mr. A. W. Trevarthen (Birmingham), Mr. John T. Campbell, Alderman Jessop and Captain H. P. Deasy.

The Chairman, in proposing "The Movement for Improved Roads and the Third International Road Congress," remarked that the worst thing that happened to the roads of this country was that the railways came into existence at the time they did, for it had been previously realised that the roads ought to be improved, and they were being levelled up and rebuilt. Now we came back to the stage we were at about seventy or eighty years ago. The need for road improvement had been again recognised, consequent upon the traffic on the roads. The work of the Roads Improvement Association started before there was a motor in the country. When the motor came there was an increased necessity for looking to the upkeep of the roads, and by the course of education, of which they had been the originators, they had paved the way for the creation of the Road Board. If there had been no educational work by the association there would not have been any Road Board at the present time. The idea of the association was that the roads should be under a central authority; for it was perfectly obvious that a country authority which had to administer a section of main road like the Great North Road was not financially able to keep the roadway in a condition to carry the traffic. Central responsibility, they maintained, was bound to come. They had not reached that stage yet, but he had not the least doubt that the Road Board would take more power to itself as time went on.

Mr. W. Rees Jeffreys, in response, thanked the company for the kind manner in which they had received the toast. The subject of roads and road improvement was one to which he had devoted the best years of his life. It was over twenty years since he first joined the council of the Roads Improvement Association. At that time he was very enthusiastic, and was very dissatisfied with the procedure of the association and its policy. He then made the acquaintance of the chairman, Mr. Robert Todd, and that acquaintance had deepened into friendship, and he would say that he knew no one whom he respected

more, or for whom he had a deeper affection. He had fought many battles in which Mr. Todd and himself had been ranged on opposite sides, but in connection with roads and road improvement they had always been at one, and fought shoulder to shoulder. After a time he induced the council of the association to drop niggling and adopt his views; they went into the larger question of roads—to experimental work on the technical side, and legislative action, with a view to establishing a central road department. He thought the association as a body might congratulate themselves that, though small in numbers and with very inadequate financial support, they had secured changes and improvements, and been able to record a progress which bodies with a much larger membership, a greater financial backing, and with bigger names in their membership, had not been able to show. Their first experiment was carried out in 1903 at Farnborough with £100 which Mr. Leo Strachey gave him for the purpose. It was with Californian oil, before the motor car had forced itself upon the public, and was a failure. In 1907 they organised the trials with tar in Surrey, Berkshire and Middlesex. These proved a great success, and from that period dated the entire movement of treating roads with bituminous materials, a movement which was now finding expression in the transfer of the whole of the roads of the country from water-bound material to bituminous binding. Great Britain had a larger mileage absolutely as well as proportionately of roads bound with bituminous materials than any other country in the world. We had not the straightest roads; the roads of France and Germany beat us in straightness and alignment; but as regarded their condition for carrying the traffic cast upon them our roads were superior to any other roads in the civilised world. They were the strongest roads, and, as he had said, were not to be beaten in their adaptability for heavy vehicles, for public service motor vehicles, and for the conveyance of goods for the service of the community. This had resulted very largely from the influence exercised by the Roads Improvement Association in co-operation with some of the most far-seeing of the county surveyors and borough engineers of the country, in the steps they took in 1907 when they carried out the trials he had referred to. We were one of the few countries with no central organisation with respect to roads. The management was left in the hands of a multitude of local authorities, numbering 15,000 or 20,000 in the last century. When the association started their campaign there were 2,000 higher local authorities, all independent, with no central control to inspire, assist, advise, stimulate or supervise. The seed which the association planted, or the changed atmosphere they created, was to insist upon a recognition of the fact that before any great progress could be made to bring roads up to modern conditions it would be necessary that the State should come to the assistance of the local authorities. As a result, upon the initiative of the Chancellor of the Exchequer, the Road Improvement Funds Act was introduced and passed, creating a central authority, which had placed at its disposal £1,250,000 per annum, to be used for the improvement of the roads. He did not want to take any credit, but he ventured to think that the money was going to secure far more than the earlier policy of this association. A general improvement in the roads was now being brought about. It was a slow thing. He who had passed through the mill knew how slow it was to bring about improvements. Parliament was jealous of dividing authority, therefore the Road Board was given no powers of initiative. It could only act when the local authority made application, and if the local authority did not make application the board had no jurisdiction. They were told that the Road Board was hoarding money. It was quite true that the Road Board had a large amount of invested funds, but before it could promise a grant it had to have the money in its coffers. If a grant was arranged for the board had to lay the necessary money aside, and it could not be used for any other work. The money, in fact, had to remain while the local authority matured its plans and entered into contracts, and this was always a slow business. For this reason the Road Board must always have a considerable sum invested. The International Road Congress, to which the speaker made brief reference, occurred at an important period, for, as regarded roads, we were in a state of transition. The congress was bound to have a great influence upon road construction in this country and in all parts of the world by forcing essentials to the forefront and compelling their consideration, and he was looking forward to continued progress in road improvement as a result of its deliberations.

"The Roads Improvement Association and Its Branches" was proposed by Mr. E. S. SHRAPNELL SMITH, who alluded to the fact that the association's *locus standi* had now been recognised in Parliament and at official inquiries. Speeches in response were given by Mr. A. LYLE RATHBONE, J.P., C.C. (Manchester), Councillor T. WINN (Leeds) and Mr. A. W. TREVARTHEN, all of whom dwelt upon the sound, practical work of the association in creating and promoting a demand for road improvement.

Colonel CROMPTON submitted "The Chairman," and dwelt upon the combined qualities of tact, temper and judgment which had enabled Mr. Todd to sustain with success the main efforts of the association.

A brief acknowledgment by Mr. TODD concluded the proceedings.

CONSULTING ENGINEER'S CLAIM.

JUDGMENT AGAINST THE RHYL URBAN COUNCIL.

In the Chancery Division, last week, Mr. Justice Joyce delivered judgment in the action brought by Mr. William Tregarthen Douglas, a civil engineer, of London, against the Rhyl Urban District Council for £1,087, alleged to be due for preparing a report as to the value and cost of widening and extending Rhyl pier for submission to the Local Government Board. The defendants alleged that if the scheme for the purpose of which the report was prepared did not go through, Mr. Douglas agreed to accept 150 guineas.

His lordship said he saw no reason to disbelieve the evidence of Mr. Douglas with regard to the alleged agreement by him to accept 150 guineas. There had been an extraordinary conflict of testimony on the point, and the circumstances were peculiar; but it appeared to his lordship that he must rely on the contemporary written documents of what happened after the resolution of the council to employ Mr. Douglas. He did not know, but if the minutes of the council did not include a record of conversation which took place with reference to the acceptance by Mr. Douglas of 150 guineas in case the scheme did not go through, that was the fault of councillors. It had been contended for the defendants that the council acted in this matter of the pier under the provisions of the Public Health Act, and as the contract of employment was not made with Mr. Douglas under seal, the plaintiff was not entitled to recover. He thought that the transaction did not come within the provisions of the Public Health Act, and that there must be an order to pay the plaintiff on a quantum meruit basis.

The amount due to the plaintiff would have to be determined by a referee to be agreed on between the parties, or, in default of agreement, by an official referee.

Waterproofing of Cement.—One of the largest orders ever placed for a cement waterproofing material has been received by Kerner-Greenwood & Co., King's Lynn, for their patent powder Pudlo. It is for the new reservoir in Winnipeg, and over 44 tons will be used.

Road Board's Annual Report.—In the House of Commons on Monday the Secretary to the Treasury was asked the cause of the delay in the publication of the report of the Road Board for 1912-13, and if it was intended to publish it in time for discussion during this Session. Mr. Masterman said he did not think there had been any unusual delay. Last year's report was presented on August 1st. The report could not, of course, be written until the financial year was ended, and it contained accounts for that year which had to be first made up and then audited. He understood that it was now under consideration, and it would be presented as soon as possible—he hoped before the end of the Session.—Statistics have been issued showing the activity of the board since its formation. The total income has been £3,457,021. The total payments have been £844,496, divided thus: Grants, £696,849; loans, £128,239; and salaries, £19,407. The balance in hand at the bank is £14,624, and the investments which have been made amounted at cost, on May 31st last, to £2,602,527. Of this sum it is stated that grants amounting to £2,461,045, and loans amounting to £800,067, have been "definitely promised."

Law Notes.

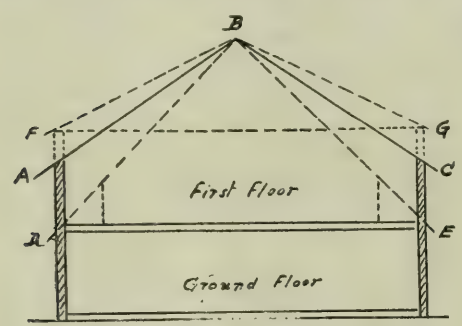
Edited by J. B. REIGNIER CONDER, 11 Old Jewry Chambers, E.C., Solicitor of the Supreme Court.

The Editor will be pleased to answer any questions affecting the practice of engineers and surveyors to local authorities. Queries (which should be written legibly on foolscap paper, one side only) should be addressed to "The Law Editor," at the office of The Surveyor, *accompanied by the writer's name and address, but correspondents who do not wish their names to be published should also furnish a "nom de plume." Where necessary, copies of local Acts or documents referred to should be enclosed.* **All explanatory diagrams must be drawn and lettered in BLACK ink only, and in such style as to be fit for direct reproduction — i.e., without re-drawing or amendment.** *Unless these conditions are complied with we cannot undertake to reply to queries.*

QUERIES AND REPLIES.

In order to avoid confusion querists are requested to use distinctive words as noms de plume. *The letter* X, *combinations such as* X.Y.Z., *and words such as* "engineer" *and* "surveyor," *should never be used.*

Building By-laws: Room in Roof.—"X. Y." writes: A local authority contends, under a section of their local Act (copy of which is forwarded), that a "room in the roof" means a room wholly in the roof, as in the case of the first-floor room shown on accompanying drawing roofed as D B E. Builders, on the other hand, seek to maintain that a room roofed according to A B C is a room in the roof, and that it is therefore only necessary to make such room 8 ft. in height over half the floor area. In the view of the local authority this room is only partially in the roof, and that under the section of the Act referred



to the ceiling must be a full 8 ft. 6 in. high over the whole floor area of the room, as shown by the roofing F B G. Your opinion is desired: (1) As to whether a "room in the roof" under this section must be wholly in the roof? (The Act contains no definition bearing on the point.) (2) Whether the Local Government Board have at any time expressed an opinion on this point? (3) Whether any "cases" bearing on the point have been decided in the Law Courts? (4) What is the latest practice of the Local Government Board in their approval of by-laws with reference to their requirements for height of such rooms in urban areas?

[copy section of local act.]

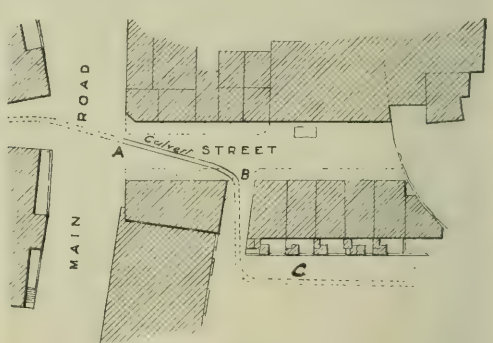
Height of Rooms. 27.—In every new building every room used as a dwelling or sleeping room, except rooms in the roof, shall be in every part thereof 8 ft. 6 in. in height at least from the floor to the ceiling, and every room in the roof so used shall be at least 8 ft. in height from the floor to the ceiling through not less than one-half of the area of the room. Provided always that this section shall not apply to rooms or parts of rooms which are additions to or alterations of buildings existing at the time of the passing of this Act.

(1) In my opinion, in the absence of anything to the contrary in the Act, the expression "room in the roof" must be read as meaning a room wholly in the roof. Had there been a contrary intention one would have expected the clause to run, "except rooms *wholly or partially* in the roof." (2 and 4) I have no information on these points. Perhaps some reader of these notes may be able to supply same. (3) I am not aware of any cases on this particular point.

Main Road: Watering Troughs.—"Pax" writes: In this (rural) district the rural district council contract with the county council for the repair and maintenance of the main roads, the county council repaying the actual expenditure incurred, plus 5 per cent for establishment charges and use of tools. On the side of the main roads (old turnpikes) there are several horse watering troughs, the origin of which is shrouded in mystery. The supply pipe to one of them has now gone wrong, and the question of liability for repair has arisen, the landowner declining any responsibility. It appears that the district council's men have previously repaired this pipe, and the cost has been charged to the county council as "labour." Does this, in your opinion, make the district council, or through them the county council, liable? My own opinion is that, being a "public watering place," the cost of repair is chargeable to the contributory place in which it is situated, but I shall be very pleased to have your opinion through the columns of The Surveyor.

Under sec. 64 of the Public Health Act, 1875, all then existing public cisterns, pumps, wells, reservoirs, conduits, aqueducts, and works used for the gratuitous supply of water to the inhabitants of the district of any local authority vested in the authority, who were empowered to cause the same to be maintained and plentifully supplied with pure and wholesome water. It appears to be doubtful how far the section casts a duty on the authority (see "Lumley's Public Health Acts," 7th edition, page 140); and I do not think the fact of the county council having been charged with the cost of repairing the pipe would of itself make the county council or the district council liable. But I agree that in a rural district the expense would be a "special expense," chargeable to the contributory place.

Private Street Works: Watercourse under Street.—"Acme" writes: (1) Notices have been served, under sec. 150 of the Public Health Act, 1875, upon the owners of property fronting street shown on the accompanying plan to pave and complete the ground. It has been ascertained that a culverted watercourse runs under this street, as marked on the plan with the letters A and B, and thence under the main road or public highway to the river. If, in executing this work, it should be found necessary to repair this watercourse, can the cost be properly



charged upon the frontagers as part of the expenses of making up the street? (2) One of the owners, more than twenty years ago, fixed a weir near to the letter B to dam up the water to be used for condensing purposes in connection with his works, and in times of heavy rain this obstruction causes the water to overflow on the land above and flood the adjoining property in the direction of the dotted line C. (*a*) Can the owner be called upon to remove this obstruction? And (*b*) who is liable for the repair of the watercourse if the street is not declared a public highway?

(1) Under this section the surveyor has to prepare plans and sections of the intended work, and the notices to the frontagers have to describe the mode to be adopted and the materials to be used in carrying out the work. If the notices are not complied with the authority may execute "the works mentioned or referred to therein." I gather that the works mentioned or referred to in the notices do not expressly include any repairs to the watercourse, and under these circumstances I think it is very doubtful whether the expenses thereof could be recovered from the frontagers. (2) [*a*] The weir having been erected more than twenty years ago, the owner may have acquired a right by prescription to dam up the water so as to prejudice other riparian owners; in which case he could not be called upon to remove the obstruction. In order to establish such right he would have to prove twenty years' enjoyment as of right, and without interruption submitted to or acquiesced in for a year. [*b*] Apparently there would be no liability on anyone.

Highway: Extent.—"Rural" writes: An unenclosed road which is upon one side about 3 ft. above the level of the fields adjoining runs through a part of

The Surveyor
And Municipal and County Engineer.

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my district. The farmers, when working the tillage fields, plough very near to the grass edging of the road, and it is feared when heavy traffic passes over the road that a subsidence will take place. The owners have been requested to see the tenants do not plough too near the edging, but these representations have been without effect. Will you please inform me if the rural district council can place stakes a distance of 15 ft. from the centre of the metal portion of the road and claim the area as part of the highway?

The council cannot place stakes at a distance of 15 ft. from the centre of the metalled road unless the whole of the 15 ft. space forms part of the highway which has been dedicated, or is presumed to have been dedicated. Where a highway runs between fences the whole space between the fences is, *primâ facie*, presumed to have been dedicated. But where (as in the present case) the road is unfenced, it would be a question of fact what width has been dedicated, and this question would generally be decided by evidence of user. See *Easton* v. *Richmond Highway Board* (L.R., 7 Q.B., 69).

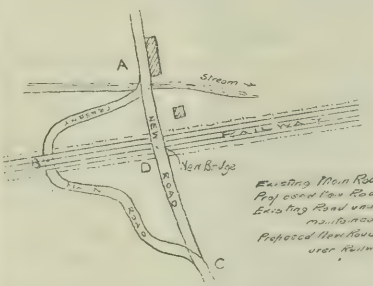
BUILDING BY-LAWS: OPEN SPACE.—"W. A." writes: The by-laws of an urban district council with respect to buildings and streets contain the usual regulations to be found in the model by-laws. I forward sketch [not reproduced] showing the proposed erection of twenty-four cottages. The plans have been approved by my council, and houses Nos. 1 to 12 have been erected in accordance with the by-laws. On inspection the other day I found that the occupiers of the houses had erected small fences and laid out vegetable gardens in front of their houses. Will you please give me your opinion whether the occupiers of these houses can cultivate the open space in front of their premises; if not, what is the proper course to take to prevent them so doing?

In my opinion there is nothing in the model by-laws to prevent the cultivation of the open space in front of premises.

RAISING ROAD LEVEL: COMPENSATION.—"Suburban" writes: An urban district council, in carrying out certain highway improvements, including the provision of a paved footpath, raises the level of the roadway and path 9 in. above the original level, the raising being necessary owing to flooding of the highway partly from meadows fronting the road. The tenant of one of the meadows where flood water comes from claims compensation owing to the drop of 9 in. between the back of the path and the original surface of the meadow at his gateway, which is very rarely used. The council has offered to form a slope into the meadow from the back of the path, and to carry out any reasonable works to the gate. Can the council be held liable for compensation? If so, kindly state section and cases.

If the tenant has sustained any damage he is entitled to compensation from the council under sec. 308 of the Public Health Act, 1875. See *Regina* v. *Wallasey Local Board* (L.R., 4 Q.B., 357).

DIVERSION OF MAIN ROAD: MEANING OF COUNTY BRIDGE.—"Courtfield" writes: A county council proposed to construct a new road, from A to C in the sketch, in lieu of the existing road A B C, which is at present crossed by a bridge carrying a railway at the point B, such bridge being maintained by the railway company. When diverting the road it is proposed to carry it over the railway by a bridge, at the point



marked D. It would appear from Pratt's "Law of Highways," page 97, that no structure can be a bridge which is not erected over water. The point is important inasmuch as certain parishes are exempt from contributing to the bridge rate. Your opinion is desired as to whether such a bridge over the railway can be classed as a "county bridge" and charged as such, or whether it is to be treated as part of the main road, and charged as a general county expense.

In my opinion the proposed bridge, not being a bridge over water, will not be a county bridge, but will be repairable as part of the main road.

We have to draw the attention of querists to the directions laid down for their guidance in regard to the preparation of diagrams. Rough sketches obviously cannot be made use of, and we should be obliged if correspondents would therefore send only carefully-prepared drawings, preferably about 6 in. in width, and without colouring or wash of any description. Failure to observe these rules will involve the risk of queries remaining unanswered.

QUERIES AND REPLIES.

We cannot undertake to reply to any queries which are not accompanied by the writer's name and address. These are required as a guarantee of good faith, and not for publication. Sketches accompanying queries should be made separate, on white paper, in plain black ink lines. Lettering or figures should be bold and plain.

897. Books on Surveying.—"A. T." writes: What books would you recommend as being suitable for study by an assistant road surveyor desirous of becoming a surveying assistant in a county road surveyor's office?

In reply to this query we would suggest "Practical Surveying," by Usill (7s. 6d.); Low & Clark's "Roads and Streets" (6s.); and "Practical Road Engineering," by Boulnois (5s.).

Water Supply in South Africa.—In the presence of almost the entire population of Salisbury, the capital of Rhodesia, the new municipal waterworks have been opened by Lady Milton, the wife of the Administrator. The dam, to be known as the Cleveland reservoir, has a storage capacity of 200,000,000 gallons, and is situated amid picturesque surroundings. Sir William Milton, in an address to the assembly, said that they had plenty of water to put on the roads; they now wanted plenty of roads to put water on. He hoped that now that the town council had been able to complete the waterworks they would be in a position to devote their energies to other important works.

Assistants' and Students' Section.

Conducted by SYDNEY G. TURNER, Assoc.M.Inst.C.E.

All communications in regard to this page must be addressed to The Editor, St. Bride's House, 24 Bride-lane, Fleet-street, E.C. *Envelopes must be marked "Assistants' Section" in the top left-hand corner. Correspondents are invited to submit questions for consideration and answers to the questions which appear. For the contributions considered to be the most meritorious, one or more premiums in books will be awarded monthly. Diagrams must be drawn to scale on separate sheets, ready for reproduction.*

THE MONTHLY PREMIUM.

Mr. Albert V. Cole, of Nelson, to whom the premium for May was awarded, has selected:

"Building Materials," by G. A. T. Middleton (Batsford).

"How to Estimate," by J. T. Rea (Batsford).

"Sewerage Engineer's Note-book," by Albert Wollheim (St. Bride's Press, Limited).

These books have been duly sent to him.

QUESTIONS.

This week answers are invited to the following questions:—

325. Air Compressors.—How is the size of an air receiver calculated in connection with an air compressor? Of what thickness of metal would it be made if (1) of cast iron, (2) wrought iron, assuming it had to withstand a pressure of from 15 lb. to 40 lb.? Give any further particulars regarding same. ("Griffo.")

330. Sewage Disposal.—Design a small sewage disposal system for a gentleman's residence, capable of dealing with 500 gallons per day. The sewage is fairly strong on account of the drainage from a small cowshed. The available fall can be neglected, and the earth is of a sandy-clay nature. State approximate cost. The effluent should discharge into a soakaway. ("Inky.")

332. Roadmaking.—What is the best form of cross-section for the surface of a macadam road? Give reasons. ("Ehu.")

333. Sewage Tank Construction.—What is a suitable formula for calculating the requisite thickness of sewage tank walls? Give an example. ("Check.")

334. Sewerage.—What would be the flattest gradient allowable for 6-in., 7-in. and 8-in. sewers respectively, to give a self-cleansing velocity? What is a good modern book on sewerage and sewage disposal, giving tables of velocity and discharge? ("Urban.")

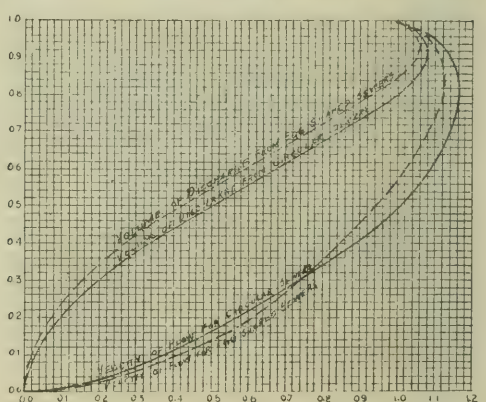
[The Editor is at all times glad to hear from readers who desire to submit questions regarding matters of general interest, points of daily practice, &c., for insertion in the "Assistants' and Students' Section." Questions which are published are taken into consideration, as well as other matter, in awarding the Monthly Premium.]

REPLIES TO QUESTIONS.

327. Flow of Sewers.—State the advantages of egg-shaped and circular sewers, and give conditions under which such advantages would occur. Give proofs of velocities and discharge. (D. G. B., *Darlington.*)

Considering sewers of all shapes and of equal cross-sectional area, the circular section gives the greatest velocity when flowing full and half full. Therefore, in the case of sewers intended to flow not less than half full the circular section is the most desirable. In a separate system of sewers the fluctuation of the sewage is not great, being about one-half the average daily flow, which is reckoned about ½ the maximum to be provided for. Thus the sewers in such a system will usually be running at about ¼ their total capacity, which means that the depth of sewage will not be very much less than half the diameter, and for this reason the circular section is the one to be adopted. In the case of a storm sewer which does not carry house sewage it is usually assumed that the sewer will be running with at least one-third its total capacity before any objectionable matter can be carried into it. Small showers which give a small flow are not likely to contribute any matter which the reduced velocity cannot carry off. So, again, under these conditions the circular sewer is to be recommended. Even in a combined system of sewers the trunk main is usually of a circular shape, because, on account of the laterals which discharge into it being tapped by storm-water overflows, the fluctuation in discharge is kept low. In construction the circular section, having the smallest perimeter of all sections, requires least material. In the case of a brickwork sewer, an egg-shaped section requires about 5 per cent more brickwork than a circular section. Thus with sewers up to 3 ft. in diameter, and designed to carry storm water and house sewage, it is not usual to adopt the egg-shape, as the advantages of such a section are not so apparent as to justify the greater cost of construction. Again, from the point of view of strength, the circular section is stronger than any other. An egg-shaped section is weak in resistance to earth pressure at its sides where the curvature is small, and also because the sides are not in a position to take the thrust of the crown.

However, in the case of a combined system of sewers, so called because the sewers carry both house sewage and storm water, the discharge must necessarily be extremely variable. In very dry weather, when only house sewage is being conveyed, the discharge will be very small compared with that after a rainstorm, or during a continuous rain. In fact the house sewage may occupy only 0·71 per cent of the total capacity of the sewer, and if the gradient is such as to give the maximum desirable velocity of 4 ft. per second, this would mean that the dry-weather velocity of flow would only amount to about ·66 of a foot per second. Again, if the gradient is increased to give the minimum allowable velocity of 1½ ft. per second, the depth of flow would only amount to ·02 of the



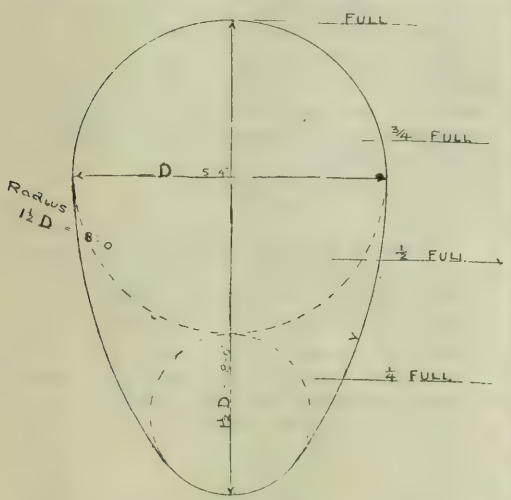
sewer's diameter. Both of these conditions are avoided in any well-designed sewerage scheme. In a circular sewer which has a flat gradient, and a consequently small velocity, deposits are formed which necessitate frequent cleaning. Some form of sewer section is therefore required which will give the necessary scouring velocity when the discharge is a minimum. Several forms of section are in existence claiming to have this advantage, but the one generally used is the standard egg-shaped section in which the radius of the crown is double the radius of the invert, and the greatest width is two-thirds the height. The advantages of such a section are at once seen. (1) For equally low discharges this form of section has a smaller wetted perimeter than a circular section of equal capacity. This increases the hydraulic radius, which means an increased velocity. (2) The depth of flow for equally small discharges will be greater in the case of the egg-shaped sewer. (3) While it gives the desirable velocity for small discharges, it also, when flowing full, keeps the velocity near the maximum limit. A circular sewer designed to give a velocity of 1½ ft. per second when flowing at ·007 its full capacity, will give a velocity of 9 ft. per second when flowing full, which is more than

twice the allowable velocity; while with an egg-shaped sewer under similar conditions the maximum velocity is only 4·7 ft. per second. Higher velocities than 4 ft. per second cause considerable wearing of the invert by the scouring action of the sand and stones swept over it. The question of maximum and minimum velocities limits the use of a section of the above dimensions when the rainfall reaches a certain point. A section of the above dimensions is quite good for combined sewer mains, where the maximum run-off is only about 2 in. from the drainage area. In laterals, however, where the proportion of house to storm sewage will be too small to give sufficient depth and velocity to the house sewage, an invert, whose radius is relatively smaller to the size of the sewer, is required. The new egg-shaped section has this advantage, the invert radius being 0·125 the diameter of the crown. It will be clearly seen from the diagram the advantage in velocity of an egg-shaped over a circular section.

The vertical ordinates show the ratio of the depth of flow to the height of the sewer, and the horizontal ordinates give the corresponding ratio of velocity and volume. The height of the sewer, the volume of discharge, and the velocity of flow with sewer running full are all taken as unity. On the same diagram the larger discharge of the circular sewer is also seen.

In conclusion, the circular sewer is to be recommended on account of its cost and strength, and also when the fluctuation in discharge is small, and when such fluctuation comes to be considerable the egg-shaped section is necessary on account of its self-cleansing nature. (A. K. F., *Aberdeen.*)

331. Sewerage.—In the case of the oval sewer in the sketch, 5,790 lin. yds. long, having a total



fall from inlet to outlet 15 ft., what flow will be discharged when quarter, half, three-quarters, and full?

Kütter's formula is the most accurate one to use for ascertaining the velocity and the discharge of the flow in sewers. It is given in nearly every work on hydraulics, and also in the "Sewerage Engineers' Note-Book," published by the St. Bride's Press. The labour-saving tables and diagrams given in the last-mentioned work enable this intricate formula to be expeditiously and accurately worked out with the minimum of trouble. On the assumption that the sewer is in "fair" condition, the value of "n" will be about ·015, and the discharge as follows:—

Full.	128	cub. ft. per sec.
¾ ,,	108	,, ,,
¾ ,,	90	,, ,,
½ ,,	54	,, ,,
¼ ,,	14	,, ,,

(H. F. W., *Tottenham.*)

Country School Sites.—At the Essex Education Committee meeting in London on Monday it was reported that considerable difficulty had been found in getting sites for country schools. The price of one site of 2 acres at Earl's Colne was £740, or higher than any town site.

INSTITUTION OF MUNICIPAL ENGINEERS.

NORTH-WESTERN DISTRICT MEETING IN SHROPSHIRE.

On Saturday the members of the North-Western District of the Institution of Municipal Engineers held their summer meeting at Wellington, Salop, the arrangements being very ably carried out by Mr. George Riley (engineer and surveyor to the Urban District Council). There was a large attendance from all parts of the district.

Mr. G. W. HARVEY (deputy chairman of the council), in the unavoidable absence of the chairman, extended a hearty welcome to the visitors in the council chamber. He said the council considered that Wellington had been honoured by a visit from the Institution of Municipal Engineers. They all recognised the important work being carried out in the country by engineers in preventing disease, and in promoting the health of the community. In Wellington during the last twelve or fifteen years they had been going forward in the work of sanitary reform, and had several important schemes under their control, which would, no doubt, interest the visitors.

Mr. J. W. CLIFT (chairman of the sanitary committee) said he had been engaged in public life for twenty-four years, and he realised more and more the great and important work done by engineers, and especially by those engaged on the sanitary side of the profession. The town of Wellington had been well governed, and their rates were not high. The urban rate was 3s. 4d. and the poor-rate 3s., making 6s. 4d. in the pound.

Mr. J. W. GLEAVE (Heywood), honorary secretary of the North-Western District of the institution, expressed his thanks to Councillors Harvey and Clift for their warm welcome, and congratulated the town upon being able to carry out so many important schemes and at the same time keeping the rates so low.

At the Gasworks the party were received by the chairman of directors, Mr. H. Shepard, J.P., and the manager, Mr. H. J. Woodfine, by whom the visitors were shown over the works, and later refreshments were served by the kindness of Mr. Shepard.

Before leaving ALDERMAN BEDDOES said they had all been greatly interested in what they had seen at one of the most up to date and best-equipped gasworks in the country.

Mr. SHEPARD said the directors were only too pleased to throw open the works to inspection by the visiting engineers. The company recognised the importance of always being up to date, and in that direction they had a very capable officer in Mr. Woodfine.

The tour of inspection was continued to Wrekin, where a pleasant half hour was spent, and the journey was continued to the sewage works and on to Wellington College, where the visitors were received by the principal (Mr. J. Bayley) and the vice-principal (the Rev. J. Y. Hamlet), and entertained to tea.

After tea Mr. RILEY returned thanks to Mr. Bayley for the privilege of inspecting one of the finest educational establishments in the country. They hoped Mr. Bayley would continue his work in the cause of education for many years to come.

Mr. J. BAYLEY, in the course of an interesting speech, said the whole structure had been erected at his own cost and under his personal direction. Their towns and cities should be built up on sound lines, with due regard to efficiency and economy. There should be good drainage and water supply, and everything that would conduce to the public health. He knew there were some narrow-minded men on county councils and urban district councils, but the officers under their directions should be well supported when they were doing good work. With regard to workmen, he held that a man should have a fair day's wage; but there should also be another condition—that for a fair day's wage a workman should give a fair day's work. Efforts should be made so that in carrying out schemes they should not be made too heavy a burden upon the rates. Where surveyors and engineers were serving a council well they should receive reasonable and fair treatment from those who formed the council.

The college grounds and golf-links were afterwards visited, and before the members left for their respective destinations a vote of thanks was accorded to Mr. Riley for the completeness of the arrangements.

LOCAL GOVERNMENT BOARD INQUIRIES.

The Editor invites the co-operation of SURVEYOR *readers with a view to making the information given under this head as complete and accurate as possible.*

INQUIRIES HELD.

Horsham R.D.C. (June 10th. Major C. E. Norton).—£1,000 for sewerage works at Ifield. It appears from the statement of the clerk, Mr. A. C. Coole, and Mr. C. H. Burstow, engineer, that the work had been in hand for fifteen weeks, and would last another four weeks. The total estimated cost was £970. The inspector remarked that the total of the contract price, the fees of the engineer, the salary of the clerk of the works, and other expenses he brought to £970, and he desired to know why £1,000 was being applied for. Mr. Coole said it was desired to obtain a sum sufficient to cover the whole of the cost. The inspector: I may as well say now that the rural district council have put the Local Government Board into a very difficult position, and, incidentally, they have put themselves into a very difficult position. You have applied for a loan of £1,000, and without asking for, or obtaining, the leave of the Local Government Board, you have started this work of extending the sewer. You now ask the Local Government Board to grant you the loan. I can say at once that the Local Government Board would not have passed this scheme as submitted. What the Local Government Board will do as regards this loan I cannot tell you. Whether they will ask you to reconstruct the scheme or pay for it out of current rates I do not know.

Pershore R.D.C. (June 24th. Mr. E. Leonard).—£2,800 for the building of sixteen working-class dwellings in Pinvin.—It was mentioned that the proposed rents would be 3s. 6d. a week, and, until the loan was paid off, there would be an annual deficit of about £22. The inspector stated that, if the rents were 4s., the scheme would be self-supporting. The council had expressed the opinion that the whole of the cost should be borne by the parish of Pinvin, and not by the whole district, but several ratepayers of Pinvin who were present protested strongly against this course. Mr. T. W. Parkes (chairman of the council) said when the new water scheme was finished the parishes which it concerned would have a serious burden thrown on them. Pinvin was one of the parishes.

Tenby T.C. (June 18th. Mr. P. M. Crosthwaite).—£9,699 for works of sewerage, including a new western outfall sewer.—The scheme has been prepared by Mr. T. J. Moss-Flower, ASSOC.M.INST.C.E. The new outfall will consist of a 4-ft. cast-iron pipe carried to extreme low-water mark, a distance of 1,500 ft., and certain low-lying sewers which are now defective will be relaid. Objection was offered by Mr. Egerton Allen. He suggested that the sewage should be deposited on the marsh, but the inspector stated it was not likely the Local Government Board will ever consent to such a scheme.

Wath-upon-Dearne U.D.C. (June 17th. Mr. F. O. Stanford).—£12,000 for extending the waterworks.—The surveyor and engineer (Mr. J. H. Drew) stated that the council supplied water to the inhabitants of the urban district of Wath-upon-Dearne, and portions of the parishes of Brampton Bierlow (Rotherham Rural Council), and Adwick-on-Dearne (Doncaster Rural Council). They might take the average daily consumption per head of population to be 17 gallons. The water supplied by the council was practically all used for domestic and public purposes. Allowing for the average daily consumption to increase to 300,000 gallons per day, it was now proposed to add the following additional storage accommodation: Receiving reservoir 354,000 gallons, service reservoir 270,000 gallons, total 624,000 gallons. That would give 904,000 gallons total storage capacity, or equal to three days' supply, allowing for the probable increase. The reservoir site, proceeded Mr. Drew, was a very suitable one, and at the highest elevation of any in the district.

Wellington T.C. (June 20th. Mr. F. O. Stanford).—£4,700 for works of sewerage and sewage disposal. Evidence was given by the engineer, and the inspector afterwards visited the site of the proposed scheme.

APPLICATIONS FOR LOANS.

Billericay R.D.C.—£2,873 for street improvement purposes.

Bristol T.C.—£1,236 for road works.

Clitheroe T.C.—£1,200 for the purchase of land for a school and other purposes.

Croydon R.D.C.—£4,368 for wood paving work.

East Barnet U.D.C.—£460 for works of sewerage.

Erpingham R.D.C.—350 for the erection of two cottages.

Heaton Norris U.D.C.—£1,101 for private street improvements.

Huntingdon T.C.—£1,600 for the purchase and conversion of barracks into working-class dwellings.

Norman Cross R.D.C.—£700 for sewerage works.

Peterborough R.D.C.—£525 for relaying a portion of the main drainage of Eye.

Rawtenstall T.C.—£467 for public conveniences.

Taunton T.C.—£2,600 (in addition to £2,500 for plant) for the extension of the electricity works.

Watford U.D.C.—£220 for works of sewerage.

LOANS SANCTIONED.

Banbury T.C.—£33,360 for sewerage and sewage disposal works.

Chatham T.C.—£2,040 for the High-street improvement.

Colwyn Bay U.D.C.—£6,236 for the purpose of the gasworks.

Mansfield T.C.—£1,650 for the purchase of property for road improvement purposes.

Mexborough U.D.C.—£4,082 for turbo-generator for electricity works (for seventeen years); £3,914 for buildings (thirty years); £1,600 for boilers, &c. (fifteen years); £1,030 for cooling tower (ten years); £300 expenditure on proposed public lighting works (ten years); £300 for the provision of services in connection with the proposed public lighting works (fifteen years).

Newhaven R.D.C.—£16,044 for the reconstruction of the Lewes-Newhaven road.

Paignton U.D.C.—£326 for sewer extension and £115 for a water main.

Sheerness U.D.C.—£17,150 for a water supply scheme.

Ulverston R.D.C.—£1,167 for a new water supply.

Wycombe R.D.C.—£2,532 for the erection of twelve working-class dwellings.

FORTHCOMING INQUIRIES.

	£
JUNE.	
30.—**Southgate.** For private street works (Mr. M. K. North)	2,283
30.—**Sutton-in-Ashfield.** For laying out Portland-square and erecting a public sanitary convenience thereon (Mr. R. H. Bicknell)	450
30.—**Sutton-in-Ashfield.** For the erection of a fire station (Mr. R. H. Bicknell) ...	393
30.—**Sutton-in-Ashfield.** For the purchase of a fire engine and escape, &c. (Mr. R. H. Bicknell)	507
JULY.	
1.—**Cheadle.** For the water supply of the villages of Werrington, Cellarhead, Wetley Rock, and Cheddleton (Mr. A. W. Brightmore)	5,600
1.—**Hemsworth.** For the widening and improvement of the Barnsley-road (Mr. R. H. Bicknell)	550
1.—**West Hartlepool.** For the electricity undertaking (Mr. H. R. Hooper) ...	4,330
2.—**Goole.** For works of water supply for the parish of Swinefleet (Mr. R. H. Bicknell)	1,360
2.—**Peterborough.** For schemes under Part III. of the Housing of the Working Classes Act, 1890 (Mr. C. H. Eyles) ...	5,700
2.—**Peterborough.** For the purchase of land and the erection of working-class dwellings in the parishes of Walton and Eye (Mr. C. H. Eyles)...	4,000
3.—**Sheffield.** For purposes of their electricity undertaking (Mr. H. R. Hooper)	130,860
3.—**Shoreham-by-Sea.** For sewerage and sewage disposal works (Mr. R. G. Hetherington)	25,000
4.—**Barrow-in-Furness.** For the extension of their infectious diseases hospital (Mr. R. A. Farrar)	6,000

Municipal Work in Progress and Projected.

The Editor invites the co-operation of SURVEYOR *readers with a view to making information given under this head as complete and accurate as possible.*

The following are among the more important projected works of which particulars appear below: Buildings—Cardiff, Marylebone £73,168; housing and town planning—Evesham, Grays, Stafford, Tredegar; roads and materials—Bethnal Green, Govan £13,480, Lambeth £27,000, Littleborough £9,602, Wandsworth £26,502; sewerage and sewage disposal—Edinburgh £15,400, Emsworth £5,636, Stoke-on-Trent £70,000; water, gas and electricty—Birmingham £6,300, Loughborough £14,000. Particulars of other works projected will be found in our "Local Government Board Inquiries" pages.

BUILDINGS.

Burnham (Somerset) U.D.C.—Alternative schemes prepared by the surveyor, Mr. W. H. Chowins, for the construction of a new pier to receive the discharge of vessels at any state of the tide, have been referred to a committee for consideration.

Cardiff T.C.—The city surveyor, Mr. W. Harpur, has received instructions to prepare a design for a scheme for a covered bath at Canton on more economic lines than the one already suggested.

Chesterfield T.C.—Alterations are to be carried out at the market hall at an estimated cost of £2,500.

Fulham B.C.—It is proposed to reconstruct the pavilion at the bowling green in the Bishop's Park, recently destroyed by a fire, at an estimated cost of £115.

Leeds T.C.—The question of providing public washhouses in Leeds is being considered by the Corporation Property Committee. Under the proposed scheme, if it receives the necessary sanction, washhouses will be installed in various parts of the city in which the wearing apparel of families may be cleansed, a charge of so much an hour being made for the use of the utensils required.

Marylebone B.C.—The tender of Messrs. J. Greenwood, Limited, of 12 Arthur-street, E.C., at £73,168, has been accepted for the erection of the new town hall, in accordance with the specification and conditions prepared by the architect, Mr. Edwin Cooper.

HOUSING AND TOWN PLANNING.

Blofield (Norfolk) R.D.C.—A letter has been received from the Local Government Board emphasising the necessity for dealing with the housing question in several parishes, and the council have decided to extend the scope of their inquiries into the subject.

Evesham R.D.C.—A committee has reported on the need for a combined housing scheme for the Littletons, and that thirty-five cottages should be erected.

Grantham R.D.C.—The Local Government Board having asked the council what was being done towards providing housing accommodation in the rural district, the council have replied that they were taking steps to provide houses at Carton Scroop and South Witham, but until they had proved by experience whether they could build houses to be let at rents which the labourers could afford to pay without unduly burdening the ratepayers, they were not prepared to embark on schemes elsewhere.

Grays (Essex) U.D.C.—The Housing Committee have received instructions to submit a scheme for more municipal cottages.

Prestatyn U.D.C.—The tender of Mr. Joseph Williams, at £2,331, has been accepted for the erection of fifteen dwellings for workmen.

St. Austell U.D.C.—Tenders are to be obtained for the erection of about twenty-two workmen's dwellings in accordance with plans and specifications prepared by the surveyor, Mr. E. D. Groves.

Skegness U.D.C.—The council have instructed the surveyor, Mr. R. H. Jenkins, and clerk to report as to the utility of the Town Planning Act as a means of ensuring the proper development of the town and district. Mr. Jenkins has been appointed a delegate to the conference on the subject at Great Yarmouth.

Stafford T.C.—The scheme for the provision of sixty workmen's dwellings at Lammascotes, Backwalls South and Coton Field is to be proceeded with forthwith.

Tredegar U.D.C.—The surveyor, Mr. W. L. Roach, has prepared plans for the erection of fifty-two workmen's dwellings.

Wrexham T.C.—It has been decided to appoint a Town Planning Committee, and to apply to the Local Government Board for authority to prepare a scheme embracing practically the whole of the undeveloped land within the municipal borough, reached in 1911, when a similar application was before them.

PARKS AND OPEN SPACES.

Brighton T.C.—As a result of the financial success of the municipal golf links at Hollingbury Park, it is contemplated that in the near future the Parks and Gardens Committee will turn their attention to the provision of a golf course for ladies. A favourable spot at Hollingbury has been viewed.

Coventry T.C.—The Housing Committee have been instructed to prepare plans for 100 additional houses, this being a requirement of the Local Government Board before they assented to the demolition of dwellings in Leicester-street for widening purposes.

Holyhead U.D.C.—Mr. William Thomas, a Liverpool shipowner, has presented to the council 10 acres of land for the use of the public as an open space.

Launceston T.C.—The provision of a public bowling-green has been referred for consideration to the General Purposes Committee.

REFUSE COLLECTION AND DISPOSAL.

Abertillery U.D.C.—What is described as the first refuse destructor in Monmouthshire was opened last week. It has been built by the council, under the direction of the engineer and surveyor, Mr. Lionel D. Lewis, at a cost of about £5,000, and is capable of burning 60 tons of refuse to clinker in twenty-four hours.

Kensington B.C.—The Works and Public Health Committees have submitted a joint report on the question of the removal of house refuse, and a daily collection is recommended as an experiment during July, August and September, in that portion of the Golborne Ward north of the Great Western Railway.

ROADS AND MATERIALS.

Antrim C.C.—The council have requested the Road Board to undertake a series of experiments with various materials on a length of road from Belfast to Lisburn, over which there is a considerable volume of heavy traffic.

Bethnal Green B.C.—The Works Committee have reported that they had given considerable attention to the question of endeavouring to obtain a grant from the Road Improvement Fund towards the work on road crusts requiring reconstruction or renewal. As the result of a conference between the town clerk and the surveyor, Mr. A. E. Darby, ASSOC.M.INST.C.E., and the chairman of the Road Board, a scheme was approved whereby the Road Board should contribute £4,000 on condition that the borough council provide for an expenditure of £23,868 on road works in the course of the next two years. The committee proposed that the council should accept the offer and proceed at once with relaying Bethnal Green-road from Teesdale-street to the "Salmon and Ball" with creosoted deal blocks, and Bonner-road and approach road with slag tar-macadam, other works included in the scheme to be taken in hand in due course.

Chatham T.C.—An intimation has been received that the Road Board have sanctioned a grant of £317 towards the cost of widening Maidstone-road at the Horsted estate.

Colwyn Bay U.D.C.—A new footpath is to be constructed on the east side of Brompton-avenue, at a cost of £505.

Farnborough U.D.C.—Part of the carriageway of Queen's-road is to be repaired with tarbound granite, at a cost of £200.

Govan T.C.—It is proposed to expend £12,080 on road repairs with whin setts, and £1,400 on granite paving.

Hunts C.C.—Road improvements are to be carried out at a cost of £5,920.

Lambeth B.C.—The borough engineer, Mr. H. C. J. Edwards, Assoc.M.Inst.C.E., has prepared a scheme for repaving works throughout the borough, estimated to cost £27,000. Towards this sum the Road Board have promised to contribute £10,000. The council applied to the London County Council for permission to borrow the remaining £17,000 for five years. They also required sanction for the borrowing of £14,600 for paving roads for the first time in place of macadam. The county council have replied granting the necessary sanction, and at the same time stating they viewed with some concern the large increase in the debt of the borough council, and hoped they would make every endeavour to restrict the borrowing of money for paving in future to the smallest possible amount, and would not seek to borrow any further sum for repairing works.

Launceston T.C.—The county surveyor, Mr. E. A. Brookes, has expressed approval of the scheme prepared by the borough surveyor, Mr. A. W. Grace, for the proposed improvement of the Exeter road near Bamham, and has promised to support an application to the Road Board for a grant of £300 in aid of the cost of the scheme.

Littleborough (Lancs) U.D.C.—Paving work with granite setts is to be carried out at a cost of £9,602.

Marylebone B.C.—The tender of Messrs. Constable, Hart & Co., Limited, has been accepted for tar-macadam works in sixteen streets, maintenance to be free for the first two years, and for the five years thereafter at prices varying from 6d. to 8d. per super. yard. The prices varied from 4s. 11d. to 5s. 3d. per yard.

Norwich T.C.—The council have agreed to the purchase of plots of land in Norfolk-street, Union-street, Eaton-street and Westwick-street for road improvements.

Nuneaton T.C.—The Highways Committee recommend the adoption of the following resolution: "This council is of opinion that, having regard to the heavy and growing cost of maintenance and upkeep of highways, consequent upon the ever-increasing use thereof for purposes of through traffic of motor cars and heavy and light locomotives, it is imperative that a larger and more adequate contribution shall be made from the Imperial Exchequer towards the cost of this national service."

Southampton T.C.—The borough surveyor, Mr. J. A. Crowther, has received instructions to prepare an amended estimate of the cost of laying slab and tar footpaths in certain roads.

Totnes T.C.—The mayor, Mr. E. Windeatt, at the council meeting on Tuesday, stated that the greater part of the increase in road maintenance was due to the rural district roads. The county estimate for the urban roads was about the same as last year, whereas the rural roads cost between £14,000 and £15,000 extra in addition to the remaking of certain roads under a grant from the Road Board. The rural district councils were those in default, and, really, the people who were complaining were those who were not carrying out their duties properly. He contended that the whole of the county roads should be in the hands of the county council, and would further suggest that there should be three classes of roads in the county—the main roads supported by the Road Board, urban roads to be controlled by the county council, and district roads by the district councils, who would find them as much as they could manage.

Wandsworth B.C.—Sanction has been given by the London County Council to the borrowing by the council of a sum not exceeding £15,000 for wood paving. The total cost of the work will be £26,502, towards which the Road Board are making a grant of £10,000, and lending £15,000, repayable within five years, free of interest.

Weardale R.D.C.—The question of constructing a new road from the main road at Bradley to Thornley is under consideration.

Whitley and Monkseaton U.D.C.—Hill Heads-road from the council yard to the bridge is to be relaid with Durax at a cost of £3,400.

Worcestershire C.C.—Among the special works on county main roads which have been sanctioned the council have agreed to the laying of tar-macadam on a section of the Stourbridge and Kidderminster main road at Norton, in the Stourbridge Urban District, at a cost of £500, towards which they have offered to contribute £115, provided the existing foundations meet with the county road surveyor's approval.

SEWERAGE AND SEWAGE DISPOSAL.

Edinburgh T.C.—A scheme for the disposal of the sewage of Portobello has been prepared. It is proposed to construct a large new sewer, so that sewage will be conveyed westward and discharged into the Pow Burn outfall sewer at Seafield. That outfall discharges so far out into the Forth that it is anticipated the beach at Portobello will escape pollution. The probable cost of the scheme is £15,400, and the length of the new sewer will be fully 2,000 yds.

Emsworth R.D.C.—Plans have been adopted for sewage disposal works for South Kirby, South Elmsall, and North Elmsall, to cost £5,636.

Erpingham R.D.C.—The Holt sewage farm is to be extended at a cost of £205.

Golcar U.D.C.—The question of constructing two sewage tanks at a cost of £250 is under consideration.

Peterborough R.D.C.—The surveyor, Mr. G. A. Penwill, has prepared the plan, specification, and quantities for the relaying of a portion of the main drainage of the village of Eye, at an estimated cost of £525.

Redditch U.D.C.—Land for sewage disposal works is to be purchased for £1,034.

Stoke-on-Trent T.C.—A proposal has been made for the provision of a new sewage disposal scheme for Stoke, at an ultimate cost of between £70,000 and £80,000.

Wycombe R.D.C.—The question is under consideration of providing two revolving percolating filters at the sewage farm.

WATER, GAS, AND ELECTRICITY.

Atherstone R.D.C.—The trial-boring at Warton has been completed, and a fortnight's continuous pumping test has proved the yield to be at least 240,000 gallons per day, without any lowering of the water-level. The site for this boring, which is in the as yet untapped local Bunter rocks, was selected and recommended by Dr. H. Lapworth, M.Inst.C.E., Westminster, and the work has been carried out in consultation with him by the council's engineer, Mr. H. J. Coleby. The yield of the boring was anticipated to be between 150,000 and 200,000 gallons per day, and the result of the pumping test, therefore, has more than satisfied the expectations. The contractors were the New England Boring Company, Peterborough. A scheme for utilising this source in meeting the shortage of water in the district will probably be drawn up at an early date.

Birmingham T.C.—The Electric Supply Committee recommend the provision of cooling towers for the electricity department, at an estimated cost of £6,300.

Bridlington T.C.—The nett profit of the electricity undertaking last year was £1,324.

Coventry T.C.—The water undertaking earned last year a profit of £6,863.

Fulham B.C.—The surplus on last year's working of the electricity undertaking was £4,665.

Loughborough T.C.—The General Purposes Committee have passed a scheme for the extension of the electricity works, and for the extension of the mains, involving a sum of £11,000 for the works and £3,000 for the mains.

Oldham T.C.—A profit of £6,493 was earned last year by the water undertaking, compared with £9,743 in the previous year, the difference being accounted for by the cost of extra works and repairs.

Petersfield R.D.C.—The council have accepted a scheme prepared by Messrs. Taylor & Wallin, of Newcastle, for supplying the parish of Bramshott with water. The water is to be obtained from a deep well and boring in the lower green sand, from whence it will be pumped to a service reservoir, from which the distributing mains will be fed. The estimated cost of the works is about £7,000. This is the third scheme the Petersfield Council have entrusted to Messrs. Taylor & Wallin.

Sudbury T.C.—Mr. Percy Griffith has received instructions to prepare specifications and obtain tenders for a new pumping plant at the waterworks.

MISCELLANEOUS.

Birmingham T.C.—The Tramways Committee have prepared a scheme of new tramways, the construction of which, while not making a connection between all the routes, would link up most of them, and provide for a considerable amount of cross-city traffic. The total estimated cost of the scheme, including rolling stock, is £245,709.

Coventry T.C.—The profit of the tramway undertaking last year was £1,443.

Kingston (Surrey) T.C.—Tenders have been accepted for bricks from the Sussex Brick Company, Limited; lime and cement from George Bristow, Limited; drain pipes, &c., from Doulton & Co., Limited; and scavengers' brooms from Bird & Co. and J. Jonas. For 880 yds. of 1 sq. in. low-tension cable at £198, and 440 yds. of $\frac{7}{16}$-in. low-tension cable at £47 10s., the tender of the Craig Park Electric Cable Company has been accepted.

PERSONAL.

Mr. N. Wilson, burgh surveyor of Langholm, died, we regret to state, last week.

Mr. C. R. Fortune, city surveyor of Bath, who is still at Weston-super-Mare, is slowly improving.

Mr. J. C. Walker, surveyor to the Hunstanton Urban District Council, is, we regret to state, indisposed.

Mr. A. L. Parker, surveyor to the Oakham Urban District Council, has had his salary increased £20 a year.

Mr. John H. Brett, county surveyor of Antrim, has sent in his resignation, to date from November 16th next.

Mr. A. J. Merrilees, burgh surveyor of Denny, has been appointed burgh surveyor of North Berwick, at a salary of £150 a year.

Mr. J. E. Hargreaves, surveyor to the Farnborough Urban District Council, has been granted an increased salary of £50 a year.

Mr. W. E. Coles, surveyor of highways to the Stratford-on-Avon Rural District Council, has been granted an increase of salary of £25 per annum.

Mr. J. P. Mead, deputy surveyor of St. Helens, has been apointed borough engineer of Ipswich, at a salary starting at £350, and rising to £500 a year.

Mr. George Nicol, Inverurie, has been appointed district road surveyor by the Garioch District Committee of the Aberdeenshire County Council.

Mr. W. Howard-Smith, M.INST.C.E., of Westminster and High Wycombe, is, we regret to learn, suffering from a painful ailment which promises to confine him to bed for some days.

Mr. Robert Grant, road surveyor of the western district under the Kirkcudbrightshire County Council, has been appointed county road surveyor to the Sutherlandshire County Council.

Mr. Reginald Blomfield, A.R.A., was on Monday night, at a meeting of the Royal Institute of British Architects, presented by Lord Plymouth with the Royal gold medal which is annually bestowed by the Sovereign, on the advice of the institute, for the best efforts in the promotion of architecture.

Mr. W. B. Madin, engineer and surveyor to the Rushden Urban District Council, in consideration of the extra work involved in connection with the new sewage disposal works and housing scheme, has been voted unanimously a special increase of salary of £75 per annum for two years, and a permanent increase thereafter of £20 per annum.

Mr. Percy Taylor, surveyor to the Hampton Wick Urban District Council, is to be congratulated on a narrow escape from what might have been a serious accident. On Friday he was cycling in his district, and suddenly realised that a runaway horse, drawing a vehicle, was within a few yards of him. With quick decision he turned his machine on to the footpath. Curiously enough, the horse bolted from Hampton Court, and—although only stopped at Kingston by the cart becoming locked between a wall and a tram pole—was neither injured itself nor inflicted injury.

Mr. F. Wallis Stoddart has transferred all rights in the manufacture and sale of his patent sewage distributor to Mr. Charles Walker, of Denmark-avenue, Bristol, to whom all enquiries for this apparatus should be addressed. Mr. Walker has been associated with Mr. Stoddart in this business since its commencement, has superintended the erection of many filters fitted with the distributor, and controls works of which such filters form part, so that he is intimately acquainted with all practical details. Mr. Stoddart retains no financial interest in the business, but reverts to his original practice as consultant on matters of sewage disposal and water supply.

Mr. James Hembrow, a member of the Chelmsford borough engineer's department, who has been appointed town planning assistant at Edmonton, has been presented by his colleagues with a travelling bag and a case of pipes. The presentation was made by the borough engineer, Mr. Percival T. Harrison, who spoke of the very efficient and enthusiastic services rendered by Mr. Hembrow, and the personal regret he experienced at his departure. Mr. Hembrow was very popular among his colleagues, and would carry with him their heartiest wishes for his future success and happiness. Other members of the staff also spoke of the good comradeship which existed between them and Mr. Hembrow. Mr. Hembrow has been connected with the borough engineer's staff for nearly five years.

London Fire Brigade.—The cost of upkeep of the London Fire Brigade amounts to £300,000 a year.

Fluxphalte and Mexphalte.—The merits of these productions of the Anglo-Mexican Petroleum Products Company, Limited, Finsbury-court, Finsbury-pavement, E.C., are shortly but clearly set out in a booklet, printed in English, French and German, which has been issued during the week in connection with the International Road Congress.

Trans-Atlantic Refuse Destructors.—Since the first municipal refuse destructor was installed in 1906, at Westmount, Quebec, the number has grown to twenty-seven in the United States and Canada, including in each case three which are "pending awards." In the United States there are seventeen cities with nineteen separate plants of 115 grates, and a daily capacity of 1,767 tons; in Canada ten cities with eleven separate plants of thirty-three grates, and a daily capacity of 570 tons. Two of the cities employ the surplus power for pumping water for the city supply or for fire protection, one furnishes auxiliary power for electric lighting, another develops power for pumping sewage. In one large industrial works the destructor boiler is an auxiliary to the steam power plant, and in another city the destructor furnishes steam for the operation of a reduction plant. At four of the installations additional equipment is being installed for utilising the power from destructor boilers for pumping water and municipal electric lighting. In seven of those under construction and pending award it is proposed to use the power for several forms of municipal and private service.

Problems in Engineering, with Solutions.*—The English journal THE SURVEYOR AND MUNICIPAL AND COUNTY ENGINEER carries on a section devoted to various questions which might be put in an examination for the position of municipal engineer in an English town or city. The questions are given one week and answers provided by various correspondents given in subsequent issues. The volume noted above is the first one to be made up from these questions and answers. As is well known, the position of municipal engineer in England is one of most varied activity, so that the subject covered by the questions and answers extends through the whole field of engineering. For example, the chapter headings are as follows: Mechanics and Hydrostatics; Strength and Elasticity of Materials; Theory of Structures; Surveying and Levelling; Water Supply and Hydraulics; Sewerage; Sewage Disposal; Road Making and Tramways; Building Construction and Materials; Law and Miscellaneous. While the questions and most of their solutions are distinctly British in character, the wide range of subjects and the method of treatment make the book of some value to American engineers. There is a good deal to be said in favour of the question and answer method of instruction.—*Engineering News.*

* Being Questions and Answers reprinted from the Assistants' and Students' Section of THE SURVEYOR AND MUNICIPAL AND COUNTY ENGINEER. First Series, 1909-10. Edited by Sydney G. Turner, ASSOC.M. INST.C.E. London: St. Bride's Press, Limited. Price 5s. nett.

FOR OTHER ADVERTISEMENTS
See End of Paper.

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HEREFORDSHIRE COUNTY COUNCIL.

HIGHER EDUCATION COMMITTEE.

SECONDARY SCHOOL FOR GIRLS, WIDEMARSH STREET, HEREFORD.

TO BUILDERS AND CONTRACTORS.

The Committee invite Tenders for the erection of this Building. The drawings may be seen and Bills of Quantities and Forms of Tender obtained at the County Surveyor's Offices, Shire Hall, Hereford, on payment of Two Guineas, which will be returned on receipt of a *bonâ-fide* tender.

Tenders addressed to the Chairman of the Education Committee, Shire Hall, Hereford, and marked "Girls' School," are to be delivered not later than noon on Monday, July 14th next. The lowest or any Tender not necessarily accepted.

The Contract to be entered into will contain the usual clause as to the payment of the standard rate of wages current in the district.

(By order)
G. H. JACK,
County Surveyor and Architect.

The Shire Hall, Hereford,
June 25th, 1913. (590)

WEMBLEY URBAN DISTRICT COUNCIL.

TO ROAD CONTRACTORS.

The above Council invite Tenders for the work of providing Foundation and Subcrust ready to receive a surface coating of "Quarrite" Paving and of Kerbing and providing surface Water Drains to the Watford-road (until recently known as Pinner or Sheepcote road), in the Urban District of Wembley, about 1 mile 5 furlongs in length.

Plans may be seen at the Office of the Engineer and Surveyor to the Council (Mr. Cecil R. W. Chapman), Public Offices, High-road, Wembley.

Copy of Specification and Quantities can be obtained upon application at his Office.

Sealed Tenders, upon the Form of Tender provided, to be sent in to me on or before noon on Tuesday the 8th of July, 1913.

The Council does not bind itself to accept the lowest or any Tender.

FREDK. W. RODD,
Clerk to the Council.

Public Offices, High-road, Wembley.
23rd June, 1913. (589)

BOROUGH OF HORNSEY.

APPOINTMENT OF ROAD FOREMAN.

The Town Council require to engage a Road Foreman for part of the Borough. The wages will be £2 5s. a week, rising by 2s. 6d. a week for the second year and a further 2s. 6d. a week for the third year to £2 10s. a week. Residence at the Highway Depot, with coal and lighting, is provided

Candidates must be between 30 and 45 years of age, and those with experience under a Local Authority will be preferred.

Forms of application can be obtained from Mr. E. J. Lovegrove, Borough Engineer, to whom applications are to be forwarded, accompanied by not more than three recent testimonials as to character and competency, not later than Saturday, the 12th proximo.

F. D. ASKEY,
Town Clerk.

Town Clerk's Office,
99 Southwood-lane, Highgate.
25th June, 1913. (592)

HONG KONG GOVERNMENT.

APPOINTMENT OF OVERSEER.

Second Class Overseer required by Hong Kong Government for 3 years' service, with possible extension. Age about 30. Unmarried. Salary £200 to £230. Second-class passages. Candidates must have had considerable experience in the making and maintenance of paved footways, ordinary macadam and tar-macadam roads, and in concrete work as applied to road channels, &c.; must be capable of measuring up work and preparing statements of same. Tradesmen experienced as Road Overseer or Foreman under a Municipal Engineer should apply at once to the Crown Agents for the Colonies, Whitehall-gardens, London, S.W. (593)

BOROUGH OF CHELMSFORD.

ROAD FOREMAN.

The Town Council of Chelmsford invite applications from persons not exceeding 40 years of age for the position of Road Foreman, at a weekly wage of £2, rising (subject to satisfactory service) by two annual increments of £6 10s. to a maximum weekly wage of £2 5s.

Applicants must have had a thorough experience in the construction and maintenance of roads and be thoroughly competent to supervise labour.

Application forms and full particulars of the duties, &c., will be supplied by the undersigned on receipt of a stamped and addressed foolscap envelope.

Applications, enclosed in sealed envelopes endorsed "Road Foreman," and accompanied by copies of three recent testimonials, must be delivered at my office by not later than four o'clock p.m. on Thursday, 10th July.

GEORGE MELVIN,
Town Clerk.

Municipal Offices,
Chelmsford.
26th June, 1913. (5 4)

MATLOCK URBAN DISTRICT COUNCIL.

FILTERING MEDIUM.

Tenders are invited for supplying about 5,700 cube yards of good, hard, clean, and gauged Clinker for Bacterial Percolating Filters.

Form of Tender, Specification, and other necessary particulars may be obtained on application to the Engineers, Messrs. James Diggle and Son, 14, Victoria-street, Westminster, S.W., and Hind Hill-street, Heywood, Lancashire, on payment of a deposit of Two Guineas, which will be returned on the receipt of a *bonâ-fide* Tender and the Specification.

Sealed Tenders, addressed to R. Taylor, Clerk to the Council, Council Offices, Matlock, endorsed "Filtering Medium," to be delivered not later than Saturday, July 12th.

The Council do not bind themselves to accept the lowest or any Tender.

(By order)
R. TAYLOR,
Clerk to the Council.

Town Hall, Matlock.
June 24th, 1913. (587)

ASSISTANT (25) requires appointment. 3 years' articles; 3½ years Assistant, County Surveyor's Office. Good Surveyor, Leveller, Draughtsman. Experience in Schools, Hospital, Sewerage, Roads, &c. Use theodolite. Good testimonials.—Box 1,264, Office of THE SURVEYOR, 24 Bride-lane, Fleet-street, E.C. (591)

The Wellington (Salop) Urban District.*

By GEORGE RILEY, Engineer and Surveyor to the Council.

Wellington is the centre of a large agricultural district, and serves as the market town for it and the neighbouring mining and manufacturing districts. The principal industries are brewing, malting, manufacture of furniture, and all kinds of woodwork and agricultural implements. In addition, several large and well-equipped boarding schools have grown up and added materially to its prosperity. In the summer numerous visitors pass through the town on their way to spend a day on the Wrekin. The town has an area of 684 acres. The surface levels vary a good deal, and for the most part drainage gradients are satisfactory. The subsoil is clay and gravel, overlaying the lowers layers of the new red sandstone. The water supply is under the control of the council, who have water rights over some of the surrounding rural area besides. The sewers are for the most part modern, and the outfall is about half a mile from the border of the district. The roads are under the management of the local authority, and are constantly undergoing improvement. There is a good market hall, free library, public swimming baths, Smithfield, cottage hospital, recreation ground and sanatorium. The rateable value of the district as on December 31, 1912, is £38,205 2s. 6d., and the assessable value £37,682 17s. 9d. Outstanding loans for sanitary purposes on the same date amount to £34,938 15s. 9d.

WELLINGTON SEWAGE WORKS: SEDIMENTATION AND DETRITUS TANKS.

The population at the end of 1912 was 7,905. The infantile mortality at the end of the year was 80. The death-rate for the year was 12·6 per 1,000; thirty-seven deaths occurred in persons over seventy years of age. The town is very healthy, and mostly of a residential character.

FIRE STATION.

The fire station is situate in Walker-street, close to the council offices. The equipment consists of one Merryweather's Greenwich gem double-cylinder steam fire engine, capable of discharging 250-300 gallons per minute, one manual engine, hose cart, and a Shand Mason's 40-ft. curricle fire escape.

PUBLIC BATHS.

Public baths were erected three years ago, and are built of local bricks, the interior being faced with W.G. bricks. The swimming bath is 75 ft. by 22 ft., 6 ft. at the deep end, and 3 ft. at the shallow end; there are also nine slipper baths, foot baths, &c. The swimming bath is heated by means of Matthews' steam heaters; the total cost, including main building, heating, laundry, caretaker's house, &c., amounted to £3,500.

PUBLIC LIBRARY.

The public library is in Walker-street, and the site was presented to the town by Mr. H. France Hayhurst, while £500 was received from Mr. A. Carnegie. The building contains large reading-room, lending and reference library, and the council have under consideration additional accommodation for ladies.

MARKET AND SMITHFIELD.

The market is a large covered building belonging to a private company, and is well patronised by the townspeople and persons from the neighbouring districts. The Smithfield is one of the finest in the Midlands, and is well attended by butchers and dealers from all parts of the county, Birmingham, Wolverhampton and Staffordshire.

COTTAGE HOSPITAL AND RECREATION GROUND.

The Cottage Hospital and recreation ground were presented to the town by Mrs. Jno. Crump-Bowring, and were opened by Earl Powis on May 24, 1913. The hospital has accommodation for eight beds—four male and four female—and the building is of local brick rough casted and covered with Tucker's hand-made tiles. It stands in a beautiful position, having a commanding view of the Wrekin and Ercall Woods. The recreation ground adjoins, and there are tennis courts, bowling green, and 2½ acres of playing field.

PUMPING STATION.

Owing to the growth of the population the water supply was insufficient for the town and district, so the council decided, on the recommendation of the author, to put down a 12-in. borehole, which went to a depth of 246 ft. from the surface. The strata are of a stiff marl and new red sandstone, and a plentiful supply of water was obtained. The test pumping required by the Local Government Board for fourteen days, twenty-four hours per day, was maintained

* Notes presented at a North-Western District meeting of the Institution of Municipal Engineers held at Wellington, Salop, on Saturday last.

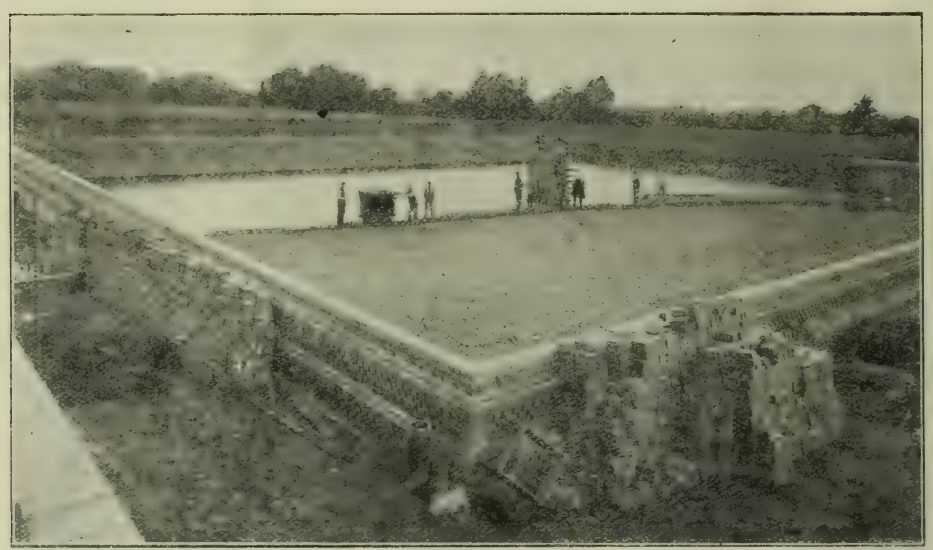
at the rate of 9,000 gallons per hour; when the pumps ceased working at the end of fourteen days the water rose in the borehole 30 ft. in five minutes. It was then decided to put down engine and pumps. The author recommended the pumping of the water from the borehole to the reservoir in two lifts by means of a 36×9 Ashley pump for lifting the water to the surface into a launder box. The water is then lifted by means of a treble ram pump from the launder box to the reservoir, the length being 2,000 yds. and the lift 210 ft.; both pumps are belt driven by means of a 28 b.h.p. National gas engine. The Ashley pump was supplied by Glenfield & Kennedy, Kilmarnock, the treble ram pump by Joseph Evans & Sons, Wolverhampton, the whole of the work being carried out by James Clay, Limited, engineers, Wellington.

SEWAGE DISPOSAL WORKS.

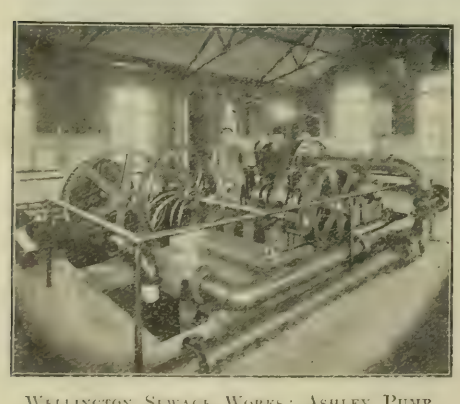
The sewage disposal works are situate 2 miles from the town, and were designed and laid down by the author six years ago at a cost of £6,000. The sewage enters the works by means of an 18-in. cast-iron pipe. The maximum dry-weather flow is 200,000 gallons. The works consist of two detritus tanks, 30 ft. by 18 ft. by 8 ft., and three sedimentation tanks having a holding capacity of 87,500 gallons each. One detritus tank and two sedimentation tanks work together, the others acting as stand-by tanks. The sewage, after passing through the tanks, is discharged on to a filter bed, 150 ft. by 135 ft. by 8 ft. deep, by means of Jones & Attwood's fixed sprays working with 5½-ft. head. The filtering medium is of cold-blast slag broken to 2¼-in. gauge, resting on a 6-in. bed of concrete; the floor is covered with bacteria tiles from Naylor Brothers, Denby Dale. The filtered effluent is then discharged into humus tanks, 75 ft. by 15 ft. by 3 ft. deep, and after leaving these tanks is discharged on to the land before entering the stream. It is necessary at all times to produce a good effluent, as in summer the effluent from the works is the only water that enters the stream, and is used for the watering of cattle on the land adjoining.

WREKIN RESERVOIR.

There are two impounding reservoirs at the Wrekin, with a holding capacity of 19,000,000 gallons, the water being filtered through three gravity filters at the rate of 350 gallons per square yard per twenty-four hours. The filters are composed of 2 ft. of graded gravel, varying in size from 2½ in. to ¼ in., the media resting on a bed of concrete 6 in. thick; the underdrainage is by means of Naylor's bacteria floor tiles. On the top of the gravel is 2 ft. 6 in. of Leighton Buzzard and local sand. The water after leaving the filters is discharged into a covered service reservoir of brick, with a holding capacity of 175,000 gallons. The analysis of the water from time to time shows a high rate of purification.



Wellington Sewage Works: Filter in Course of Filling.



Wellington Sewage Works: Ashley Pump and Frith Ram Pump.

STREETS.

Most of the footpaths are laid with Croft Adamant kerbs, flags, and channels, work amounting to £10,000 having been carried out by this firm during the last ten years. All the streets in the urban area are tar painted each year (the total area approximates 100,000 yds.), crude tar from the local gasworks being used for the purpose. The tar is collected and stored during the winter months in seven brick-built vats, holding 100 tons, and is heated by live steam from the public baths boiler being blown into it. The area covered on an average is 6 super. yds. per gallon, and the cost of tar, sand, and labour works out at less than 1d. per square yard of surface covered; the results obtained are considered highly satisfactory. All the streets are lighted with incandescent lamps, and the town is considered, as far as lighting is concerned, second to none in the county.

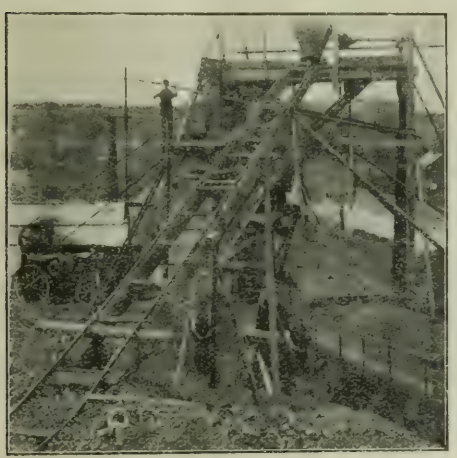
GAS SUPPLY.

The Wellington (Salop) Gas Company was formed in 1851 as the Wellington Coal and Gas Light Company, with powers to supply gas to Wellington, Oakengates and Ketley, or any other place not exceeding 5 miles from Wellington; but in an Order of 1872 these powers were restricted to a radius of 2 miles from the parish church of Wellington with certain reservations. The title was changed in 1903 to the Wellington (Salop) Gas Company, with the same area of supply but with full statutory powers, and the usual "sliding scale" whereby with a standard price of 3s. 9d. per 1,000 cub. ft. and a dividend of 5 per cent, the latter is augmented by 2s. 6d. per cent for every 1d. reduction in price per 1,000 ft. The selling price

is now 3s. per 1,000 ft., with a special rate of 2s. 6d. for cooking and heating, and 2s. to 2s. 3d. for engines. The total capital of the company (including £15,660 added on conversion in 1903) is £47,600. The works are capable of supplying 75,000,000 ft. of gas per annum, and the present output is 57,500,000 ft. Regenerator settings on the Winstanley principle are employed in manufacturing the gas, and the works are well equipped with modern purifying, washing and scrubbing plant. There is also a "Radcliffe" plant installed alongside the sulphate house for the purification of the ammoniacal liquor effluent before it enters the sewer.

WELLINGTON COLLEGE.

The town of Wellington is noted for its educational facilities, and prominent among the scholastic establishments is the college, which ranks among the best of the colleges in the Midland Counties. The college premises extend over a large area, with boarding houses, extensive playing fields, golf links, swimming baths, gymnasium, lecture hall, an up-to-date rifle range for the accommodation of the Officers Training Corps, which is now one of the most efficient among the corps connected with the public schools and colleges of the country, and other attractions which



Wellington Sewage Works: Slag Crushing Plant.

combine to make Wellington College exceedingly popular with parents who desire efficient education amid most healthful surroundings. The principal of the college is Mr. J. Bayley, who has been one of the first elected members of the county council, and is a member of the Shropshire Education Committee. His assistance and advice on this body are much valued by those with whom he is associated. Mr. Bayley has also occupied a prominent position among the Association of Secondary School Masters of the country.

THE WREKIN.

The famous Wrekin, about 1½ miles from the centre of the town, is regarded as the "mountain glory of Shropshire." From the summit, about 1,300 ft. above sea level, on a clear day it is possible to view over nineteen counties. The geology of the Wrekin is extremely interesting, and the famous hill is regarded by residents in Shropshire as the centre towards which the best wishes and affections of the heart converge in that well-known convivial sentiment used at all social gatherings, and never out of place, in the opinion of Salopians, "All friends round the Wrekin."

COALBROOKDALE AND IRON-BRIDGE.

These are situated about 6 miles from Wellington, and are well worthy of a visit. Crossing the river Severn at Iron-Bridge is the first iron bridge made in England. It was constructed at the famous Coalbrookdale Ironworks, and the Act of Parliament which compels the reigning monarch to pay a toll when crossing the bridge has never been repealed.

Town Planning for Harrow.—Harrow District Council have given notice of their intention to apply to the Local Government Board for leave to prepare a scheme of town planning for their district and parts of the adjoining parishes in the Uxbridge Rural and Hendon Rural areas.

SOME RECENT PUBLICATIONS.*

The New English System of Money, Weights and Measures, and of Arithmetic. By Engineer Rear-Admiral Elbrow, R.N. Price 1s. nett. London: P. S. King & Son.

The author of this very ingenious little book considers not only that the present system of money, weights and measures in vogue in this country is inconvenient and illogical, but he makes a similar complaint with regard to the metric system. He has therefore compiled an entirely new system—the duodenal—which he claims to be adaptable for all peoples and serviceable for all purposes. He is a pioneer reformer, and we are afraid that it will be many years before the rising generation are taught such numbers as "tyteen," "linty lin," &c. While admiring the industry and ingenuity of the author, therefore, we can only recommend his book as a very interesting mathematical curiosity, which it has afforded us no little pleasure (and some amusement) to investigate.

Earthwork Haul and Overhaul. By J. C. L. Fish. Price 6s. 6d. nett. London: Chapman & Hall, Limited.

In this work the author deals with all problems affecting estimating for works involving the haulage of large masses of material, and the most economical methods of carrying out such works. It is evident that if works of this character are undertaken without a very clear idea of the most advantageous distribution of the removed material, much time, labour and money will inevitably be wasted. The whole matter is here put upon a purely scientific basis, and the reader is able to follow quite easily the processes described, owing to the fact that the author has made free use of their application to actual problems by way of illustration. Mr. Fisher's work should prove of great value to students of civil engineering and to those engineers and contractors who may have to deal with the removal of large quantities of earth.

ELECTRICITY AND GAS.

MUNICIPAL ELECTRICAL ASSOCIATION PRESIDENT'S SUGGESTION.

In his presidential address at the annual convention of the Municipal Electrical Association Mr. C. E. C. Shawfield, formerly chief electrical engineer to the Corporation of Wolverhampton, remarked that up to the present the history of electricity supply in this country had been one of constant warfare against gas competition for lighting, heating and motive power, and it might now be safely affirmed that electricity had won for itself an assured and unassailable position as regards public and private lighting and for motive power purposes, while it was making a strong attack upon the hitherto impregnable position of heating and cooking.

Hitherto the competition between electricity and gas had been beneficial both to the competitors and to their consumers, but he had thought that the time might arrive when it might be to the interests of both parties, and of the community generally, for competition to be replaced by co-operation, the suppliers of gas devoting their energies to the economical production of non-illuminating producer gas, which could be used by the suppliers of electricity for the production of electrical energy. If such an arrangement were possible it would assist in the husbanding of the coal resources, and would bring a little nearer that flat rate of something less than ½d. per unit, which at present seemed rather a Utopian vision.

SEA-COAST EROSION.—For a very complete and inexpensive library on the cause, prevention and repair of coast erosion the following three works are recommended: "Coast Erosion and Foreshore Protection," by John S. Owens, M.D., Assoc.M.Inst.C.E., F.R.G.S., and Gerald O. Case (price 7s. 6d., post free 7s. 10d.), with numerous illustrations and diagrams; "Sea-Coast Erosion and Remedial Works," by R. C. Allanson-Winn, M.Inst.C.E.I. (price 1s., post free 1s. 1d.); and "Erosion of the Coast and its Prevention," by F. W. S. Stanton, Assoc.M.Inst.C.E., F.S.I. (price 3s., post free 3s. 2d.), with numerous maps and other illustrations. The publishers are the St. Bride's Press, Limited, 24 Bride-lane, Fleet-street, London, E.C.

*Any of the publications reviewed, or referred to as received, will be forwarded by the St. Bride's Press, Limited, on receipt of published price.

Expeditious Methods in Trench Work.

By H. C. H. SHENTON.

Although an enormous amount of trench work is done in this country in connection with sewers, water mains, gas pipes, electric cables, and so forth, it does not seem that we are very ready to avail ourselves of the labour-saving appliances which are in common use in America.

Numerous machines and devices have been developed for trench work, and these include mechanical excavators, fillers, rammers, and pipe-laying appliances. If the use of these machines enables the American contractor to save labour, time and money, there is surely every reason to suppose that those English contractors who are sufficiently observant to be ahead of their fellows will reap a great advantage by a change of methods in this country. A study of the American machines is therefore to be desired.

One has only to open the current numbers of the American engineering papers in order to see how extensively the mechanical trench-making machines are being used. It is to be gathered that on large contracts, under certain conditions, those contractors who do not possess mechanical excavators are unable to compete successfully with those who are better equipped. It is by no means surprising that this should be so. For ordinary small trenches from 28 in. to 78 in. in width, and of any depth up to 20 ft., one excavating machine will do the work of from fifty to one hundred men in any kind of soil. Excavators of the dredger and steam shovel types are well known for larger work in this country, and the application of the same type of machine to the smaller work of trench digging has, without doubt, proved to be satisfactory.

It is, however, to the trench filler and to the mechanical rammer that the English contractor will do well to turn his immediate attention, for in these cases we have machines of such simplicity, cheapness, and obvious usefulness that there can be no great difficulty or expense involved in giving them a trial. As municipal engineers and contractors know to their cost, it is one of the most difficult things in the world to ensure that trenches are properly filled and rammed, and much money is wasted in remaking the surfaces of roads over trenches which continue to settle. Contractors frequently lose money simply because it is practically impossible to ram the material properly in the trenches by hand. The trenches having been filled and rammed, and the surplus material carted away, the surfaces are then metalled, and in due course the road sinks in places along the line of the trench. This results in considerable trouble, for in the case of a good road with a granite surface the contractor will have to fill up the hollows with granite and to use a steam roller, and, moreover, to keep on doing so at frequent and inconvenient intervals, probably for months. If the road surface is paved the difficulty may be even greater. In addition to this there is risk, one might almost say certainty, of claims for injury or damage done whenever any considerable hollow occurs along a trench line which is not promptly discovered and attended to. Thus the need for better ramming is very great, and it is surprising that the mechanical rammer has been so long in making its appearance, seeing that any simple machine used for the purpose would consolidate the earth-filling more evenly and regularly than could be done by hand, and would exert the same uniform pressure at every point, which pressure could be arranged with the right degree of intensity; moreover, it would enable the work to be done more rapidly.

Engineering News, of New York, in a recent issue described works on which a mechanical excavator was followed immediately by a simple portable pipe-laying derrick, by means of which stoneware pipes were lowered into a trench as soon as it was made. The derrick consisted of a framework carried on wheels, which ran on planks laid on each side of the trench. A drum worked by a hand crank was attached to the frame, and the pipes were slung on a special V-shaped hook. The method suggests the very rapid manner in which trench work may be accomplished under modern conditions. The idea of the pipe-laying machine following immediately behind the mechanical excavator suggests an enormous saving of timbering, pumping, and incidental work Surely much money and time are lost owing to the slow and painful way in which trenches of moderate depth are excavated with pick and shovel, lined with timber, and allowed to fill with water before any pipe-laying starts. Trenches in moderate ground which would stand unsupported for some days cannot be trusted to stand open for weeks. Hence costly timbering is required. The slow progress of the navvies as compared with an excavating machine alone makes much more timbering work necessary than would be ordinarily required, while the immediate excavation of the trench to its proper and exact level must enable the pipe-layer to start work at once, and must minimise the timbering and pumping required in a very marked degree.

TRENCH FILLING.

The trench-filling machine is the outcome of the practice of hitching a horse to a rope attached to a scraper on the opposite side of the trench. The scraper being then hauled forward by the horse moves a regular quantity of earth to fall over the edge into the trench. The scraper is then moved back by hand and adjusted for the next haul. Thus the spoil can be rapidly and evenly filled into the trench ready for ramming. In the machine scraper the work of the horse is performed by a light hoisting engine. A 10-horse power engine and boiler can be mounted on a frame carried by small flanged wheels on a short piece of portable track of 5 ft. 6 in. gauge, or the machine may be mounted on traction wheels and made self-propelling. The scraper is a large flat board fitted with arms for the chain attachment, and having a wheel at the back for convenience in running it away after each haul. It can be operated by two men with handles, by means of which the scraper is tilted back to take its load, and tilted forward to throw its material into the trench. It is stated in the *Engineering News* that in ordinary trench work one of these machines will do the work of fourteen men, and that it has filled a trench 200 ft. long by 33 in. wide by 12 ft. deep in ten hours.

RAMMING TRENCHES.

The machine rammer consists of a truck carried on two wheels in front, and supported by two legs at the back, and a long frame pivoted over the truck axle, which frame carries a small gasoline engine at one end and a long vertical bar or timber fitted with a ramming shoe at the other. A strap from the engine pinion drives a pulley and gearing at the rammer end of the frame so as to give a vertical reciprocating action to the rammer. The frame can be swung to and fro horizontally to cover the width of the trench. The wheels and the shoes on the rear legs have a vertical adjustment of about 8 in., so that the machine can be set level when working close to the kerb with one wheel and leg on the footway and one wheel and leg in the road. The vertical rammer bar is of hard wood, faced on two sides with small steel channels which slide in guides. The lifting mechanism consists of two rolls on opposite sides of the bar, geared together. The front roll is pressed against the rammer bar by coiled springs, and, a portion of the circumference of each roll being cut away, the bar is automatically released, and falls to the ground at once as soon as it loses contact with the rolls. Thus the rammer is gripped, raised and dropped once with each revolution of the rolls, the length of the stroke being 2 ft. The number of strokes is from fifty to sixty per minute. When not in use the rammer is held in the raised position by a pair of dogs or grips attached to the guides and pressed against the bar by springs. These grips can be thrown into action if necessary while the engine is running so as to prevent the bar falling. The bar will in such a case be raised by the revolving rolls till they finally lose their contact with the bar, which happens when it is lifted to the full length of its travel, the bar being of reduced thickness at the lower end in order to produce the effect.

The bars used are of varying lengths; with a 10-ft. bar the machine can ram to a depth of 6 ft. below the surface, which is found to be sufficient for trenches as deep as 9 ft., owing to the force of the blow. The rammer

head is 8 in. by 9 in., and weighs from 80 lb to 90 lb. A 16-ft. bar will work to a depth of 12 ft.; for greater lengths the weight of the head is reduced so that the total weight may not exceed 100 lb. On small trenches the machine can be worked by one man, but generally two men are employed. According to the *Engineering News*, it is stated that for surface work two men can ram from 1,200 sq. ft. to 1,500 sq. ft. per hour. In 30-in. trench work they can ram ten layers of 40 lin. ft. to 50 lin. ft. in one hour—that is to say, from 1,000 to 1,250 ft. super. with single ramming.

The work has been found to be far superior to hand ramming; even with a 10-in. pipe the whole of the earth taken out of the trench can be put back so that there is no settlement and no cartage of spoil. In one case, where a trench was being filled by hand labour, twenty-three shovellers and twenty-three rammers were employed. The machine doing the same work employed two men with one man to level and fill in the trench. Thus twenty men were eliminated, and the work was better done, so that the saving in labour paid for the machine in a few days. The machine has been used on a good many works in America, and it is reported by one well-known contractor for electric conduit work that he effects a saving of $8 a day per machine as compared with hand work. There is little doubt that English contractors engaged on similar work could effect a similar saving.

LOWER THAMES VALLEY DISTRICT SURVEYORS' ASSOCIATION.

AN INTERESTING ROUND OF VISITS.

About twenty members of the above-named association took part in a summer visit of inspection held on Saturday, the 14th inst. The first visit was to the works of Messrs. Clements, Knowling & Co., Limited, Brentford, where the party witnessed the manufacture of "Clinkerment" building blocks, fireproof partition slabs, and other productions.

The members next drove to Acton and inspected a length of "Quarrite" paving, 4 in. thick, being laid, also a length which had been in use nearly three years. The material is supplied by the Northern Quarries Company, and consists of Leicester granite treated with bitumen. The bottom bed is 2½ in. thick, of 2½-in. graded stone, with a proportionate mixture of tarred chippings to fill in the interstices. The top bed is 1½ in. thick of ¾-in. to 1-in. stone, surface sealed with a thin coat of ¼-in. stone, and waterproofed with a squeegeed coat of bitumen.

The party next proceeded to view a roadway which is being paved with "Bitulithic" paving, laid by Messrs. Wm. Shepherd & Sons, and consisting of tarred Wellingborough slag, mixed graded material, anl surfaced with bitumastic composition and granite chippings. The traffic over this road was 1,400 vehicles per day.

ACTON SEWAGE PUMPING WORKS.

Subsequently the members visited the Acton sewage pumping works, assembling at the point at which all the sewers of the district converge, and where the sewage is delivered into the London County Council's system. A large proportion of sewage is delivered at so low a level that pumping is necessary, but all the sewage, whether it is pumped or delivered by gravitation, is collected in the chamber at the north-western corner of the sewage works. From this chamber the sewage flows along a channel some 180 ft. long. At the side of this channel there is a weir extending the full length, and at the end there are two orifices which discharge into the London County Council's system. These orifices are each capable of discharging 3,000,000 gallons per day. The rate of discharge must at no time exceed 6,000,000 gallons per day, and the height of the 180-ft. weir is so fixed as to prevent this occurring. When the discharge from the two orifices reaches 6,000,000 gallons per day the surplus flows over the long weir and then through the filter-beds to the river Thames. In the case of a heavy storm, the sewage flows direct to the river through a 6-ft. effluent barrel.

ROAD WORKS.

Two roads which had been resurfaced with "Quarrite" paving 3½ in. thick were afterwards inspected. In the case of one of these the work was done nearly four years ago, and the road carries 600 to 700 vehicles per day. Other roads were visited later, one being laid in "Quarrite" for half its length and for half its length in Tarmac. Another was laid wholly in tarred granite. The traffic on these roads is about 1,000 vehicles per day.

The party next visited the Acton council offices, where an inspection of the council chamber was made, and where tea was provided by Mr. F. Sadler, the engineer and surveyor.

The inspections were continued after tea. One of the roads seen was laid with Tarmac over four years ago, and sustains a traffic of about 1,500 vehicles per day. The surface has been tarred and treated with chippings twice since it was laid. A "Carmarco" surface was also inspected. Further roads surfaced with Tarmac were subsequently inspected. The material used on these was tarred ironstone slag treated, while hot, with a mixture of tar, pitch, resin, &c. The bottom layer was of 2½-in. gauge, 2½ in. thick, the top layer being 1¼-in. gauge, 1½ in. thick, sprinkled with ¾-in. Tarmac to fill in the interstices, and finished with slag dust.

ACTON REFUSE DESTRUCTOR.

The party were then conveyed to the refuse destructor, which was erected in 1909, at a cost, inclusive of approach roads, but exclusive of land, of £22,950. The plant was erected by Messrs. Hughes & Stirling, Liverpool. It consists of eight top-feed cells, with drying hearths, each capable of destroying 18 tons of refuse per twenty-four hours. Four cells are sufficient to deal with the present delivery of refuse, so that the cell installation is really in duplicate, a set of four cells being used on alternate weeks.

The cost of collection of refuse in the district is 4s. 9d. per ton. Up to the present the house refuse has been collected by horses and vans. As all the loaded vans have to be carted uphill to the destructor, a system of motor haulage has been put into operation after an experimental trial. A 6-ton light hauling engine with six vans of 10 cub. yds. capacity each will be used, and it is hoped considerably to reduce the cost of collection.

The party afterwards inspected the slab-making plant, which completed the visit.

Cardiff Reservoir as Bath.—Members of the Cardiff Parks Committee met recently at the Penhill service reservoir to discuss a suggestion that the reservoir should be used for bathers instead of constructing an open-air bath in Llandaff Fields. Alderman Roberts (the chairman), Mr. W. Harpur (city engineer) and Mr. Priestley (waterworks engineer) were among those present. Mr. Priestley explained that the reservoir had not been used for nearly twelve years, but there was the possibility of its being required for trade purposes at some future time. The committee talked over various suggestions for altering the reservoir to make it suitable for bathers, and it was agreed to ask the town clerk to report as to the legal aspect of the Waterworks Committee handing it over for the purpose, and, subject to this, to request the city engineer to prepare a scheme for its conversion which should be both practicable and economical.

The American Road Congress.—The American Road Congress will hold its third annual meeting at Detroit for a week at the end of September. It is the great annual assemblage of the good roads organisations throughout the United States, and is held under the auspices of the American Highway Association, the American Automobile Association, and the National Association of Road Machinery and Materials Manufacturers. As there are between thirty and forty State and interstate organisations identified with the American Highway Association, in addition to its 1,800 regular members, the big meeting will be thoroughly representative in character. Arrangements have also been made to hold in conjunction with the congress the annual meeting of the Michigan States Good Roads Association, which has 15,000 members, and other associations, the combined attendance from which will be over 5,000. A special session will be held for the benefit of contractors. The exhibition associated with the congress will be held on the ground floor of the large hall in which the congress will meet, and adjacent land and a street adjoining will be utilised for further exhibition space for heavy road-making machinery. As heretofore, the remarkable Government exhibit of road models will be a feature, and various State exhibits will also be shown in much larger number than at the congress held in Atlantic City in 1912.

INSTITUTION OF MUNICIPAL AND COUNTY ENGINEERS.

President—Mr. R. J. THOMAS, M.INST.C.E., County Surveyor, Buckinghamshire.

District Chairman—A. T. DAVIS, M.INST.C.E., County Surveyor, Shropshire.

MEETING AT LEEK.

A meeting of the institution will be held in the West Midland District at the Town Hall, Leek, on Saturday, July 5th.

PROGRAMME.

11 a.m.—Reception in the town hall by the chairman of the Leek Urban District Council, Mr. Thomas Mason, J.P.
Paper by W. E. Beacham, engineer and surveyor, on "Leek and its Municipal Works," which will be taken as read.
Discussion.

1.15 p.m.—Lunch at Swan Hotel. (Tickets 2s. 6d. each.)

2.30 p.m.—Assemble at town hall previous to visiting the following works—viz.: Public baths, butter and poultry markets, Nicholson Institute, public library, technical schools, and gymnasium.

4 p.m.—Afternoon tea at town hall, by invitation.

4.30 p.m.—Inspection of fire station, Globe-yard improvement, and Belle Vue-road, electricity works, gasworks, including coal handling plant, and sewage disposal works.

F. C. COOK, ASSOC.M.INST.C.E.,
Hon. District Secretary.

Municipal Offices,
Nuneaton.

ANNUAL GENERAL MEETING AND TOWN PLANNING CONFERENCE, GREAT YARMOUTH.

(*July 16th—19th.*)

Wednesday, July 16th.—Morning: General business of the institution; presidential address and presentation of premiums; adjournment for lunch. Afternoon: Conference on Housing and Town Planning Act.

Thursday, July 17th.—Morning: (*a*) Papers on road matters; (*b*) conference (continued); adjournment for lunch, given by mayor and corporation to members of the institution and delegates to the conference. Afternoon: (*a*) Papers on road matters (continued); (*b*) conference continued and concluded. Evening: Annual Dinner.

Friday, July 18th.—Morning: Papers on road matters and subjects of general interest. Afternoon: Trip to waterworks at Ormesby Broad.

Saturday, July 19th.—Morning and afternoon: Trip by rail and steam launches over some of the rivers and broads of Norfolk.

The following is a preliminary list of the papers to be read and discussed at the Town Planning Conference:—

"Town Design in Practice," by J. E. Wilkes, town planning engineer, Dunfermline.

"Legal Aspects of Town Planning," by J. L. Jack, town clerk, Dunfermline.

"Description of Birmingham Schemes," by H. E. Stilgoe, city engineer, Birmingham.

"Early Examples of Town Planning in the City of Edinburgh," by A. H. Campbell, city engineer, Edinburgh.

"Cities Beautiful by the Sea," by J. S. Brodie, borough engineer, Blackpool.

"The Small Dwellings Acquisition Act, 1899," by J. L. Redfern, borough engineer, Gillingham.

"The Housing Question and its Solution," by Reg. Brown, surveyor to the urban district council, Southall.

"Factors Causing Bad Housing," by G. B. Hartfree, surveyor to the urban district council, Alton.

"Description of Town Planning Schemes and Housing in Sheffield," by C. F. Wike, city surveyor, Sheffield.

"A Description of the Ruislip-Northwood Town Planning Scheme," by W. Louis Carr, surveyor to the urban district council, Ruislip-Northwood.

The delegates to the conference will be welcomed by the mayor and corporation of Great Yarmouth, and entertained to luncheon by kind invitation of the mayor and corporation.

An important exhibition of plans of town planning schemes, kindly lent by authorities in various parts of the kingdom, will be available during the meeting.

THOMAS COLE,
92 Victoria-street, S.W. *Secretary.*

ROYAL SANITARY INSTITUTE.

ANNUAL CONGRESS AND EXHIBITION, EXETER.

The annual congress of the Royal Sanitary Institute will be held at Exeter from July 7th—12th next, under the presidency of Earl Fortescue, K.C.B., Lord-Lieutenant of Devonshire. The order of proceedings will be found set out in our issue of May 23rd.

E. WHITE WALLIS,
Secretary.

Drainage Works and Sanitary Fittings.—A third edition, revised and brought up to date, particularly as regards the questions of concrete sewers, sewer ventilation and flushing, and the Public Health Acts Amendment Act of 1907, still further evidences the success of this little manual,* which manifestly deserves the attention and confidence of all concerned in the important subject with which it deals.—*The Bookseller.*

APPOINTMENTS VACANT.

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ROAD SURVEYOR'S CLERK.—June 28th.—Corporation of Birmingham. £60—£110.—Mr. Henry E. Stilgoe, city engineer and surveyor.

SEWAGE OUTFALL WORKS MANAGER.—June 28th.—Willenhall Urban District Council. £100 per annum with house and light.—Mr. Rowland Tildesley, clerk.

ASSISTANT ENGINEER AND SURVEYOR.—June 30th.—Corporation of Chelmsford. £150—£180.—Mr. P. T. Harrison, borough engineer and surveyor.

ASSISTANT VALUER AND SURVEYOR.—June 30th.—Calcutta Improvement Trust. 600—800 rupees per month.—Mr. C. H. Bompas, chairman, 5 Clive-street, Calcutta.

CITY SURVEYOR'S DEPUTY (ENGINEERING DEPARTMENT).—June 30th.—Corporation of Manchester. £750 per annum.—City Surveyor, Town Hall.

CITY SURVEYOR'S DEPUTY (SURVEYING DEPARTMENT).—June 30th.—Corporation of Manchester. £750 per annum.—City Surveyor, Town Hall.

BOROUGH ENGINEER'S TEMPORARY ASSISTANT.—June 30th.—Corporation of Dorchester.—Mr. A. G. Symonds, town clerk.

GENERAL ENGINEERING AND SURVEYING ASSISTANT.—June 30th.—Corporation of Stoke-on-Trent. £90—£120.—Mr. A. Burton, borough surveyor.

DRAUGHTSMAN. — June 30th. — Hampstead Borough Council. £80 per annum.—Mr. Arthur P. Johnson, town clerk, Town Hall, Haverstock Hill, N.W.

SEWAGE WORKS FOREMAN.—July 1st.—Buxton Urban District Council. 37s. 6d.—£2 5s. per week.—Mr. F. Langley, engineer and surveyor.

CLERK OF WORKS.—July 1st.—Finchley Urban District Council. £3 3s. per week.—Mr. C. J. Jenkin, Council Offices, Church End.

INSPECTOR OF NUISANCES.—July 2nd.—Thedwastre Rural District Council. £100 per annum.—Mr. H. E. Wilkes, clerk, Stowmarket.

INSPECTOR.—July 2nd.—Goole Urban District Council. To assist resident-engineer in connection with new sewerage scheme. 50s. per week.—Mr. R. Tyson, clerk.

* "Drainage Work and Sanitary Fittings." By Wm. H. Maxwell, Price 2s. nett. London: St. Bride's Press, Ltd., 24 Bride-lane, E.C.

CLERK OF WORKS.—July 3rd.—Godstone Rural District Council. £3 3s. per week.—Mr. Geo. E. Crowter, engineer and surveyor.

THREE PROBATIONARY SURVEYORS.—July 4th.—For the river survey department of the Port of Calcutta. Rs.120—Rs.200 per month.—Mr. J. Angus, consulting engineer and London agent, 17 Victoria-street, Westminster, S.W.

CLERK OF WORKS.—July 5th.—Corporation of Cheltenham.—Borough Engineer.

INSPECTOR OF NUISANCES.—July 5th.—Sleaford Rural District Council. £80 per annum.—Mr. E. Clements, clerk.

SANITARY INSPECTOR.—July 7th.—Hampstead Borough Council. £150 per annum.—Mr. A. P. Johnson, town clerk.

SEWER FOREMAN.—July 7th.—Corporation of Birkenhead. 45s. per week.—Mr. Charles Brownridge, borough engineer.

CLERK OF WORKS.—July 8th.—Leyton Urban District Council. £3 per week.—Mr. E. H. Essex, surveyor.

CLERK OF WORKS.—July 8th.—Neath Rural District Council. £2 10s. per week.—Mr. W. E. Clason Thomas, engineer.

VALUER.—July 9th.—Dewsbury Assessment Committee.—Mr. C. P. Pickersgill, clerk, Union Offices, Wellington-street, Dewsbury.

ASSISTANT ENGINEER.—Public Works Department of British Guiana. £600 a year, with travelling expenses and subsistence allowance when absent from station.—Crown Agents for the Colonies, Whitehall-gardens, London, S.W. Quote M. 6,071 on left-hand top corner of application.

HIGHWAY SURVEYOR'S ASSISTANT.—July 1st.—Elham Rural District Council. £100 per annum.—Mr. B. C. Drake, Hythe, Kent.

ASSISTANT SANITARY INSPECTOR.—July 1st.—Merton Urban District Council. £75 per annum.—Mr. C. J. Mountfield, clerk, Merton, Surrey.

ASSISTANT ENGINEER.—July 5th.—Corporation of St. Helens. £2 per week.—Mr. Arthur W. Bradley, borough engineer and surveyor.

ENGINEER'S ASSISTANT.—July 7th.—Corporation of Worcester. £130 per annum.—Mr. T. Caink, city engineer.

INSPECTOR OF NUISANCES.—July 8th.—Clutton Rural District Council. £130—£150.—Mr. J. Sumner Dury, clerk, Temple Cloud, Bristol.

TECHNICAL (SANITARY) INSPECTOR.—October 1st.—Municipality of Alexandria.—The Director-General of the Municipality.

MUNICIPAL COMPETITIONS OPEN.

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LIVERPOOL.—July 24th.—Designs for a sanatorium of 250 beds. Premiums, 150, 100 and 50 guineas.—Mr. Edward R. Pickmere, town clerk.

CHEPPING WYCOMBE.—September 1st.—Designs for town-planning the borough and an area immediately adjoining. Premiums, £25, £10 and £5.—Mr. T. J. Rushbrooke, borough surveyor, High Wycombe.

MUNICIPAL CONTRACTS OPEN.

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Buildings.

TIVERTON.—June 28th.—For the erection of eighteen cottages, for the corporation.—Mr. J. Siddalls, borough surveyor.

SOUTHAMPTON.—June 30th.—For the construction of Great Town Bridge, Whitchurch, consisting of four small brick arches with concrete abutments and piers, the construction of 1 mile of surface-water drains, and the construction of short lengths of surface-water drains, for the county council.—Mr. H. Barber, clerk, The Castle, Winchester.

ROMFORD.—June 30th.—For the erection of eighteen cottages, for the rural district council.—Mr. W. J. Grant, surveyor.

SEAHAM HARBOUR.—June 30th.—For the erection of forty-five houses, road and sewer works, and fencing, for the urban district council.—Mr. F. E. Boaz, surveyor

FLEETWOOD.—June 30th.—For the extension of boiler house, for the urban district council.—The Surveyor.

HARROGATE.—June 30th.—For the erection of a boundary wall, for the corporation.—Mr. C. E. Rivers, borough engineer and surveyor.

ABERDEEN.—June 30th.—For conversion of premises to a public convenience, for the corporation.—Mr. W. Wyack, burgh engineer.

DUNDEE.—June 30th.—For the extension of generating station, for the electricity department.—Mr. H. Richardson, general manager and engineer.

WEST HAM.—July 1st.—For the erection of a school, for the corporation.—Mr. W. Jacques, architect to the Education Committee, 2 Fen-court, Fenchurch-street, E.C.

DARLINGTON.—July 1st.—For the erection of a mortuary, for the corporation.—Mr. G. Winter, borough surveyor.

ESSEX.—July 1st.—For alterations and additions to Hadleigh school, for the county council.—Mr. F. Whitmore, county architect, Duke-street, Chelmsford.

SEVENOAKS.—July 2nd.—For the erection of six cottages, for the rural district council.—Mr. C. W. Bowles, architect, 9 Staple-inn, Holborn-bars, London W.C.

KENT.—July 2nd.—For the erection of a school, for the Education Committee.—Mr. F. W. Crook, secretary, Caxton House, Westminster, S.W.

GLAMORGAN.—July 2nd.—For re-modelling general offices and other works, for the county council.—Mr. T. Mansel Franklen, clerk, Cardiff.

NANTWICH.—July 3rd.—For alterations and extensions to a bridge, for the rural district council.—Mr. T. J. Peake, district surveyor, Wistaston-road, Willaston.

GODSTONE.—July 3rd.—For the construction of a reinforced-concrete bridge, for the rural district council.—Mr. Geo. E. Crowter, engineer and surveyor.

BRECON.—July 4th.—For the construction of school latrines and drainage, for the Education Committee.—Mr. C. W. Best, surveyor, County Hall, Brecon.

RHONDDA.—July 4th.—For building a keeper's cottage, for the urban district council.—Mr. W. P. Nicholas, clerk, Council Offices, Pentre.

DURSLEY.—July 5th.—For the erection of thirty-eight cottages, laying sewers, and making roads, for the rural district council.—Mr. A. W. Probyn, architect and surveyor, 9 Berkeley-street, Gloucester.

GUILDFORD.—July 7th.—For alterations and repairs to schools, for the Education Committee.—Mr. C. G. Mason, borough surveyor.

MALDENS AND COOMBE.—July 8th.—For the erection of new council chamber and offices, for the urban district council.—Mr. R. H. Jeffes, Municipal Buildings, New Malden.

BARNES.—July 8th.—For building a keeper's cottage at Barnes-common, for the urban district council.—Mr. G. Bruce Tomes, surveyor.

TWICKENHAM.—July 9th.—For the construction of about 650 ft. of stone-pitched inclined embankment along the river frontage of Radnor House pleasure ground, for the urban district council.—Mr. Fred. W. Pearce, surveyor.

GREAT BERKHAMPSTEAD.—July 10th.—For the construction of an open-air swimming bath, for the urban district council.—Mr. E. H. Adey, surveyor.

STEPNEY.—July 10th.—For the erection of an iron and steel high-tension electricity generating station, offices, messrooms, and lavatories, for the borough council.—Mr. M. W. Jameson, borough engineer, Municipal Offices, Whitechapel, E.

PADDINGTON.—July 12th.—For the construction of abutments, with steps and appurtenant works of new footbridge, construction of steel work of footbridge over canal, or with ferro-concrete, for the borough council.—Mr. E. B. B. Newton, borough surveyor.

MIDLETON (Co. Cork).—July 12th.—For sinking a well and erecting a pump, for the rural district council.—Mr John Stanton, clerk.

Iron and Steel.

EAST GRINSTEAD.—June 28th.—For the supply of fencing and gates, for the urban district council. —Mr. W. E. Woollam, engineer.

BEDLINGTONSHIRE. — June 30th. — For the supply of 750 yds. of cast-iron spigot and socket 9-in. water pipes, for the urban district council.—Mr. J. E. Johnston, surveyor.

DARLINGTON.—July 1st.—For the supply of wrought-iron fencing, for the corporation.—Mr. G. Winter, borough surveyor.

LLANDRINDOD WELLS.—July 4th.—For the supply of a pair of mechanical filters with fittings, for the urban district council.—Mr. H. Crabtree, surveyor and waterworks engineer.

HOUGHTON-LE-SPRING.—July 5th.—For the supply of cast-iron spigot and socket pipes, for the urban district council.—Mr. J. W. Holbrook, engineer and surveyor.

ILFORD.—July 8th.—For the supply and erection of iron fencing and gates, for the urban district council.—Mr. H. Shaw, engineer and surveyor.

ECCLES.—July 12th.—For the erection of engine-room, supply of machinery parts and cast-iron pipes, and supply of gas engine and suction producer gas plant, for the Sewage Disposal Committee.—Mr. G. W. Willis, sewage works engineer, Peel Green-road, Patricroft.

OUNDLE.—July 12th.—For providing and laying 4-in. and 3-in. cast-iron water mains with valves and hydrants, for the rural district council.—Messrs. G. & F. W. Hodson, engineers, Bank Chambers, Loughborough.

BROWNHILLS.—July 14th.—For the supply, erection, and maintenance for twelve months of gas engine, suction gas plant, and three throw pump, capable of lifting 22,500 gallons per hour, for the urban district council.—Mr. Robert Green, 37 Waterloo-street, Birmingham.

Roads.

WALMER.—June 28th.—For making-up work, for the urban district council.—Mr. H. W. Baker, surveyor.

NEYLAND.—June 28th.—For carrying out private street works, for the urban district council.—Mr. F. W. Evans, surveyor.

BASINGSTOKE.—June 30th.—For the supply of flat granite kerb, granite channel, granite setts, and Bristol pennant channel, for the corporation.—Mr. F. R. Phipps, borough engineer.

BECKENHAM.—June 30th.—For the supply of 300 cub. yds. of tarred road material, for the urban district council.—Mr. John A. Angell, surveyor.

BECKENHAM.—June 30th.—For the supply of about 600 super. yds. of artificial stone paving, 2in. thick, for the urban district council.—Mr. John A. Angell, surveyor.

LOUGHTON.—June 30th.—For the supply of broken granite, gravel, and hire of steam roller, for the urban district council.—Mr. H. White, surveyor.

WHITCHURCH.—June 30th.—For work of steam rolling, for the rural district council.—Mr. J. T. P. Clarke, clerk.

WARMINSTER.—June 30th.—For making up a road, for the urban district council.—Messrs. Fletcher & Brett, architects, Wimborne Minster, Dorset.

DOVER.—June 30th.—For widening a portion of Folkestone-road, for the corporation.—Mr. W. C. Hawke, borough engineer.

FELLING.—June 30th.—For paving part of a main road, for the urban district council.—Mr. C. W. Hall, surveyor, Felling-on-Tyne.

BRIERFIELD.—June 30th.—For paving works, for the urban district council.—Mr. B. Halstead, surveyor.

WATFORD.—July 1st.—For road making, constructing storm-water drainage, and fencing, for the urban district council.—Mr. D. Waterhouse, engineer.

TOTTENHAM.—July 1st.—For making up Wargrave-avenue, second section, for the urban district council. Mr. W. H. Prescott, surveyor, Town Hall, Tottenham.

WATFORD.—July 1st.—For road making, drainage, and fencing, for the urban district council.—Mr. D. Waterhouse, engineer and surveyor.

LONDON.—July 1st.—For repairs to carriageway, for the county council.—Mr. G. W. Humphreys, clerk.

CHISWICK.—July 2nd.—For making up a road, for the urban district council.—Mr. E. Willis, surveyor.

BASINGSTOKE.—July 2nd.—For work of road rolling, for the rural district council.—Mr. R. Forrester, surveyor.

STANLEY (Durham). — July 2nd. — For road improvement at Maiden Law, for the urban district council.—Mr. A. Routledge, surveyor.

BLYTH.—July 3rd.—For making up certain streets, for the urban district council.—Mr. R. Grieves, surveyor.

TADCASTER.—July 4th.—For the preparation of specifications for private streets work, for the rural district council.—Mr. G. A. Bromet, clerk.

SEAFORD.—July 5th.—For the supply of 1,000 tons of granite flake, for the urban district council.—Mr. B. A. Miller, surveyor.

STRETFORD.—July 5th.—For paving work in rock asphalt, for the urban district council.—Mr. E. Worrall, surveyor.

LUTON.—July 5th.—For the supply of broken granite, for the corporation.—Mr. J. W. Tomlinson, borough engineer and surveyor.

GRIMSBY.—July 5th.—For road widening and improvement, for the rural district council.—Surveyor and Engineer.

WANDSWORTH.—July 7th.—For making up and paving Shamrock-street, for the borough council.—Mr. P. Dodd, borough surveyor.

HETTON-LE-HOLE.—July 7th.—For the supply of tarred slag, fine tarred slag, and slag, for the urban district council.—Mr. J. Harding, surveyor.

ROMFORD.—July 7th.—For the supply of blue Guernsey granite of various sizes, for the rural district council.—Mr. G. Lapwood, highway surveyor.

BROMLEY.—July 8th.—For making up certain roads, for the corporation.—Borough Engineer.

HAMMERSMITH. — July 9th. — For repairing margins of carriageway, for the borough council.—Mr. H. Mair, borough surveyor.

TWICKENHAM.—July 9th.—For paving portion of a road with creosoted deal paving blocks, laid on concrete, and re-surfacing with asphalt macadam or bituminous-bound granite of two roads, for the urban district council.—Mr. Fred. W. Pearce, surveyor.

CHELMSFORD.—July 9th.—For paving High-street and portions of Moulsham-street and Springfield-road, containing about 9,000 sq. yds., with creosoted deal blocks, for the corporation.—Borough Engineer.

ATCHAM.—July 12th.—For the hire of a 10-ton steam roller, for the rural district council.—Mr. E. P. Everest, clerk, St. John's-hill, Shrewsbury.

WATFORD.—July 15th.—For the supply of 4,950 tons of broken granite chippings and dust, for the urban district council.—Mr. D. Waterhouse, engineer and surveyor.

BUSHEY.—July 15th.—For making up Part II. of Belmont-road, under the Private Street Works Act.—Mr. Ernest E. Ryder, surveyor.

ROTHERHAM.—July 19th.—For making up a road, for the corporation.—Mr. E. B. Martin, borough engineer.

FEATHERSTONE.—July 26th.—For private street work, for the urban district council.—Mr. S. Chesney, engineer and surveyor.

Sanitary.

WHITTINGTON AND NEWBOLD.—June 30th.—For the construction of 1,600 yds. of 12-in., 15-in. and 18-in. earthenware pipe sewers, with manholes, tanks, filters, engine and pump house, machinery, and other works, for the urban district council.—Mr. Bathgate Comb, surveyor, St. John's-road, Whittington Moor, Chesterfield.

HAMPSHIRE.—June 30th.—For the construction of surface-water drains, for the county council.—Mr. W. J. Taylor, county surveyor, The Castle, Winchester.

TENDRING.—June 30th.—For laying sewer with manholes and ventilators, for the rural district council.—Mr. A. J. Martin, 7 Victoria-street, Westminster.

NORTH BROMSGROVE.—June 30th.—For the construction of 1,000 yds. of 6-in., 7-in. and 9-in. diameter stoneware pipe sewers, manholes, overflow chamber, ventilating columns, and other works, for the urban district council.—Mr. Francis T. Leven, clerk.

HOUGHTON-LE-SPRING.—July 1st.—For scavenging work, for the rural district council.—Mr. R. B. Marley, clerk.

ROWLEY REGIS.—July 1st.—For works of sewerage, for the urban district council.—Mr. D. Wright, clerk, Old Hill, Staffs.

LISBURN.—July 1st.—For carrying out drainage works, for the rural district council.—Messrs. Swiney & Croasdale, engineers, Royal-avenue, Belfast.

KANTURK (Co. Cork).—July 2nd.—For sinking wells, erecting pumps, and constructing sewers, for the rural district council.—Mr. T. Guiney, clerk.

HARTSHORNE AND SEALS.—July 4th.—For constructing detritus tanks, percolating filter, dosing chamber, carriers and subsidiary works, for the rural district council.—Mr. Norman F. Spence, engineer and surveyor.

LEEDS.—July 14th.—For sewering, draining, and kerbing streets on new estates, and other sewer and drainage works for three years, for the corporation.—Mr. W. T. Lancashire, city engineer.

LEEDS.—July 21st.—For constructing a sewer, for the corporation.—Mr. W. T. Lancashire, city engineer.

CHELMSFORD.—July 2nd.—For levelling a portion of the sewage farm, for the Joint Sewerage Committee.—The Surveyor, 16 London-road, Chelmsford.

LLANDAFF AND DINAS POWIS.—July 2nd.—For laying 670 lin. yds. of cast-iron and earthenware sewers with manholes, for the rural district council.—Mr. J. Holden, 20 Park-place, Cardiff.

BYSHOTTLES.—July 3rd.—For laying a 6-in. sewer, for the urban district council.—Mr. G. G. Donkin, surveyor, Langley Moor.

MANCHESTER.—July 7th.—For the construction of main drainage work, for the Rivers Committee.—City Surveyor.

NEATH.—July 8th.—For the construction of sewerage and sewage disposal works, for the rural district council.—Mr. W. E. Classon Thomas, engineer and surveyor.

HAY.—July 8th.—For laying sewers and manholes, for the rural district council.—Mr. J. Gunter, clerk, Glasbury.

HOLLINGBOURNE.—July 9th.—For the construction of a sewer and manholes, for the rural district council.—Mr. H. M. Apps, sanitary inspector, Sutton Vallance, near Maidstone.

CHADDERTON.—July 11th.—For the construction of 1,375 yds. of 3-in. and 18-in. steel tube sewers, and 77 yds. of 24-in. earthenware pipe sewers, with storm overflow chamber, and manholes, for the urban district council.—Messrs. J. Diggle & Son, 14 Victoria-street, Westminster.

STAINES.—July 12th.—For laying cast-iron pipe sewers and appurtenances, for the urban district council.—Mr. E. J. Barrett, engineer and surveyor.

BROWNHILLS.—July 14th.—For relaying stoneware pipe sewer and alterations to existing tanks at Mosspits, for the urban district council.—Mr. Robert Green, 37 Waterloo-street, Birmingham.

MADRAS.—September 9th.—For the supply and delivery of English stoneware pipes and specials, varying from 4 in. to 21 in. internal diameter, and aggregating a total length of about 143 miles, for the corporation.—Messrs. James Mansergh & Sons, agents. 5 Victoria-street, Westminster, S.W.

STANLEY (Durham).—For the construction of a settling tank, for the urban district council.—Mr. A. Routledge, surveyor.

MATLOCK.—For the supply of about 5,700 cube yards of good, hard, clean and gauged clinker for bacterial percolating filters, for the urban district council.—Messrs. James Diggle & Son, 14 Victoria-street, Westminster, S.W.

Stores.

DOVER.—June 30th.—For the supply of stores, materials, and labour, for the corporation.—Mr. R. E. Knocker, town clerk.

KEIGHLEY.—June 30th.—For the supply of ironmongery, iron castings, pitch, oil, broken limestone, granite, earthenware pipes, and cement, for the corporation.—Borough Engineer.

Miscellaneous.

CHEPPING WYCOMBE.—July 8th.—For a supply of best anthracite coal, for the corporation.—Mr. T. J. Rushbrooke, water engineer.

TENDERS FOR MUNICIPAL WORKS OR SUPPLIES.

The Editor invites the co-operation of SURVEYOR *readers with a view to making the information given under this head as complete and accurate as possible.*

* Accepted. † Recommended for acceptance.

ALDERSHOT.—For making up a terrace, for the urban district council.—Mr. F. C. Uren, surveyor:—

Ripley, Strong & Co., Farnborough, Hants	£54
W. Norris, Upper Hale, Farnham	53

CHESTER-LE-STREET.—For making up sixteen private streets, for the rural district council.—Mr. G. W. Ayton, highway surveyor:—

H. Meredith, Durham	£2,052
G. E. Simpson, Newcastle	1,946
Johnson & Strong, Stanley	1,784
G. Armstrong, Whitley Bay	1,750
C. S. Bunch, Newcastle	1,675
G. Dyson, Petton	1,656
J. Burnett & Son, Birtley	1,591
E. R. Davison, Blaydon	1,477
J. Friend, Blaydon	1,343

CHISWICK.—The urban district council have accepted the tenders of Hardy & Co., for Welsh nuts, 24s.; hard steam, 21s. 6d.; large Welsh, 25s. 9d.; Silkstone house, 22s.; best house, 21s. 6d.; bright cobbles, 20s. 6d.; smithy (Hollybush), 26s.; and W. Moore & Co., for coke, 20s. 9d. The prices are for delivery at the council's depots and schools where directed.

DEPTFORD.—For installing heating equipment at the Ravensbourne school, for the London County Council:—

Hayward Brothers & Eckstein, Limited, Borough	£780
B. Harlow & Son, Macclesfield	743
T. S. Knight & Sons, Great Portland-street	730
J. Yetton & Co., Limited, Limehouse	716
E. Deane & Beale, Limited, Monument-street	710
R. H. & J. Pearson, Limited, Notting Hill-gate	651
H. J. Cash & Co., Limited, Westminster	644

Architect's estimate, £685.

HAMMERSMITH.—For installing heating equipment at West Ville-road school, for the London County Council:—

Palowkar & Sons, Queen-street	£933
J. & F. May, Lincoln's Inn-fields	749
Tilley Brothers, Kingsland-road	710
G. Davis, Kensington	670
Brightside Foundry and Engineering Company, Limited, Westminster	639
J. Yetton & Co., Limited, Limehouse	634
R. H. & J. Pearson, Limited, Notting Hill-gate	599

Architect's estimate, £640.

HARROGATE.—For private street improvement work, for the corporation.—Mr. C. E. Rivers, borough engineer and surveyor:—

C. H. Dickinson, Starbeck, Harrogate, £1,550.

LONDON.—For extensions to Charing-cross-road school, for the county council:—

Brand, Pettit & Co., Tottenham	£1,557
W. Johnson & Co., Limited, Wandsworth-common	1,443
J. Garrett & Son, Balham-hill	1,343
H. L. Holloway, Deptford	1,318
Triggs & Co., Clapham	1,294
A. Roberts & Co., Limited, Earl's Court-road †	1,210

Architect's estimate, £1,209.

NEWTON ABBOT.—For the reconstruction of Penn Inn Bridge, for the urban district council. Mr. Coleridge D. White, surveyor:—

E. Harris, Exeter	£1,847
L. Bearne, Newton Abbot *	1,559

OAKENGATES.—For the construction of a sewerage scheme, for the urban district council:—

Johnson & Langley, Birmingham	£18,260
Jowett Brothers, Liverpool	18,147
G. Law, Kidderminster	16,900
R. C. Brebner & Co., Edinburgh	16,800
J. J. Shardlow, Leicester	16,442
T. Smart, Nottingham	15,999
W. Thorpe, Birmingham	15,456
Martin & Element, Birmingham	15,428
G. P. Trentham, Birmingham	14,750
M. A. Boswell, Wolverhampton	14,500
G. Holloway, Wolverhampton	13,750
R. C. Crawford, Inverness	13,300

ST. PANCRAS.—For installing heating equipment at Stanhope-street school, for the London County Council:—

G. Davis, Kensington	£1,360
Arding & Dyne, Southwark-bridge-road	1,200
Brightside Foundry and Engineering Company, Limited, Westminster	1,189
Cannon & Hefford, Peckham	1,070
E. Deane & Beale, Limited, London-bridge	1,032
J. Yetton & Co., Limited, Limehouse	1,025
T. S. Knight & Sons, Great Portland-street	1,009
J. & F. May, Lincoln's Inn-fields	997
W. G. Cannon & Sons, Limited, Southwark	990
Tilley Brothers, Kingsland-road	944
Palowkar & Sons, Queen-street	933

Architect's estimate, £995.

SAXMUNDHAM.—For the supply of broken granite chippings and gravel binding silt, for the urban district council.—Mr. J. E. Hattersley, surveyor:—

Enderby and Stoney Stanton Granite Company, Narborough, near Leicester.—1½-in. granite at 13s. 4d. per ton; ¾-in. granite chippings at 10s. 4d. per ton.

TENBY.—For the supply and delivery of 1,500 ft. of cast-iron pipes of 48-in. diameter, and 922 ft. of 9-in. diameter, also certain special castings, and other works, for the corporation:—

Shelters.—W. H. Phillips, Tenby, Jubilee, £61; North shore, £92.

Urinals, &c.—Musgraves, Liverpool, £20.

Tender for cast-iron pipes under consideration.

WOOLWICH.—For installing cooking apparatus at the Avery Hill Training College hostels, for the London County Council:—

E. Deane & Beale, Limited, Monument-street	£668
J. Yetton & Co., Limited, Limehouse	650
R. H. & J. Pearson, Limited, Notting Hill-gate	607
Carron Company, Upper Thames-street	600
Cannon & Hefford, Peckham	600
Brightside Foundry and Engineering Company, Limited, Victoria-street	597
Wilson & Smith, Limited, West Strand	592
Falkirk Iron Company, Limited, Kingsway	577
G. Wright, Limited, Queen Victoria-street	560
McDowall, Stevens & Co., Limited, Upper Thames-street	555
T. S. Knight & Sons, Great Portland-street	545
J. & F. May, Lincoln's Inn-fields	539
W. G. Cannon & Sons, Limited, Southwark	537

Architect's estimate, £600.

MEETINGS.

Secretaries and others will oblige by sending early notice of dates of forthcoming meetings.

JULY.

5.—**Institution of Municipal and County Engineers: Meeting at Leek.**

7-12.—**Royal Sanitary Institute: Annual Congress and Exhibition at Exeter.**

16-19.—**Institution of Municipal and County Engineers: Annual Meeting at Great Yarmouth.**

APPOINTMENTS OPEN.

Official and similar advertisements received up to 4.30 p.m. on Thursdays will be inserted in the following day's issue, *but those responsible for their despatch are recommended to arrange that they shall reach* THE SURVEYOR *office by noon on* **Wednesdays** *to ensure their inclusion in the weekly list of summaries. Such advertisements may, in cases of emergency only, be telephoned (No. 1359 Holborn), subject to later confirmation by letter.*

DEWSBURY UNION.

APPOINTMENT OF VALUER.

The Assessment Committee of the Dewsbury Union invite applications from competent persons to survey and re-value certain classes of rateable property in each of the 13 Parishes of the Union—viz., Batley, Birkenshaw, Birstal, Dewsbury, Gomersal, Heckmondwike, Liversedge, Mirfield, Morley, Ossett, Ravensthorpe, Soothill Nether and Thornhill. The remuneration to be by a fixed sum for carrying out the work.

Particulars of the Conditions of Contract and the different classes of property and the number of items may be obtained on application to the undersigned by enclosing a stamped addressed foolscap envelope. Persons desirous of Contracting must send written applications stating the total sum they will require for carrying out the work, accompanied by testimonials of recent date, to me, the undersigned, not later than 10 a.m. on Wednesday, the 9th day of July, 1913, and those selected will receive due notice of the day of appointment. Canvassing the Guardians will disqualify.

No allowance made for estimates, and the lowest or any Tender not necessarily accepted.

(By order)

C. P. PICKERSGILL,
Clerk to the Assessment Committee.

Union Offices, Wellington-street,
Dewsbury.
June 23, 1913. (578)

MANAGER REQUIRED

for office of road construction company. Good prospects for capable man. State fully experience, age, and salary expected to BOX 1,263, office of THE SURVEYOR, 24 Bride-lane, Fleet-street, E.C. (581)

COUNTY BOROUGH OF STOKE-ON-TRENT.

BOROUGH SURVEYOR'S DEPARTMENT.

The Corporation invite applications for the appointment of a General Engineering and Surveying Assistant in the Borough Surveyor's Office, at a salary of £90, rising, in the discretion of the Council, to £120 per annum.

Applicants must be neat and expeditious Draughtsmen and accurate Surveyors and Levellers.

Preference will be given to candidates who have had experience in a Borough Surveyor's Office.

Applications, stating age and experience, accompanied by not more than three recent testimonials, and endorsed "General Assistant," must be sent to me not later than Monday, the 30th June, 1913.

Canvassing, directly or indirectly, will be a disqualification.

A. BURTON, ASSOC.M.INST.C.E., F.S.I.,
Borough Surveyor.

Town Hall,
Stoke-on-Trent.
Saturday, June 14, 1913. (546)

BRITISH GUIANA.

ASSISTANT ENGINEER REQUIRED.

Assistant Engineer required by the Government of British Guiana for the Public Works Department for five years, with possible extension. Engagement terminable after one or three years' service. Age not more than 35. Strict medical examination and vaccination if necessary.

Salary, £600 a year. Travelling expenses and subsistence allowance when absent from Station in accordance with service regulations. Necessary camp outfit when on survey. Free first-class passage out and home again on satisfactory termination of engagement if appointment is not made permanent. Half salary on voyage out, full salary from date of arrival in the Colony.

Candidates should have had experience in surveying, in preparing plans and estimates for, and in the construction of, agricultural works of drainage and irrigation.

Preference will, as far as possible, be given to candidates who have passed the examination for Associate Membership of the Institution of Civil Engineers, or who have obtained one of the University degrees or other distinctions in Engineering which are recognised as equivalent to that examination.

Applications, by letter (no special form required), stating age, should be sent at once to the Crown Agents for the Colonies, Whitehall-gardens, London, S.W.

Quote M/6071 on left-hand top corner of application. (583)

THE RURAL DISTRICT COUNCIL OF GODSTONE.

HIGHWAYS AND BRIDGES DEPARTMENT.

APPOINTMENT OF CLERK OF WORKS.

The above Council invite applications for the appointment of Clerk of Works to supervise the construction of a Reinforced-concrete Bridge at Waterlane, Lingfield.

Applicants must have had experience in Ferro-concrete Construction.

The appointment will hold good for a period of about 3 months.

Salary, Three Guineas (£3 3s.) per week.

Applications must be made in the Candidate's own handwriting, with copies only of 3 testimonials of recent date, and stating age and previous experience, and must be marked "Clerk of Works," and delivered to me not later than 12 noon on Thursday, the 3rd day of July, 1913.

Canvassing, either directly or indirectly, will disqualify any application.

GEO. E. CROWTER,
Engineer and Surveyor.

High-street,
Godstone,
Surrey.
June 24, 1913. (586)

Building Exhibition at Olympia.

"The Surveyor" Section.

To-morrow (Saturday) at noon the Lord Mayor of London (Sir David Burnett) will formally open the Building Exhibition at Olympia. Here, as on previous occasions, The Surveyor has arranged in the gallery a comprehensive exhibition of road making materials and municipal engineering requisites which will be found to form an interesting and valuable complement to the unique display of building materials and requirements on view in other parts of the huge structure. The fact that practically all departments of municipal engineering are represented in The Surveyor section will render it particularly serviceable to members of the profession of every degree and standing, and it is to be hoped that the opportunity will be widely embraced by them to pay at least one, and, it is to be trusted, repeated visits to Olympia during the ensuing fortnight. It is specially worthy of note that "Municipal Engineers' Day" has been fixed for April 19th—the middle Saturday—and that upon this occasion, when engineers have invariably foregathered in large numbers, The Surveyor conference will take place under the presidency of Sir George Gibb, chairman of the Road Board. These reunions have in the past served an exceptionally useful purpose in promoting alike the practical aims as well as the fraternal ends of the profession, and there is every reason to believe and expect that the forthcoming conference will in this respect prove no exception to the rule. We print in the present issue an instalment of advance notices of the stands in The Surveyor section, and from these it will be gathered that the variety and technical value of the exhibition is well maintained, and that, in fact, there has been brought together by the commendable enterprise of a large number of business firms a collection worthy to rank in quality and interest with any of its predecessors. We have dealt with the municipal surveyors' section only this week; next week there will be another special issue covering the Building Exhibition proper.

NORTON & GREGORY, LIMITED.

(Bay 1.)

Architects and surveyors should not fail to make an inspection of the stand in the occupation of Messrs. Norton & Gregory, Limited, Castle-lane, Buckingham-gate, S.W., and 34 Robertson-street, Glasgow. Reproductions of plans on to tracing linen, opaque linen, tracing paper, parchment, drawing paper, cartridge paper, litho paper, are stamped with the firm's registered trade mark, "Velography," the result being, they point out, that this word has become almost to be looked upon as a word representing "Perfection," combined with "Speed." When making reproductions by their well-known process they are able to make 50 or even 100 reproductions from an average-size tracing in the first sixty minutes. The copies on linen, bearing the trade mark "Record Tracing Linen" imprinted on the border, are guaranteed to be absolutely permanent, and not to smudge, the lines being fast. They are accepted by official bodies, consulting engineers and municipal engineers as equivalent to hand-made tracings, while reproduction on white opaque linen are stamped with the trade mark "Velopaque," such copies being often used for signed contract drawings. The "Arcus" sun printing frame, which is shown on the stand, consists of a curved frame fitted with bent plate glass, over which a canvas cover is stretched, any desired tension being obtained by a very simple arrangement conveniently placed at one end of the frame. It offers the advantages of lightness—the double elephant frame only weighs about 30 lb.—simplicity, portability, economy of time in manipulation, and perfect "contact." The "Perfect" drawing table possesses many obvious advantages. It can be adjusted to any height and any angle, permitting of the draughtsman sitting or standing at his work as may be most convenient. The board is fitted with a patent T-square, which leaves the left hand entirely free. Two patterns are exhibited, showing different methods of adjustment. The firm are directing special attention to their surveying instruments.

WEBB LAMP COMPANY, LIMITED.

(Bay 2.)

The Webb Lamp Company, Limited, 11 Poultry, London, E.C., and Legge-street and Corporation-street, Birmingham, have their sewer ventilation lamps in operation, and among their other exhibits are their non-return ventilators for sewers, sewage tanks, drains and mortuaries, drain dredgers for clearing drains and sewers of silt, sand and sludge, and drags for clearing drains of grease and film. The Webb "Galvo" chemical fire extinguishers will also claim attention, a special type for use on motor 'buses, cabs and lorries being shown for the first time. Other items are "Galvo" powder bins for electric light and power stations and a variety of filters and taps.

STEPHENS & CARTER.

(Bay 3.)

At this stand the visitor to the exhibition will find an excellent display of builders' plant, including ladders, barrows, steps, trestles and trucks of every description. The address of the firm is 1 Green-street, Paddington, London, W.

TARMAC, LIMITED.

(Bays 4 and 5.)

Tarmac, Limited, of Ettingshall, Wolverhampton, and 20 Victoria-street, Westminster, S.W., have arranged an interesting display, numerous photographs adding to the attractiveness of their stand. "Tarmac" has been on the market for nearly twelve years, and has been used extensively in all parts of the country with conspicuous success. It is made of blast-furnace slag, specially selected for the pur-

pose. The company's works are adjacent to the furnaces of Messrs. Alfred Hickman, Limited, and the Denby Iron Company, Limited, respectively. The company have a fully equipped tar distillation plant at their works, and the tar compound used for coating is distilled and prepared to physical and chemical standards known to give the best results as regards strength of binding properties, freedom from tendency to affectation by atmospheric variations, and length of life as an effective bind. Examination of the samples of untreated slag exhibited will demonstrate that the slag used by the company has an exceptionally rough and uneven surface, which means that it possesses the maximum "holding power" for the mixture used for coating. It is porous enough to retain and hold the mixture perfectly, and is, at the same time, claimed to be as strong as the best classes of granite and similar materials. "Tarmac" is made in three gauges: 2½ in. (2½ in. down to 1½ in.), 1½ in. (1½ in. down to ½ in.), ⅜ in. (⅜ in. down to ⅛ in.), and is recommended for the construction of dustless, mudless and durable roads and carriageways, footpaths, carriage drives and school playgrounds. The company have recently carried out very large extensions to their works, but still further extensions are now in progress.

G. TUCKER & SON, LIMITED.

(Bay 6.)

Loughborough bricks and tiles form the exhibit of Messrs. G. Tucker & Son, Limited. All the goods shown (except where otherwise stated) are made entirely by hand in the old-fashioned manner, no machinery whatever being used during their manufacture after the clay has been ground. On the front of the stand are the following: Exhibit A—Naturally vegetated Loughborough tiles; Exhibit B—"Slop-made" bricks, produced by exactly the same methods as the old-fashioned bricks seen in Tudor (and earlier) buildings. On the left side of the stand the firm have arranged their goods as follows: Exhibit C—Dark red Loughborough tiles; Exhibit D—Mottled brickwork, made up of "T.S.L." sand-stock facing bricks in reds, old-style and rustic colours; Exhibit E—Dun-coloured Loughborough tiles; Exhibit F—Red "T.S.L." sand-stock facing bricks; Exhibit G—Light red Loughborough tiles; Exhibit H—"Rustic T.S.L." sand-stock facing bricks. On the back part of the stand are displayed: Exhibit J—Mixed red and rustic brown Loughborough tiles; Exhibit K—Smooth red hand-pressed facing bricks; Exhibit L—Rustic brown Loughborough tiles; Exhibit M—Mottled red brickwork, made up of light and dark red "T.S.L." sand-stock facing bricks. Further exhibits on the right side of the stand are as follow: Exhibit N—Mottled red Loughborough tiles; Exhibit O—Hard-burned engineering wire-cut bricks; Exhibit P—Mixed dun and rustic brown Loughborough tiles; Exhibit Q—Red tapped and sanded wire-cut facing bricks; Exhibit R—Thick (¾-in.) red Loughborough tiles; Exhibit S—"Old-style T.S.L." sand-stock facing bricks. A special exhibit of this well-known Loughborough firm is the Clare-Tucker cavity wall tie. This is made in blue brick and is stated to be practically imperishable, outliving the existence of the wall itself. It is impervious to moisture, while it not only ties the walls together but forms an interlocking brick, which adds considerably to the strength of the structure. Various models showing its uses and adaptations are on view.

BRITISH STEEL PILING COMPANY.

(Bay 7.)

The British Steel Piling Company, whose head office is Dock House, Billiter-street, London, E.C., are exhibiting their "Universal" joist steel sheet piling. This has a weight of 13 lb. per super ft. when

"Universal" Piling.

assembled, as shown in the accompanying illustration, and is used for large dams of all kinds, sea walls, retaining walls, colliery shafts and similar work. Their "Simplex" piling, weighing 22 lb. per super. ft. when assembled, is intended for lighter cofferdams, wharves, trenches of all kinds, retaining walls, and as a substitute for timber runners for excavations. Other steam pile-driving plants for driving steel, timber

"Simplex" Piling.

or ferro-concrete piles, Blaw collapsible steel centering for sewers, culverts, conduits, tunnel and shaft linings, and so forth, and metal trench braces.

PALMER'S TRAVELLING CRADLE AND SCAFFOLD COMPANY.

(Bay 8.)

The exhibits of Palmer's Travelling Cradle and Scaffold Company, Victoria Works, 112 Belvedere-road, London, S.E., include ladders of many kinds, and the firm's patent lock for extending ladders or towers is being shown. The process of manufacturing their registered wire scaffold lashings will be demonstrated at the stand. Trucks and many other productions of the company will be on view, their registered steel putlog being an especially interesting item. Illustrations and examples of various scaffolds, including the firm's now well-known cradles, are other features of the exhibit.

ANGLO-MEXICAN PETROLEUM PRODUCTS COMPANY, LIMITED.

(Bay 9.)

Everybody interested in good roads should visit Stand No. 9, where the Anglo-Mexican Petroleum Products Company, Limited, are displaying their bituminous materials Mexphalte and Fluxphalte—which are specially marketed to meet the requirements of modern road construction and maintenance. Mexphalte, which is 99 per cent pure bitumen of very high quality, has been used with great success in the construction of new roads designed to bear heavy traffic, motor omnibuses, lorries, &c., and is claimed to be equally successful with either the mixing or the grouting methods. This bitumen is of a high cementing and ductility value, and has given excellent results both in London and provincial towns. Fluxphalte, which contains 66 per cent of pure bitumen, is a more liquid product designed for surface dressing of country roads as a dust preventative. It not only fulfils this function very completely, but also acts as a binder, increasing the life of the road and rendering it durable, dustless and waterproof. One special point of its superiority over tar is that it contains no poisonous elements to be washed off the roads into neighbouring streams with consequent danger to fish life. A great demand is springing up for this product all over the country, but in view of the vast resources of the parent company, the Mexican Eagle Oil Company, and the complete organisation for supplying these road materials, there is stated to be no danger of shortage in stocks or of violent fluctuations in price. The price at which this road dressing is quoted compares most favourably with the price of tar, and its superiority to that by-product in many particulars, the company assert, secures it the preference wherever a comparison is fairly made between the two materials. A very interesting exhibit at the stand is the model of the s.s. "San Fraterno," the world's largest oil-tank steamer, which, with the remainder of the fleet of twenty tank steamers built or building in connection with Mexican Eagle petroleum products, is designed to carry Fluxphalte in bulk. Inquiries for samples and prices of Mexphalte and Fluxphalte should be addressed to Anglo-Mexican Petroleum Products Company, Limited, Asphalt Dept., Finsbury-court, E.C.

FRANK KEEP.

(Bay 11.)

Mr. Frank Keep, 9 and 10 St. Mary-at-Hill, London, E.C., has arranged his usual excellent display of samples of filtering media for sewage purification. All descriptions of clinker and breeze for fireproof floors, &c., can be seen at his stand, coke breeze for brickmakers' use being also exhibited.

J. & P. HILL.
(Bay 12.)

The patent motor vacuum road cleansing machine recently introduced by this well-known Sheffield firm has been fully described in our pages, and its working

Hill's Motor Vacuum Road Cleansing Machine.

demonstrated in several of the great provincial towns, but there are doubtless still many road engineers who have not yet had the opportunity of seeing it in operation, and who will therefore welcome the announcement that a special trial has been arranged for Municipal Engineers' Day on Saturday week next, the 19th inst., at 2.30 p.m. It is claimed for the machine that it cleans all roads without causing any dust. The conditions under which it works are scientific and healthy, and it can be worked rapidly after heavy falls of rain or snow without any inconvenience to the public. It is a simple and practical method of cleaning roads of rubbish, whether light or heavy, wet or dry, and of collecting and depositing it without dust. It gathers up every kind of road rubbish, garbage, dust, mud, stones, snow, and water, without manual labour of any kind. It, moreover, cleanses the road surface without damaging it, the makers point out. It is also applicable for fixing to tramcars for track and rail work driven by an electric motor. The machine consists of three main components: No. 1, a complete 20-30 h.-p. 4-cylinder motor chassis; No. 2, a cylindrical sweeping-roller and shell, fitted to the chassis; No. 3, a large receiver, fitted behind the sweeping-cylinder, for collecting the sweepings. The "Galloway-Hill" furnace, which is also being shown by

Hill's Motor Vacuum Road Cleansing Machine, showing Bins Withdrawn.

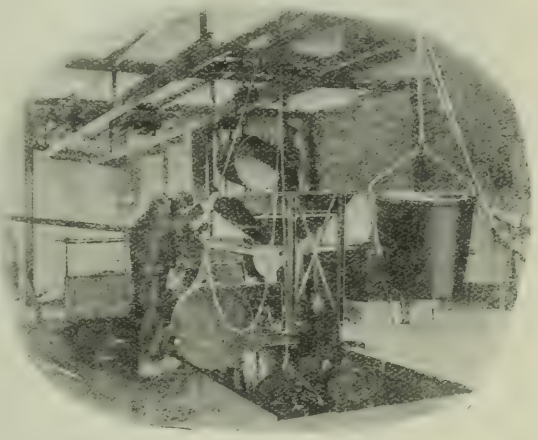
Messrs. Hill, is described as providing a quick and positive method of drying stone, granite, sand, chippings, and other materials used in the construction of tar-macadam and other roads.

TRINIDAD LAKE ASPHALT PAVING COMPANY, LIMITED.
(Bay 13.)

An excellent display has been arranged by the Trinidad Lake Asphalt Paving Company, Limited, Britannia Wharf, Townmead-road, Fulham, London, S.W. Samples of the material as dug from the lake in the Island of Trinidad are exhibited on the stand, samples of refined Trinidad Lake bitumen, for road work, electrical purposes, &c., being also shown. The firm point to the fact that many miles of roadway in England have been successfully laid with their asphalt macadam. One of the chief features of the process is the elimination of the Portland cement concrete foundation usually associated with asphalt pavements. Samples are shown of the composition as laid in various thicknesses, there being exhibited also samples of mastic asphalt for roofs, floors and damp-courses.

B. J. HALL & CO., LIMITED.
(Bay 14.)

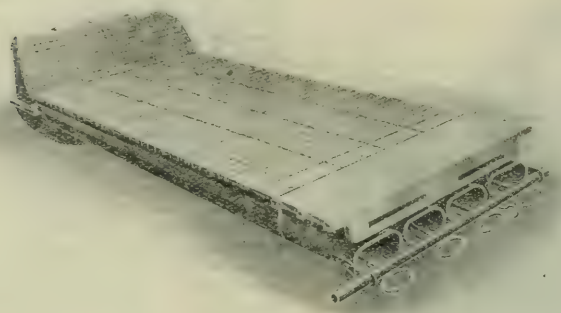
The productions of Messrs. B. J. Hall & Co., Limited, Chalfont House, Peter-street, Westminster, S.W., form an admirable display, copiers, drawing instruments and office furniture comprising the articles on view. Hall's patent "Drum"



Hill's Tar-macadam Plant.

continuous copier is designed to produce blue, ferro-gallic, sepia or other prints in any length without joint. It consists of a felt-covered drum worked in a curved glass plate illuminated on the outer surface by arc lamps. The machine is driven by a small electric motor. The speed can be readily altered to suit any class of paper. It has a current consumption of only four units per hour on a 200-volt circuit. Among the advantages claimed for the machine are: Extreme simplicity of construction, with few working parts, and consequently small maintenance charges; easy charging in horizontal position; a very close contact, giving sharp definition; and a very wide range of speed. Hall's patent vertical electric copiers are self-contained pillar machines to deal with two tracings 42 in. by 30 in. The cylinder is fitted with the latest tightening gear. Upwards of 1,100 of these machines have been installed by the patentees. The firm's selection of office furniture includes the "Pluperfect" and "Catena" drawing tables, the principal features of the latter of which

are the wide range of movements and independent control of horizontal and vertical motions. Dr. Owen's new instrument for the measurement of smoke is shown at the stand, the instrument in question, as already stated in our columns, enabling the observer



Hill's Dryer and Mixer.

to estimate by comparison with a series of graduated tints the degree of opacity of smoke issuing from a chimney of any size, and to compute from this by the calculating scale the density of the smoke or the relative amount of soot which it contains.

R. S. CLARE & CO., LIMITED.

(Bay 15a.)

"Bi-Tarco" is the name by which a new binder containing pure bitumen for the manufacture of improved tar macadam, and introduced by Messrs. R. S. Clare & Co., Stanhope-street, Liverpool, is known. It is stated to have wonderful adhesive and agglomerating power, and to be elastic and never brittle. Stones, when treated with it, adhere firmly together in one solid, unbreakable mass, and it is said to be especially suited to the treatment of hard granite, such as Syenite. At the firm's stand will be found some very interesting models showing the different stages of construction of Pitchmac roads, and several sections cut from Liverpool roads which have been under traffic from one to over twelve years are also exhibited. Princes-avenue, Liverpool, was laid with Pitchmac by the city engineer, Mr. J. A. Brodie, in 1901, and no repairs have since been necessary. The road is still in good condition in spite of the fact that the traffic is as great as 120,000 tons per yard width per annum, on the Road Board basis. The area of Pitchmac laid to date in Liverpool exceeds 400,000 super. yds. All those who realise the dangers incurred by tar and pitch workers who neglect thoroughly to cleanse their hands after work will be interested in a powerful antiseptic, "Tarcolene," which Messrs. Clare & Co. are bringing to the notice of visitors to the exhibition. Road engineers and others who realise the necessity of encouraging cleanly habits among their workmen will appreciate this preparation both for its rapid action and its economy in use. The firm are also exhibiting several of their well-known disinfectants.

JOHN WAINWRIGHT & CO., LIMITED.

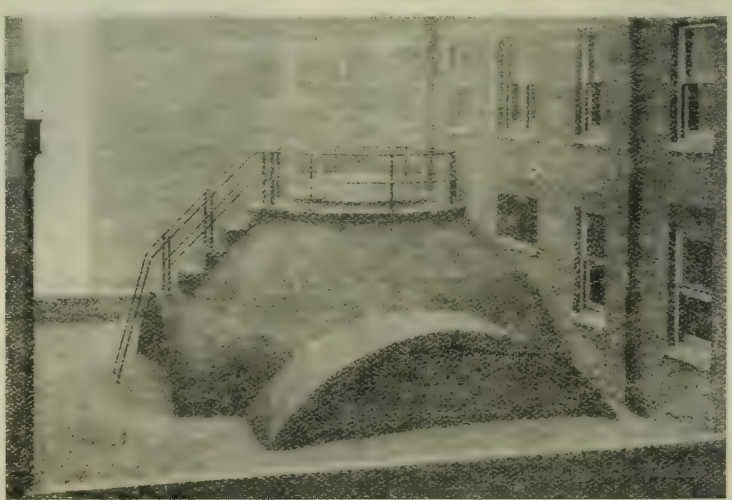
(Bay 15.)

As usual Messrs. John Wainwright & Co., Limited, Shepton Mallet, and 173 Maida-vale, W., exhibit basalt, quartzite, black rock, limestone macadam, British and foreign asphalt, tarred macadam and tar-paving, chippings and grit, basaltic concrete slab paving, all matured twelve months. The firm contract for the supply and laying of any of the materials mentioned.

LIMMER ASPHALTE PAVING COMPANY, LIMITED.

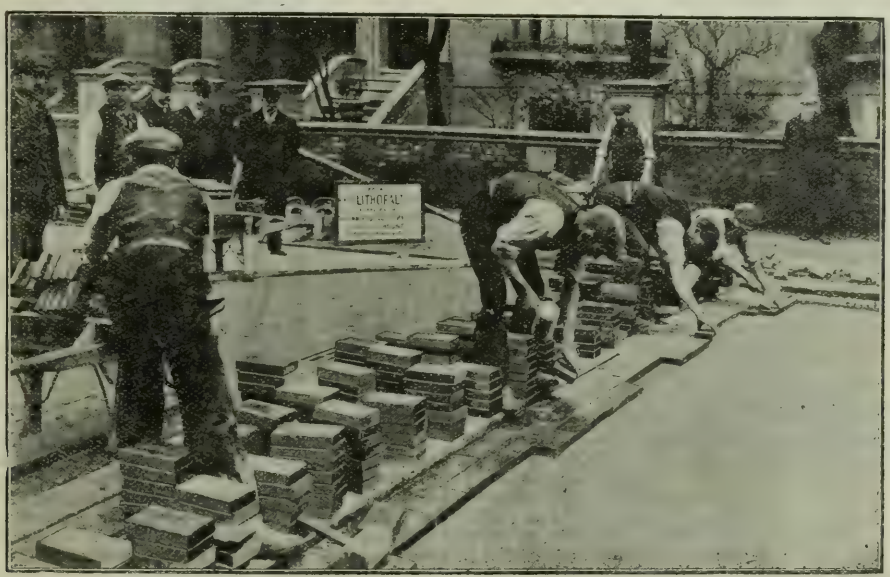
(Bay 16.)

Specimens of mineral rock asphalte, mineral rock mastic asphalte, refined Trinidad bitumen and Bridport grit, "Lithofalt" paving blocks, "Lithomac" asphalte macadam, and "Lithofaltum" are shown at the Limmer Asphalte Paving Company's stand. Models serve to illustrate vertical and horizontal dampcourses in asphalte, a stable with roof and floor laid with mastic asphalte, and the method of applying vertical dampcourse plates for wet walls, other items on the stand being samples of "Bitma" specialities, including joint box, lead sleeve and troughing compounds and paints for insulating purposes, and "Bitmarin" bituminous specialities, including paints, varnishes and damp-proofing composition; while a series of photographs illustrate the roofing, flooring and street paving work carried out by the firm, and their mines in the Bassin de Seyssel (Haute Savoie), France. The uniform quality of the company's specialities is the outcome of standard ingredients, mixed in fixed proportions, under constant care and conditions, and carefully tested and standardised in the company's laboratories. The process of manufacturing their mineral rock mastic asphalte is explained in an illustrated pamphlet which visitors to the exhibition will doubtless be able to obtain copies of on application at the stand. During the past half century the uses to which the material has been put are very numerous, and it is being increasingly specified and adopted by the principal engineers, architects and others in the erection of important public buildings. The extensive use to which compressed mineral rock asphalte has been put for street paving in the City of London is generally known, and the process of laying is now a fairly familiar one. The natural rock, tough and homogeneous of texture, is reduced to powder. This powder, when spread over the area to be coated, adapts itself perfectly to its new bed, and with the aid of little heat and pressure is made at once to resume its former state. It is claimed for it that it has proved to be the most satisfactory sanitary paving procurable; it is impervious to moisture and non-absorbent, and being jointless, nothing can get into crevices and decay. Considerable saving in regard to labour is claimed



Limmer Asphalting on Roof Dome, New King's College Hospital, Denmark Hill.

to be effected by the adoption of the firm's "Lithofalt" paving blocks, which can be laid quite satisfactorily by casual employees. As their name implies, these blocks are of a composite nature, containing sufficient asphalte, however, to give the resultant paving the desirable attributes of compressed mineral rock asphalte at a smaller cost. Experience has proved their great durability and remarkable uniformity in wear, due to the manner of their compression. The blocks are made in four thicknesses — viz., 1¼-in., 1½-in., 1¾-in. and 2-in.—to suit the different conditions of traffic. Being laid on a concrete foundation they require only the necessary cement mortar for bedding purposes. The borough surveyors of Poplar, Hampstead and Folkestone were the first to put Lithofalt paving blocks to a practical test in this country, and now, after several years of experience, do not hesitate to say that their early impressions of their merits have in no way been weakened, but rather to the contrary. Our issue of July 21, 1911, contains an article dealing fully with "Lithomac" asphalte, "the twentieth century paving," as it is called, but it may not be out of place, in conclusion, again to draw attention to its unquestionable advantages in situations where, while a really substantial carriageway is a necessity, the heavy cost of concrete foundations frequently renders the provision of such a road impossible.



Method of Laying "Lithofalt" Blocks.

UNITED STONE FIRMS, LIMITED.

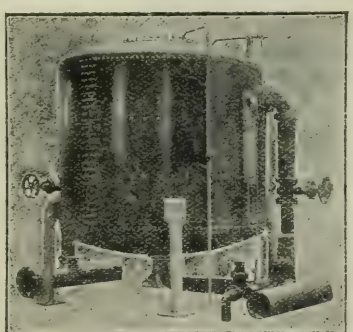
(Bay 16A.)

At this stand the United Stone Firms, Limited, 2 Bristol-chambers, Nicholas-street, Bristol, and Crown Wharf, 69 Lots-road, Chelsea, S.W., exhibit samples of their products for surveyors' purposes, comprising the celebrated Porthgain granite macadam and screened chippings from their extensive quarries situate on the North Coast of Pembrokeshire, midway between St. David's Head and Strumble Head. These are among the largest and best equipped quarries in the country, with all the most modern plant and appliances. Porthgain Harbour is the property of the firm, and they possess their own fleet of steamers, included in the exhibit being a model of their vessels. Samples of kerb, channel, paving flags, setts, &c., are also exhibited out of the following materials from the firm's own extensive quarries in the various districts named: Cornish granite from the famous De Lank Quarries and the Dartmoor Quarries at Merrivale, near Tavistock; blue Bristol pennant stone from the Fishponds, Stapleton and Hallatrow quarries; Keinton stone from the Keinton and Street quarries in Somersetshire; and Shamrock flags, of natural stone from the well-known Irish quarries in County Clare. The firm's stone and granite for architectural and engineering purposes are exhibited at a separate stand, No. 147, Row G, downstairs.

CANDY FILTER COMPANY, LIMITED.

(Bay 18.)

The importance and rapid advancement of the science of mechanical and chemical water filtration is well shown by the exhibit of the Candy Filter Company, Limited, of Westminster, at their stand at Olympia, Bay No. 18, the walls being covered with framed photographs and pictures of some of the many installations of the several types of water purification plant put down by this company in various parts of the world. One of the most interesting is the large photograph of the comprehensive installation of twelve filters put down for the Torquay Corporation, which successfully deal with the water from two of their reservoirs, the daily capacity of the plant being 2,250,000 gallons. Another installation of an entirely different type is shown in the photograph of the patent De-Clor Filters for dealing with the supply to the city of Truro. This plant is a substantial testimony to the contention of modern filtration experts—*i.e.*, that the ordinary sand filter beds which used to be thought more or less infallible are not by any means the safeguard they were imagined to be. The company point out that at Truro there are sand filters of the latest and best type



Candy Filter.

which, although worked in the most careful manner, fail to produce a water which bacteriologists could certify as being free from objectionable germs, and it was found necessary to put down the De-Clor process to deal with the water after the sand beds had finished with it. This town now enjoys a supply entirely free from any intestinal organisms and containing but very few of the ordinary harmless water bacteria. A well-known and widely discussed installation is that of the

Reading Corporation, which consists of five Candy De-Clor filters filtering 1,000,000 gallons a day. This plant deals with the very impure water from the navigable river Kennett, which, after rough filtration, is pumped through the De-Clor filters to the town reservoirs. The results are astonishing, and far transcend anything that can be accomplished by other forms of purification. A dirty, yellow-coloured river water, teeming with bacteria, is converted into a clear, colourless water of the greatest purity, and this at an infinitesimal capital and working cost compared with the old-fashioned sand beds. Engineers and scientists from many parts of the world have visited this plant and expressed their appreciation of the efficiency of the process. Lack of space forbids mention of many other interesting plants, and visitors to the Exhibition should not fail carefully to study the various illustrations of Candy filters, including those for removing iron without the use of chemicals, for dealing with peaty colour, and for other waters, by means of their latest filter the "Compound." Attention should be paid also to the large diagram of one of the company's patent chemical injectors, which is both simple and efficient. Altogether, a very profitable half-hour can be spent at Bay No. 18, and visitors should not leave the Exhibition without obtaining one of the company's pamphlets explaining their compound filter and other processes. Our illustration shows a typical Candy filter for general purification purposes.

HAM, BAKER & CO., LIMITED.

(Bay 19.)

Automatic and power-driven travelling distributors for rectangular sewage filter-beds form an important part of the exhibit of Messrs. Ham, Baker & Co., Limited, Grosvenor-road, Westminster, S.W., and Municipal Engineering Works, Langley Green, near Birmingham. In the firm's patent buoyant sewage distributor the whole weight of the revolving parts is "air-borne" by means of a buoy floating in a small tank of water in the centre of the bed. By this form of construction the bearings are relieved of all wear and tear due to weight, a point of much importance with large distributors. The patent buoyant distributor has been adopted at Maidstone, Enfield, Harrogate, Maybole, Clay Cross, Malvern, Birmingham, Leeds, Caversham, Croydon, Ruislip, and elsewhere. An arrangement for automatically clearing sparge holes in the delivery holes of sprinklers is an interesting item on the stand, other exhibits on which are fixed sewage sprays, and a model of a sedimentation tank fitted with patent revolving apparatus for removing sludge. This machine is worked by hand, and is used for periodically removing sludge without emptying the tank. Patent sluice valves for waterworks, hydrants of various types, air valves, waste preventers, water meters are also to be seen, and among the numerous other articles to which the attention of visitors to the exhibition may be directed are direction posts, pumps, sewer ventilating shafts, gulley grates, penstocks and manhole covers.

ENDERBY AND STONEY STANTON GRANITE COMPANY, LIMITED.

(Bay 20.)

The exhibits of the Enderby and Stoney Stanton Granite Company, Limited, Narborough, near Leicester, include specimens of worked granite for buildings, bedstones, gate posts and spur stones, granite kerbs and channels, quadrants and steps, granite setts for tramway work, crossings and general paving, broken granite for road making, granite chippings and screenings for footpaths and concreting work, and granite ballast for railways and concreting. Tarred macadam and tarred screenings, broken top stone for bacteria beds, granite rubble for road foundations, and granite dresser chippings for foundations and sides of roads are also shown at the stand.

ELLISTOWN COLLIERIES.

(Bay 21.)

Ellistown Collieries, of Ellistown, near Leicester, exhibit examples of their stoneware, fireclay goods and red bricks. Under the first-mentioned heading they have included sanitary pipes and fittings, Ames' patent flexible joints, Stanford joints, Hassall's single lined joints, Light's back flush valve in syphon, quick flush traps, and patent "screw cone" stopper for interceptors, and block and flap traps. The fireclay goods comprise fire bricks, fire tiles, boiler seatings, flue covers, and flue linings, while red facing bricks, best hand-made, red sandstocks, ridges, finials, copings, pilasters, pillar caps, and ventilating bricks go to make up the third section.

MARTIN, EARLE & CO., LIMITED.

(Bay 22.)

This well-known firm of cement manufacturers, of London House, Crutched Friars, E.C., and Wickham, Rochester, Kent, are, as usual, adequately represented. The firm's "Rhinoceros brand" is guaranteed to comply with all modern specifications, including the British standard specification, as revised to August, 1910. "Ferroduric" is a special brand, manufactured to meet the requirements of ferro-concrete specifications, and has been largely used in many important ferro-concrete buildings. The works are ideally situated, forming an imposing establishment on the north bank of the river Medway, with a frontage of nearly half a mile. The only requisites in connection with the manufacture of cement which have to be brought any considerable distance are coal and coke, the raw material—chalk and clay—being found in ample quantities on the spot. Immediately adjacent to the works are immense chalk pits, from which the company have excavated large quantities for many years, and the visible supply is sufficient to keep the works going at their present capacity for many years to come. Altogether the company own about 70 acres of freehold, with all the mining rights attached thereto, while a lease is also held of an additional 30 acres, with the right to remove the chalk therefrom. With regard to clay, the company have secured the rights of huge deposits in the river Medway, which are of a particularly suitable character for cement manufacture. The manufacture of "Rhinoceros brand" cement is carried out by both chamber kiln and rotary kiln processes.

BRITISH TRUST CORPORATION, LIMITED.

(Bay 24.)

"Cormastic" road covering, road blocks, road binder, cork asphalt blocks and "Corkite" tiles are among the items of interest at the stand in possession of the British Trust Corporation, Limited, 85 London-wall, London, E.C. The "Cormastic" road covering is intended for laying *in situ* to any desired thickness upon country and suburban roads, and is claimed to be suitable for all classes of traffic. The road blocks are of the same material. "Cormasticine" is the name by which the bituminous binder used in the manufacture of the above materials is known. The cork asphalt blocks are supplied for laying in the open on inclines for light traffic, and under cover where a silent and non-slipping paving material is required. A silent and durable paving is also obtainable by the use of "Corkite" tiles, and the adoption of these in factories and for the purpose of station platforms is recommended by the company.—The "Airalite" non-explosive gas generator, which is exhibited on this stand, is a machine for generating gas from petrol, for lighting, heating and cooking. It is claimed to be both economical and efficient, and as being suitable for use in public institutions, country houses and factories. The Non-Explosive Gas Company, 5 South-street, Finsbury, London, E.C., will furnish all particulars with regard to the apparatus.

ROCMAC, LIMITED.

(Bay 25.)

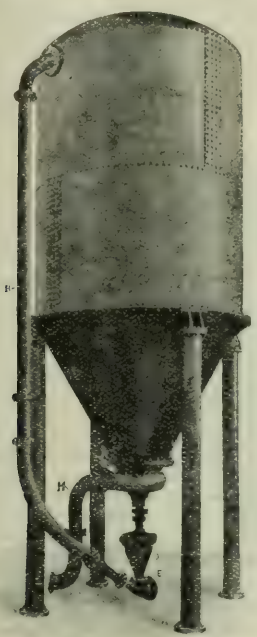
Materials for making and samples of Rocmac roads form the exhibit of Rocmac, Limited, 13 Victoria-street, Westminster, S.W., at this stand.

RANSOME-VERMEHR MACHINERY COMPANY, LIMITED.

(Bay 26.)

A novel feature of the exhibit of the Ransome-ver-Mehr Machinery Company, Limited, Brunswick House, Westminster, S.W., is a working model of their Ransome continuous filter. This filter is proving most successful in the treatment of water for town supplies, the results bacteriologically and chemically being exceptionally high. As contrary to the usual mechanical filter, no power is needed in connection with this system, and a portion of the sand that is used as filtering media is being constantly removed from the filter to a sand washer at the base, where it is thoroughly cleaned and automatically returned to the head of the filter to be re-used for filtering purposes. This use of moving sand not only eliminates the necessity for constant washing back of the filter, but, owing to the conical shape that is taken by the body of fixed

or stationary sand inside the filter, a very greatly increased filtration area is formed. Among other filters at the present time under construction, the company have in hand three 10-ft. diameter filters for the Merthyr Tydfil Corporation, which are guaranteed to treat 1,200,000 gallons per day of twenty-four hours. This contract was secured by them by public tender, and after an 8-ft. diameter filter had been in use on the town supply at Merthyr for over eighteen months.



Ransome Continuous Filter.

The patented coagulating apparatus is also shown, and by means of this invention not only is the proportion of chemical passed through the filter kept constant, but the quantity is automatically regulated in direct ratio to the amount of water treated by the filter at any given moment. It is interesting to note that the washing of the moving sand takes place outside the actual filter itself.

W. H. WILLCOX & CO., LIMITED.

(Bay 27.)

Messrs. W. H. Willcox & Co., Limited, 32, 34, 36 and 38 Southwark-street, London, S.E., have placed on view examples of their semi-rotary wing pumps (lift and force, double and quadruple action for hand and power), Willcox-Turner triple-acting plunger pumps, Woolston rotary gear pumps for power, and improved rotary piston pumps for power. There are also to be seen here centrifugal pumps, diaphragm pumps, boiler wash-out pumps, water-cart pumps, "Manor" and other manure pumps. Mention may also be made of their patent non-rubber wire-bound suction and delivery hose, ejectors, and the Willcox-Penberthy cellar, sump or pit drainer, for automatically getting rid of flood water. The last named is operated by water pressure from mains, and will be shown in operation on the stand. Penberthy standard automatic and autopositive injectors for feeding boilers at high, medium, or low steam pressures, general engineers' stores, lubricating oils, packings, belting, steam fittings, boiler mountings, and tools are other features of this exhibit.

KENT COUNTY FENCING COMPANY.

(Stand 1, Row B.)

Wire-bound cleft chestnut and cleft oak fencing and cleft chestnut "panels" of fencing, without wire, are shown by the Kent County Fencing Company, Crouch, Borough Green, Kent. Gates and tree guards are other examples of the company's work to which attention may be directed.

PARLIAMENTARY AND GENERAL BUREAU, LIMITED.

(Stand 2a, Row B.)

The above-named firm, who carry on business at 48/49 Queen Anne's Chambers, Tothill-street, Westminster, S.W., are typewriting, duplicating and addressing experts, translations being another work in which they are engaged.

EDWARD THOMAS BOWYER.

(Stand 2b, Row B.)

Mr. Edward Thomas Bowyer, 144a High-street, Slough, is the sole agent for Templeman's patent joints for water stand posts. The swan-neck of the automatic self-locking joint cannot be removed from the post. The joint is opened with a key. When a van is full the key is withdrawn. The swan-neck is then put back in line with the kerb, and will lock itself either side. The Windsor joint can be used by any height water or mortar cart or steam roller, or as a fire hydrant. The swan-neck may be left locked on the post or removed, leaving a watertight joint on post. It is claimed for these joints that they never leak, are always safe, and cannot be meddled with.

C. W. ARMITAGE.

(Stand 4a, Row B.)

Preparations for cleaning paint and removing dirt and stains from delicate materials without damage to colour are brought to the notice of visitors to the exhibition by Mr. C. W. Armitage, 104 Kenyon-street, Fulham, London, S.W.

BRISTOL WAGON AND CARRIAGE WORKS COMPANY, LIMITED.

(Stand 6 and 7, Row B.)

A water van with cylindrical body, contractors' cart, spring tipping cart, builders' van, Liverpool float, trolley, patent screw tip dust van with patent covers, light covered van, light delivery van, and cob-size improved spring float, comprise the exhibits of the Bristol Wagon and Carriage Works Company, Limited, Lawrence-hill, Bristol.

T. BAKER & SONS.

(Stand 6a, Row B.)

A 400-gall. street watering van fitted with the patent economic sprinkler with brake, and a 200-gallon sanitary tumbler cart with improved cranked axle, are the principal exhibits of Messrs. T. Baker & Sons, engineers, Compton, Berks. A three-wheeled hand dust cart is shown.

STANLEY UNDERWOOD COMPANY.

(Stand 6b, Row B.)

This firm, whose works are at Shottermill, Haslemere, Surrey, are the manufacturers of the "Stanley" cleft chestnut pale fencing. The exhibit shows the fencing in various heights and styles; also gates to match. The posts used are treated throughout their length with "Sideroleum" wood preservative, which greatly adds to their appearance and durability. Some of the fencing exhibited has been treated with this preservative. The fencing is entirely British made.

GERTRUDE SAUNDERS.

(Stand 8, Row B.)

Miss Gertrude Saunders, 36 Broadway, Westminster, S.W., has a typewriting and translations bureau at this stand.

FERNDEN FENCING COMPANY.

(Stand 8a, Row B.)

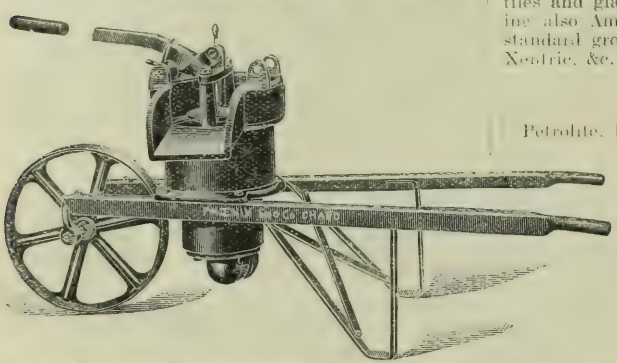
Cleft chestnut pale fencing and doors of "Fernden" manufacture are shown by the Fernden Fencing Company, Bell Vale, Haslemere, Surrey.

PHŒNIX ENGINEERING COMPANY, LIMITED.

(Stand 9, Row B.)

Pumps, tar-spraying machines, water-cart sprinklers and spray-hose and couplings are among the exhibits of the Phœnix Engineering Company, Limited, Chard. "Floodgate" pumps of various types are shown, these including one in operation which is intended for the raising of large quantities of muddy and gritty water, sewage, and so forth. A second type, mounted on a steel barrow, is fitted with a 10-in. working barrel, and is arranged for 3-in. suction. It will raise from 2,500 to 3,000 gallons of water per hour, and is suitable for lifts up to some 26 ft. It is intended for use where it is necessary quickly to move the pump from one point to another, or where a portable hand-lift pump is required for dealing with large quantities of liquids. It requires no fixing, and should be found indispensable on contracts where work is

liable to be delayed by sudden rainfall or floods. This pump is also largely used for sewer work. The firm's diaphragm pump will be seen in operation by visitors to the exhibition. This pump is fitted with a rubber diaphragm in place of the usual pump bucket. It is arranged for 3-in. suction, and will raise from 2,500 to 3,000 gallons of water per hour. The diaphragm is made of best quality rubber, and is 14 in. diameter, which is somewhat larger than that usually employed. It can be supplied with either bottom or side suction. In the "Phœnix Rapid" tar-spraying machine the pump has been specially designed for dealing with hot tar. It is



Phœnix Engineering Company's "Floodgate" Pump.

manufactured entirely of iron and steel. The valves are steel balls, which the firm have found from experience to make the best form of valve for this class of pump. Either valve is easily got at by unscrewing a small cap, and it is not necessary to take the pump to pieces to examine them. An arrangement is fitted for pumping hot air for cleaning through, if required. The plunger is of a special design, which is guaranteed not to leak, and on this account a larger barrel than usual is employed; moreover, the barrel can be left open at the top so that the plunger may be easily withdrawn without taking the pump to pieces. The air vessel is extra large, and cast in one piece so that the air cannot leak out of the top. The motion for working the pump is of the ordinary hand lever type, with up-and-down motion, and being placed on the side of the boiler, the man working it is able to keep well away from the fire. The spray nozzle is of an unique design, made specially for easy cleaning, being fitted with a small clip on cap for this purpose, thus obviating unscrewing the nozzle from the spray pipe. The spray pipe is fitted with two handles, one of which serves as a tap for turning the spray on and off and enabling the man working the spray to have perfect control without leaving go of the handles. One or more spray pipes can be fitted to the pump, or one or more nozzles to the spray pipe, the pump being of ample capacity for dealing with this. The boiler is constructed generally upon the same principle as the "Phœnix Rapid" patent tar boilers, which have met with so much success for some twenty years, the wheels and springs being strengthened to allow for continual working on the road.

T. W. PALMER & CO.

(Stand 10, Row B.)

Varieties of paling, ornamental wrought-iron fencing, corrugated steel paling, garden border hurdles, wrought-iron palisading, corrugated sheet fence, wrought-iron and chestnut hand gates, and tree guards are shown at this stand by Messrs. T. W. Palmer & Co., Merton Abbey Ironworks, Merton, S.W.

A. C. W. HOBMAN & CO.

(Stand 11, Row B.)

This old-established firm have arranged an interesting display of Kentish ragstone as used for tar-paving and tar-macadam, tar-paving and tar-macadam materials prepared for use, samples of paving after many years' wear, and samples of natural rock mastic asphalt, bitumen and grit used therewith, and models showing the application of these. The firm—whose offices are at Cliftonville, South Bermondsey—also exhibit "Clifton" artificial stone in steps, balustrades and dressings in various colours, paving *in situ* or slabs, mosaic steps, &c., "Cliftonite" ornamental non-slippery paving, and "Emerite" and leaded non-slippery treads for heavy wear.

JAMES WOODWARD, LIMITED.

(Stand 12A, Row B.)

This well-known Swadlincote firm, whose London offices are at 66 Victoria-street, S.W., are showing samples of glazed bricks, including their speciality in coloured salt-glaze cane and white enamelled sinks, white glazed manhole fittings, bacteria bed tiles and glazed stoneware pipes. They are exhibiting also Ames' patent flexible joint, Ames' patent standard grouted joint and Ewing's Xentric, Archer Xentric, &c.

PETROLITE, LIMITED.

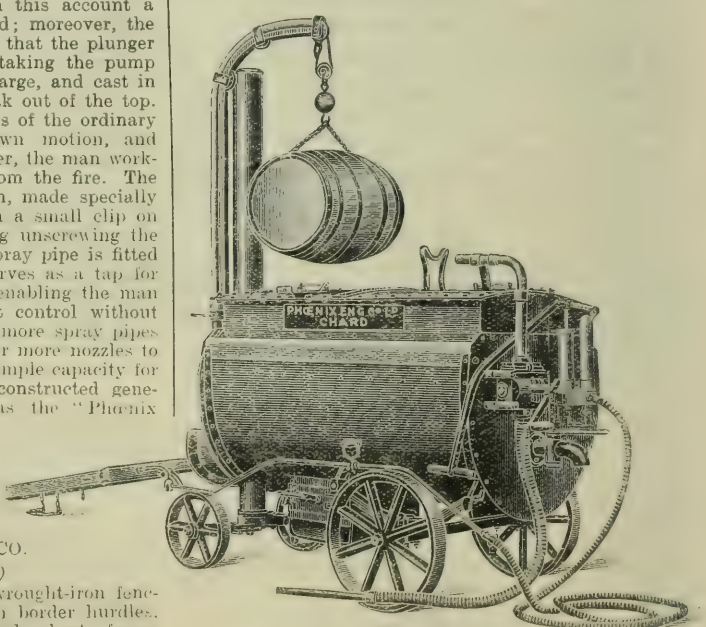
(Stands 13 and 14, Row B.)

Petrolite, Limited, 78 Wigmore-street, London, W., are the owners and manufacturers of the Petrolite safety lamp. The special feature of the lamp is the Petrolite container, which consists of a highly absorbent and incombustible stone, perforated to allow the passage of air, and enclosed in a metal container. This container is filled with petrol, which is immediately absorbed by the stone; thus in the lamp itself there is no free liquid, and explosion is impossible. The petrol absorbed in the stone gives off a vapour, and in due course is consumed in the burner, producing a hot bunsen flame, which when used with mantle gives a brilliant incandescent light. There is no wick to trim, no free liquid, no smoke, and no smell.

JOHN YATES & CO., LIMITED.

(Stand 15, Row B.)

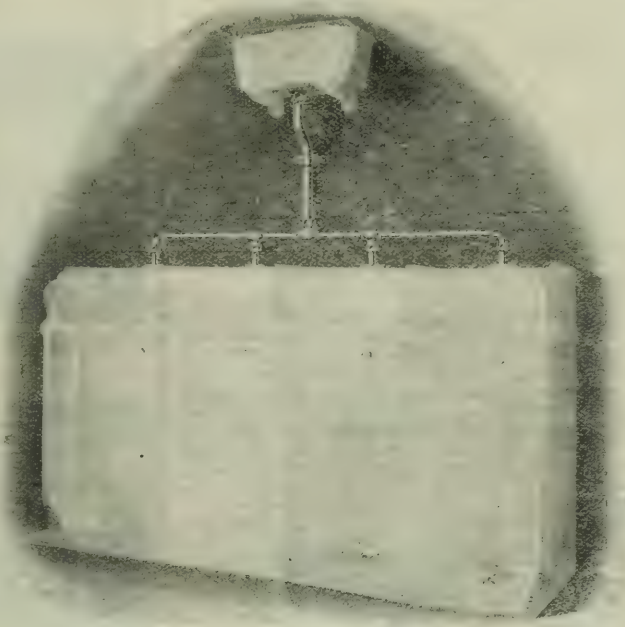
Since 1804 the above firm have manufactured, at their works at Aston, Birmingham, all classes of tools,



Phœnix Engineering Company's Tar-spraying Machine.

making a speciality of those for corporation and public work of every description, and few, indeed, have been the projects carried out in that line without the assistance of Yates' tools. At their stand they are showing a very large selection of their manufactures, ranging from a bucket to a tar-boiler fitted with spraying apparatus, and from a garden trowel to a diaphragm pump. In fact, the latter will be quite a feature of the stand, as it is one of their famous 3-in. "Contractor" pumps, and will be shown at work, the motive power being a small boy. This pump can be supplied fitted on steel barrow

complete with hose, foot valve, &c., at a remarkably low price. The 80-gallon horizontal tar-boiler which this firm will exhibit, fitted with spraying apparatus, will doubtless be a great attraction, and we have no doubt the many distinctive features of this boiler will readily commend themselves to all interested in tar work, as will also the large assortment of tar cans, buckets, and tools which the firm are also showing. It is almost superfluous to remind contractors and surveyors that the firm manufacture practically all classes of tools and appliances suitable for them. Messrs. Yates are always pleased to show their clients round their works, and the privilege is one which, we understand, scores avail themselves of annually, so that the various corners of the workshops, of which photographs have been taken, framed and hung in the office on the stand, will doubtless be recognised by many. Practically the whole of this firm's various manufactures for the home trade are represented on the stall, and the whole exhibit, including shovels, forks, picks, lamps, wedges, barrows, handcarts, and selections of tools for highways, tramways, gasworks and general contract work is excellent. Almost all have some distinctive feature showing careful thought and an exact knowledge of the particular requirements of the various classes of their *clientèle* gained from an experience extending over upwards of a century. Their barrier stand, for instance, is very much like most similar appliances in general use, except that by the special clip it is made to open just the right distance and no further, and that after use it can be compactly folded. Then, again, Messrs. Yates claim that by using their pipe-lowering and jointing appliance in conjunction with shear legs one man less is required in a trench. A large collection of blacksmiths' tools, portable forge and bench vice will, we have no doubt, attract very considerable attention from visitors, as also their handcarts and barrows, while an assortment of their lamps helps to show the great variety of this firm's manufactures. No notice of their stand would be complete without reference to Messrs. Yates' tramway tools, all of which, from their platelayers' spanners to the large jim crows, show great ingenuity of design and excellence of workmanship. The stand will be in charge of their contract manager, Mr. George Pike, and as he is well known in such circles as patronise the Building Exhibition, we expect he is looking forward to renewing a good many pleasant acquaintanceships.



Pickup & Co.'s "Diamond" Urinal Range.

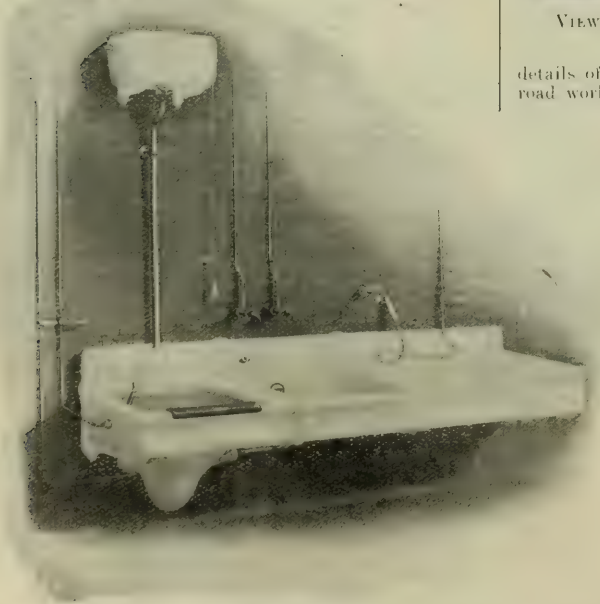
Pickup & Co.'s "Sapphire" Pedestal Slop Hopper.

W. R. PICKUP & CO., LIMITED.

(Stand 17, Row B.)

A very striking and attractive exhibit is that of the well-known firm of Messrs. W. R. Pickup & Co., Limited, of Pearl Brook Works, Horwich, Lancs. It will, of course, be remembered that these extensive and important works were carried on for many years by the late firm of Messrs. G. & D. Musgrave, Limited, and were acquired, together with the numerous moulds and complete plant, by the directorate of the John Crankshaw Company, Limited, the old-established firm of stoneware pipe manufacturers at Horwich, by whom a new limited company was formed in the name of W. R. Pickup & Co., Limited, for the purposes of the enamelled fireclay business, Mr. W. R. Pickup being the managing director of both the allied undertakings. Messrs. Crankshaw's productions have, of course, been very widely and favourably known for many years past, their pipes and fittings being manufactured at Horwich from the smallest to the largest standard sizes (3 in. to 36 in. diameter). Since Messrs. Pickup took over the Pearl Brook Works many additions and improvements have been introduced in consequence of the remarkable success achieved and the constantly increasing demand for the firm's manufactures, and the Pearl Brook works are now believed to be second to none of their kind in this country. New showrooms have been opened in numerous centres, and the firm now have branches and agencies in various parts of the kingdom, as well as on the Continent and in the Colonies. The goods manufactured comprise all descriptions of sanitary appliances for public buildings, institutions, schools and conveniences, as well as private residences, including baths, closets, lavatories, urinals, sinks, hospital and asylum specialities, laboratory fittings, &c. In the introduction to their newly-issued complete illustrated catalogue (which, by the way, should be in the hands of every up-to-date sanitarian, whether architect, municipal engineer, or tradesman)—Messrs. Pickup draw atten-

tion to the fact that only specially selected clays are used, these being prepared and blended to yield the greatest possible strength and rigidity, resulting in productions which are exceedingly hard, thoroughly vitrified, of even texture, and covered with a close, vitreous and inseparable leadless enamel, applied by a special process which ensures perfect cohesion between the clay and the enamel, the whole being subjected to an exceptionally high burning temperature, producing a finished surface of surpassing brilliancy and uniformity of colour. A unique feature of Messrs. Pickup's business methods, and a most important one from the purchaser's standpoint, is the absolute guarantee which they give against crazing or peeling, and which applies to every article supplied, under penalty of free replacement. Such, however, is the care exercised throughout the whole course of manufacture that claims arising out of this guarantee have been practically *nil*—a really remarkable record in view of the volume of the firm's output. Modern hygienic science, however, demands more than mere excellence of the actual fireclay ware although this of itself is of sufficiently vital importance and other essential points are those relating to the designs themselves, their suitability for their respective purposes, and the sanitary efficiency of the whole, both fireclay ware and metal fittings (supplies, wastes, supports and other accessories) utilised in connection therewith. In these respects a glance through Messrs. Pickup's new catalogue, above referred to, will furnish ample proof that the firm responsible for its compilation are abreast of the times, and, with their staff of trained and experienced sanitary specialists, are fully entitled to a place in the foremost rank of manufacturing sanitary engineers. If further proof were needed it is provided by the long list of important buildings to which Messrs. Pickup's goods have been supplied. Coming to Messrs. Pickup's actual exhibit at Olympia, this may be tersely described as a large selection in a small compass—the specimens shown cover such a wide variety as bidets, baths, slop hoppers, closet sets, urinal ranges, lavatories, sinks, channels, &c., in addition to one of Messrs. Crankshaw's salt-glazed stoneware pipes. To attempt to give even the briefest catalogue of the goods on view would occupy too much space, and we therefore strongly advise our readers on no account to miss seeing, and carefully



Pickup & Co.'s "Diamond" Combination of Hospital Sinks and Drainer.

inspecting, the exhibit itself, and incidentally making the acquaintance of the managing director, Mr. Pickup, who, we understand, hopes to be in personal attendance during the run of the exhibition. Our illustrations are reproductions in miniature of some of the new blocks in Messrs. Pickup's 1913 catalogue.

CANADIAN MINERAL RUBBER COMPANY, LIMITED.

(Stand 19, Row B.)

"Camarco" is the name under which the Canadian Mineral Rubber Company, Limited, of 32 Victoria-

"Camarco" on the Bath Road—Bottom Layer in Foreground.

street, Westminster, are marketing their high-grade road asphalts. At Stand 19 they will be found exhibiting samples of their various grades, together with

View of Road showing Finished Surface in Foreground.

details of the several places in the country in which road work has been carried out with their material. The most striking piece of work of this kind is that on the Bath Road between Reading and Twyford. The first portion of this work was done to the order of the Berkshire County Council in connection with a series of experimental lengths of road under the auspices of the Road Board. The result was so satisfactory, in the opinion of the county surveyor, that when the adjoining portion (laid in tar-macadam) broke up under the heavy traffic conditions, he decided to replace it with a second length of "Camarco." This portion was laid in January under very adverse weather conditions, and the resulting surface is entirely satisfactory. Many of the principal surveyors in the country have been to inspect this road, with the result that the company have received several important orders, among which are those from the county councils of Kent, Middlesex, and Essex, the Borough Council of Woolwich, and the Urban District Councils of Acton and Grays. The company claim that their material is not only absolutely insoluble, but, analysing 99½ per cent pure bitumen, is unaffected by the organic acids to be met with on the surface of a highway. Its insolubility renders it innocuous to fish and plant life, for which reason it may be used with safety in proximity to streams and rivers containing fish. We have inspected "Camarco" roads and have every

reason to believe that this material will have a large market.

DURABLE ROADS, LIMITED.

(Stand 20, Row B.)

Durable Roads, Limited, 4 Westminster Palace-gardens, Artillery-row, London, S.W., are well known as contractors for tar-macadam mixing and tar-spraying, and as sole licensees for the "Acme" tar-macadam mixer and the "Ridgway" patent tar-spraying machine. The "Acme" tar-macadam machine is a combined heating and mixing machine adapted for *in situ* work, and for use with all classes of bitumens. The "Little Acme" mixer, which is intended for use where dry stone is available, combines minimum power and labour with maximum output and efficiency of mixing. The "Ridgway" patent tar-spraying machine combines an arrangement of plates and screens in the boiler to ensure a constant supply of boiling tar or bitumen, and at the same time thoroughly screens the material during the process of heating. By this means, it is claimed, all delay caused by waiting for the tar to heat and choking jets are entirely obviated. The "Secker" automatic lock joint for water standposts can be seen at the stand.

EMPIRE STONE COMPANY, LIMITED.

(Stand 21, Row B.)

The paving and building materials of the Empire Stone Company, Limited, Thanet House, Strand, London, W.C., are shown at this stand. The paving slabs exhibited are part of a stock of over 100,000 super. yds. of thoroughly matured slabs stocked at the Narborough works. Samples of architectural dressings, showing balustrading, sun-dial and stone garden seat, are on view at the stand, and also a drinking fountain suitable for public parks, and moulded spandril and square steps. "Empire stone" is claimed to be as durable as granite, and not to be affected by atmospheric powers so detrimental to natural stone. *In situ* paving, grooved and channelled, as laid for schools, warehouses, asylums, infirmaries, laundries, cattle markets and stables, forms part of the exhibit, while illustrations of the company's ferro-concrete work are also shown.

NEWTON, CHAMBERS & CO., LIMITED.

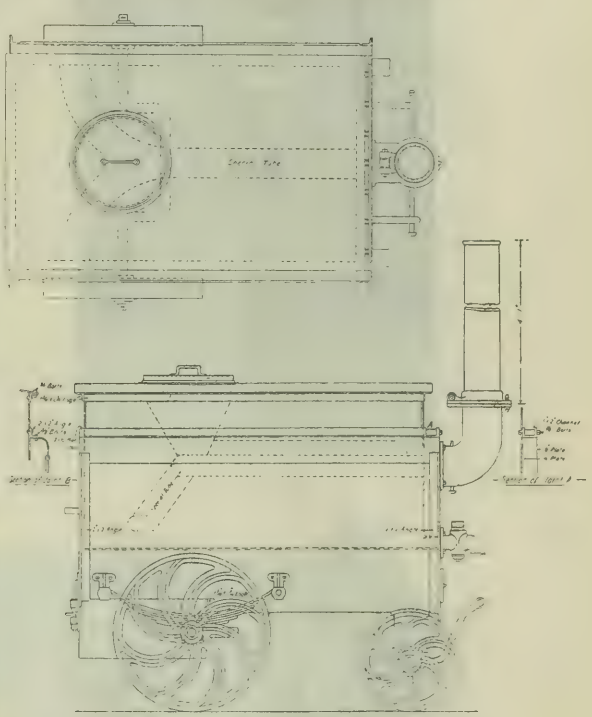
(Stand 22, Row B.)

There is at this stand an excellent display of "Izal" specialities, the manufacturers and proprietors of which are Messrs. Newton, Chambers & Co., Limited, 331 Gray's Inn-road, London, W.C.

LLEWELLINS & JAMES, LIMITED.

(Stand 23, Row B.)

The exhibit of Messrs. Llewellins & James, Limited, Castle Green, Bristol, will have a special attraction for all surveyors of districts where tar-spraying is in vogue. We are given to understand that many hundreds of their W. and B. patent spraying machine have been supplied to metropolitan, town, urban and rural councils throughout the country, and that quite a considerable number are in use in the Colonies and abroad. The machine is also being adopted in various parts of the kingdom and in many foreign countries, facts which go far towards supporting the claims of the manufacturers as to its economy and efficiency—further endorsement in regard to which is provided by nearly eighty convincing testimonials from prominent engineers and surveyors. Among the principal advantages attached to the machine is its great simplicity, as unskilled labour is all that is required for its operation—an important point for the consideration of surveyors who have only their ordinary roadmen to undertake the work. This quality of simplicity naturally reduces to a minimum the risk of any parts getting out of order, and it is worthy of note in this connection that access to all portions of the machine is obtainable with a minimum of trouble. Messrs. Llewellins & James, Limited, are this season introducing Palmer's patent feed heater, which can either be supplied with new machines or attached to existing horizontal boilers. This device has been extremely successful in preventing any stoppage of machines during the feeding in of thick materials while work is in progress, the temperature being fully maintained. This patent is a magnificent addition to an already excellent invention. Two detailed views are given of these internal tubes, a reference to which will at once indicate to practical users of machines the great advantages of the device. With this combination, owing to the simplicity of the nozzle, such materials as Tarvia (A and B), Trinidad liquid lake asphalt, and so forth, can be sprayed with ease, and it is suggested that this—as regards the latter material, at any rate—is quite unique.



Llewellins & James' "W. and B." Tar-spraying Machine.

Messrs. Llewellins & James, Limited, will, we are sure, be very pleased to supply any further information that may be required.

JOHNSTON BROTHERS.

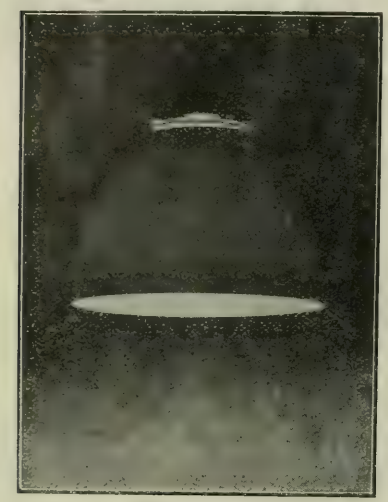
(Stand 24, Row B.)

This firm, whose business offices are at 79 Mark-lane, London, E.C., have made a speciality of tar-painting by hand, and claim to have proved that this method of tarring is quicker than machine work besides being more satisfactory in results. Even spreading of the tar is the aim of all authorities undertaking tarring operations, and the firm contend that hand-work is the only method that will permit of this. Last year this firm carried out a contract for 600,000 super. yds. for

Tar-painting with Waithman Broom at Newbury.

the Southampton County Council, and this year have supplied the council with twelve of their patent boilers, each boiler being fitted with double Waithman's tarring apparatus. They also carried out a contract for the city of Sheffield, and received an order for a boiler and Waithman's apparatus, and this year have again been given a contract for this city. At Berkhampstead they carried out a contract for 70,000 yds., and have

received an order this year for a boiler and Waithman's apparatus. Shropshire County Council have entrusted their tarring to this firm for three seasons. East Suffolk County Council have also adopted this system, and besides purchasing appliances manufactured by the firm have given them a large area to tar-paint. Many other councils are convinced of the superiority of these appliances and have adopted them, among these authorities being the Kent, Worcester, Durham, Carnarvon, and Brecon County Councils, and the cities and boroughs of York, Bradford, Leeds, Lancaster, and Northampton. A special exhibit this season is

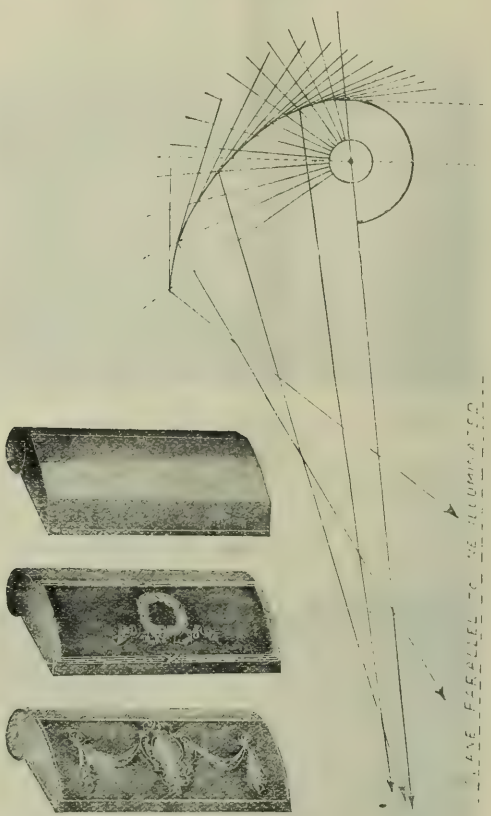


Bank Desk Unit.

"Residence" Reflectors.

"Stiletto" Reflector.

"Stiletto" Reflector-Bowl.



"Unilux" Reflector.

New Semi-indirect Lighting Unit.

Holophane Exhibits.

the patent safety shafts which the firm have brought out. These shafts allow of the immediate release, in case of fire, of the horse attached to a tar-boiler. The patent hot-air pumps attached to this firm's boilers will be of interest to all users of Tarvia and other heavy compounds. Another exhibit of interest is the latest Archer's rotary broom for preparing road surfaces for tar-painting. Further exhibits include road signs, mud breakers, hand trolleys, hand sweeping brooms and tar-brushes.

E. J. MOON & CO., LIMITED.
(Stand 25, Row B.)

This firm, whose business address is 17 Gracechurch-street, London, E.C., will show a floor at their stand laid with "Cormazzo" flooring in a combination of colours. Further exhibits will be shown of pieces of "Cormazzo" flooring which have been subject to extreme temperatures, and there will also be experiments demonstrating the great resiliency of this material. It is guaranteed not to crack or lift, and its durability is claimed to exceed that of any ordinary floor. It is warm, noiseless, non-slippery, dustless, non-absorbent, and, in addition to its being fire-proof, is also petrol-proof. The material can be laid in any indoor location in approved colours or combination of colours on concrete, stone or old wooden floors *in situ*.

JOHN KNOWLES & CO. (LONDON), LIMITED.
(Stand 26, Row B.)

Municipal engineers will find plenty to interest them at the stand of Messrs. John Knowles & Co. (London), Limited, 38 King's-road, London, N.W. Pipes, as is well known, are their speciality, and surveyors should not fail to inspect their "Free Flow" patent joint. Described by the makers as the "final form" of drain-pipes, the advantages of the pipe are set forth as follow: Self-inverting, true alignment (full bore), less cement required for joint, cost of laying reduced to an absolute minimum, and purchase cost very slightly above ordinary.

HOLOPHANE LIMITED.
(Stand 26A, Row B.)

An attractive exhibit of scientific glassware for the illumination of all kinds of buildings has been arranged by Holophane Limited, 12 Queen Anne's-gate, London, S.W. A sample 20 in. diameter hemisphere prismatic globe and reflector—the largest piece of press glass commercially manufactured—is shown in section to demonstrate clearly the shapes of the various prisms which are designed to diffuse and redirect the light from the source. The "Stiletto" reflector and reflector-bowl represents a very complete series of glassware for use with all sizes of the most recent electric metal filament lamps and modern incandescent gas burners, and the most recent advance in the production of pressed glassware is to be found in the new "Crystal" reflector-bowls, designed to produce efficient lighting and to give the spectrum colours of the brilliant-cut diamond. The firm's new "Residence" line of reflectors have their interior surfaces treated by a special satin finish, producing a restful and pleasing effect. The "Uniflux" reflector is designed to give a uniform illumination over a plane surface with the aid of sources placed near one or more edges of the area illuminated. It is claimed to be eminently suitable for the illumination of pictures, tapestries, maps, posters, bookshelves, facias, and so forth. A new desk unit introduced by the firm consists of a "Stiletto" reflector with a green opal covering shade, and is suitable for either gas or electric light. New semi-indirect lighting units consist of clear or satin finished glass bowls with Stiletto prisms, which completely screen the filament of the lamp from the eye, and are designed to distribute the light on the ceiling in a scientifically graded manner.

J. W. GLOVER & SONS.
(Stand 27, Row B.)

The Warwick firm of J. W. Glover & Sons are showing their 1913 pattern of the well-known Warwick sprinkler, and among other features of their exhibit are a scavenging cart fitted with Glover's patent cover with renewable brackets, Glover's patent rolling and sliding cover for dust vans and carts, fitted with renewable brackets, an 80-gallon hand tar-spraying machine, complete with filling

Heenan & Froude Clinkering Apparatus at Hertford.

pump and spraying apparatus, fitted with Healey's patent spraying jets, and spraying jets for tar, &c.

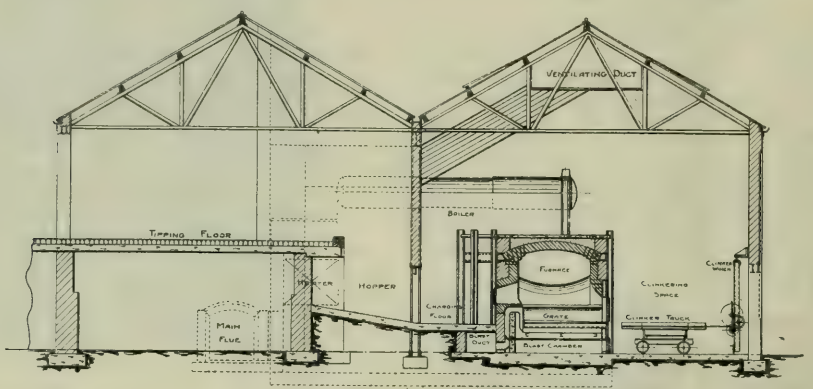
"SAVAX" LADDER SUPPORT (PARENT CO.).
(Stand 28B, Row B.)

An ingenious apparatus for overcoming the dangers incidental to the use of high ladders is shown by the "Savax" Ladder Support (Parent Company), 36 Finsbury-pavement, London, E.C. Absolute safety would seem to be assured by the use of this remarkably simple device, for ladders fitted with it cannot, to quote the claim of the makers, either slip or be pushed over, whatever the nature of the ground on which it is resting. The support fits any ladder, and, once fixed, requires no adjustment, and permits of the ladder being used at any angle.

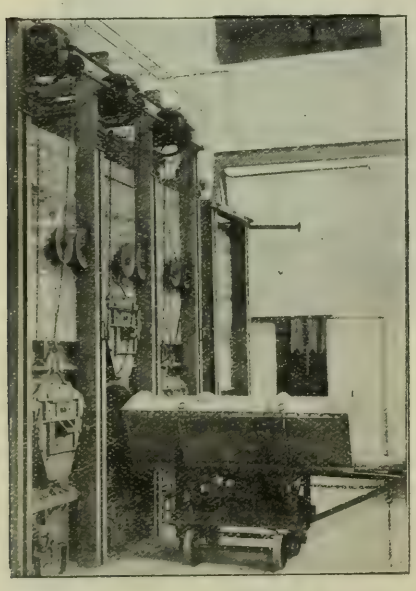
HEENAN & FROUDE, LIMITED.
(Stand 29, Row B.)

Messrs. Heenan & Froude, who now have their offices at Manchester, London, Worcester, Paris and Montreal, are showing three models of their present practice in refuse destructor design. The first model shows a two-cell back-feed plant, provided with new

patent trough grate. This type of back-feed plant is very commonly used in this country, but on the Continent engineers have introduced to a larger extent the firm's more recent system of destructor—namely, mechanical charging in combination with the "Trough" grate mechanical clinkering. This type of plant is shown in their second model, which typifies a single cell of a unit. We may add that Messrs. Heenan & Froude still adhere to their continuous grate system, the advantages of which are now fully appreciated in this country. A third model is shown illustrating the large number of uses to which the crushed clinker may be put. In the model illustrating a section of a modern road complete with side walks, the flags of the side walks are made of clinker concrete; and the same applies to the kerbs, which are faced with granite chippings in order to give them a harder surface. The foundation of the side walks rests on crushed clinker, and the road itself rests on a ballast of unscreened clinker which is covered by a layer of clinker concrete supporting the vitrified clinker-brick road metalling. Even the sewers, drain pipes, telephone and other cable ducts are constructed of this residue from the destructor. An interesting chart is shown illustrating the development of the "Heenan" type of destructor throughout the world, and further a diagrammatic drawing illustrates the quantity of refuse burnt by the Heenan destructor in each country. A chart of the world is also given showing, by means of flags, places where "Heenan" destructors have been erected, and forms a very apt illustration of the wide distribution of this type of destructor. On the stand are also given samples of unscreened, crushed, and screened clinker and flue dust. A large chart is, moreover, given, detailing the uses which the steam generated and the clinker obtained in the destructor can be put to. A scheme drawing of the firm's 450-ton destructor plant at Rotterdam, a typical modern English scheme drawing, and the scheme suggested for the Municipality of Menton, in France, are also exhibited. These drawings are well finished and notable for their bold outline and colouring. The stand contains further some very creditable photographs of plants erected by this firm throughout the world. Further drawings of scheme plants, from 5-tons to 500-tons capacity, are available for inspection to any municipal councillors and engineers interested in the subject. An interesting photographic album is also available for this purpose. A qualified engineer will be present at the stand to furnish any details that may be required with regard to the burning of the refuse and the utilisation of by-products.



Design and General Outlay of Typical English Destructor Plant (Heenan & Froude).



View showing Clinker Skip in Front of Furnace in St. Petersburg Works (Heenan & Froude).

SPENSERS, LIMITED.

(Stand 30, Row B.)

Petrol-air gas generators are the principal feature of the stand at which Messrs. Spensers, Limited, 53 South Molton-street, London, W., are showing. These are made in special sizes from twelve lights upwards, suitable for use in isolated buildings, estates and villages. The exhibit includes a special series of new design of fittings suitable for electric light, coal gas, petrol gas and acetylene.

SPIRAL BOND BAR COMPANY, LIMITED.

(Stand 30A, Row B.)

Engineers and surveyors should make a point of examining the exhibit of the Spiral Bond Bar Company, Limited, Caxton House, Westminster, S.W. "Trisec" spiral bond bars, particulars of which appeared recently in our pages, are claimed by the firm to be the most reliable and economical steel bar available for reinforced-concrete work.

BANNER SANITATION COMPANY.

(Stand 31, Row B.)

Drain-testing appliances of every description, for applying the water, smoke or air tests to drains, are shown in actual use at the stand occupied by the Banner Sanitation Company, 24 Craven-street, Charing Cross, London, W.C.—Lyte's Metallic Woven Stair Tread Company, Limited, of the same address, are also installed here.

TUKE & BELL, LIMITED.

(Stand 32, Row B.)

An "Ideal" revolving distributor, specially suitable for circular filter beds from 8 ft. to 40 ft. diam., is a noteworthy exhibit of Messrs. Tuke & Bell, 69 Leadenhall-street, London, E.C. This distributor is positive in action, and has no perforations liable to choke. Double carrier arms with serrated edged openings provide a quiet, equable distribution of the sewage over the surface of the filter bed. This distributor requires no dosing arrangements, and is claimed to be the only revolving distributor which will continue to move by its own power with so small

a flow as 3 gallons per minute. These distributors are specially suitable for small and medium sized installations where regular attention cannot be given, as they are capable of working for weeks together without cleaning or adjustment. A 60-gallon sewage ejector, similar to those supplied by the firm to the Orsett Rural District Council, an 8-in. central column and distributing tank for a "Carlton" revolving distributor, and autoflush sewage lift, and a floating arm in sheet copper have also been placed on view. Messrs. Tuke & Bell also exhibit their "Grip" road sewer cover. This, by means of the annular spaces formed by the concentric rings, holds up the road material to the frame. The road metal is compressed

Tuke & Bell's "Ideal" Distributor.

between the rings, and if grouted in forms practically a ring of reinforced concrete round the opening, and so does away with the need for setts. These are made in 18-in., 20-in. and 22-in. clear openings, with either solid or ventilated or wood-block plugs.

G. W. RILEY.
(Stand 33, Row B.)

We have made arrangements with this well-known Herne Hill firm for the loan of a goodly number of rustic seats and chairs which it is intended to distribute around the gallery for the use of visitors to The Surveyor section. Other examples of Messrs. Riley's handiwork, in the form of rustic arches, will serve to ornament the staircases to the gallery. The firm's stand will be taken up with summer houses of various shapes and sizes, arches, seats, tables, vases, and frames, lights and greenhouses, and will doubtless provide much to interest all whose duties include the occasional work of laying out recreation grounds and parks.

GEORGE WALLER & SON.
(Stand 34, Row B.)

Petrol-driven pumping and lighting sets for use in hotels and mansions are among the principal exhibits of Messrs. George Waller & Son, Phœnix Iron Works, Stroud, Glos., and 127 Pendle-road, Streatham, London, S.W. The firm show also a "Pinkney" gas engine, a petrol-driven cesspool plant, and a large selection of air valves, sluice valves, hydrants, ventilating columns, penstocks, tide flaps, disc flushing valves, handstops and automatic check valves, "E. F. B." automatic sewage distributors, alternating gear for contact beds, and an automatic sewage screen are other items of interest, in addition to which mention may be made of examples of Smiths' patent sewage and water sprays, a large range of manhole covers and gulley gratings.

W. WEEKS & SON, LIMITED.
(Stands 35 and 36, Row B.)

Tar-spraying and other machines for road work are on view at the stand of Messrs. W. Weeks & Son, Limited, Perseverance Ironworks, Maidstone. The list of exhibits is as follows: (1) Automatic pressure tar-spraying machine of 160 gallons capacity; (2) horse-drawn tar-painting machine of 230 gallons capacity; (3) horse-drawn hand-power tar-spraying machine of 250 gallons capacity; (4) hand-power tar-spraying machine of 80 gallons capacity; (5) independent hand tar-spraying machine; (6) pitch grout mixing machine; (7) direction post with cast-iron arms; (8) lime-washing machine.

R. H. REEVES & CO.
(Stand 37, Row B.)

The Reeves system of sewer ventilation will be fully explained to all interested at this stand. The Reeves sewer ventilator is the result of many years of study and testing, and a considerable amount of money has been spent by the inventor in proving their efficiency in removing of nuisances, and dealing with pathogenic germs. The principle on which the apparatus works is the injection of chilled chemically saturated air into the sewers. Ventilators of the Reeves type have been supplied to the London County Council, and are working on the main sewers on both sides of the Thames; in addition they have been adopted by Kensington, Hampstead and Lambeth Borough Councils, and are now being fixed in the cities of Westminster and Edinburgh, and at Frinton-on-Sea and other places. The sole selling agents are Messrs. Doherty & Bamber, 25 Victoria-street, London, S.W.

BURN BROTHERS.
(Stands 38 and 39, Row B.)

The firm of Burn Brothers, Rotunda Works, 3 Blackfriars-road, London, S.E., are again showing a large and varied selection of their well-known cast-iron drain, soil and waste pipes and fittings, also drain testing and clearing appliances, chief among which we notice their "Eclipse" smoke-testing machine. This machine is extensively used among engineers, surveyors, sanitary inspectors, and the trade generally, and is claimed to be the only machine which will apply a positive smoke test to drains. Various classes of drain plugs and bag stoppers are also shown, air test gauges and disc plugs being a speciality. This firm, who have recently considerably added to their premises at Blackfriars-road and Stamford-street, hold a running stock of no less than 2,000 tons of cast-iron drain and soil pipes and fittings — the latter in thousands of variations—and they can invariably give *immediate* delivery from stock, no matter how large and varied the order may be. Messrs. Burn Brothers are also showing a small selection of their appliances for use in connection with sewage disposal, sewer flushing, &c. The most prominent of these is a small example of their very carefully thought out sewage sprinkler for circular percolating filters, with which they have had considerable success, the War Office figuring prominently in their list of satisfied users. The sprinkler is of exceptionally robust construction, and the ball-bearing head is fitted with a dust and insect proof oil bath, all capable of being taken apart without dismantling the sprinkler generally. The principal feature of the apparatus, however, is the gear for automatically clearing the holes in the arms and regulating the rate of discharge of the sewage. Should the quantity of sewage supplied to the sprinkler fall below the normal, a malleable cast-iron tapered finger is automatically inserted in each hole to a greater or lesser distance, depending on the deficiency of sewage, thus reducing the area of the hole, maintaining the head in the centre tank, and ensuring that sewage will still reach all the holes, and not merely trickle out of those near the centre, a trouble frequently met with in non-regulating sprinklers, even when served from dosing tanks. When the flow of sewage is increased, the fingers are withdrawn to the extent required to ensure even distribution, while preventing overflowing at the centre tank. It is needless to point out that as these fingers are continually on the move, choking of the holes is a physical impossibility, while the sprinkler necessarily gives excellent results through a wider variation in the rate of sewage delivery than can be expected of any machine having holes of a fixed area. On the same stand are some samples of the "Certus" flushing syphon, introduced by Messrs. Burn Brothers a few years ago and now very firmly established. These syphons are made in all sizes and to suit all styles and sizes of cisterns, tanks and collecting chambers, and to draw any depth of water from 6 in. upwards. The peculiar formation of the trap of the "Certus" syphon has been an asset of great value, since it has made results with "drop feed" as certain as the most exacting can wish. The firm have so steadily improved on their patent "Horometer" apparatus for timing

the discharge of syphons in contact beds, collecting tanks, &c., that the appliance is now a very different affair from their first production, successful as that was. It will now be guaranteed to discharge the contents of a filter bed or tank on the expiration of any predetermined period, to be independent of temperature, to be dust and insect proof, quite automatic, and to require no lubrication (since there are no moving parts), and no attention. Since sewage does not enter into the timing arrangements in any way, all the difficulties of choked pipes and valves, and the general disabilities attending on the use of such a filthy liquid in timing apparatus, are eliminated. The smaller details in connection with sewage apparatus, the design of which, though apparently simple, really calls for considerable experience and care if they are not to cause trouble, are all stocked and supplied by Messrs. Burn Brothers. Such fittings as inlet and outlet dip pipes to cesspools and septic tanks are specially made for the purpose, so that there is no longer any excuse to patch together any odds and ends of ordinary drain fittings to make up "something that will do." Their selection of hand valves, penstocks, disc valves, &c., leaves nothing to be desired, and generally it may be said that few firms have entered into the business of supplying apparatus for sewage treatment and disposal in a more scientific as opposed to the usual "rule of thumb" manner than Messrs. Burn Brothers, who have been for so many years prominently before the public in connection with their cast-iron drain and soil pipe trade.

VINCENT BROOKS, DAY & SON, LIMITED.

(Stand 40, Row B.)

Specimens of work by the True-Scale Photo-litho process, printed on various papers, and tracing and opaque cloth of different kinds, will make an effective display at the stand of Messrs. Vincent Brooks, Day & Son, 48 Parker-street, Kingsway, London, W.C. This process is simply the old photo-litho system, but direct from the original to the metal plate. This naturally prevents any modification of scale, but when the same scale is required absolute precision is secured. The copies can be made from originals on Whatman Bristol boards, or from subjects on any transparent or semi-transparent substance, while the method offers unusual facilities for alterations and additions to the plates when required. The plates employed can upon request be retained—a frequent advantage both to architects and contractors when carrying out the work, especially when, from the originals having been coloured, they are no longer suitable for reproduction. Prints are obtainable in two, three or more colours by this process, so that drains or other details may appear in colour. The specimens exhibited have been printed from as many tracings as there are colours, and then registered together—a sure test of the correctness of their scale. The firm also show specimens of work by the Vinbede true-scale system, some up to 22 ft. in length, or 8 ft. long by 4 ft. 6 in. wide. It has great advantage when fewer than six copies are required. By both processes copies can be had on any class of paper and opaque or tracing cloths.

E. O. HARDING.

(Stand 41, Row B.)

A combination smoke and air-pressure drain testing apparatus, manufactured by Messrs. Geo. Jennings, Limited, is being exhibited at this stand by Mr. E. O. Harding, of Crediton, Devon. This apparatus provides for either an oil vapour or air test. The vapour is in the form of a dense smoke with detecting smell, provided by a vaporiser, and is forced into the drain by means of pressure from a pump attached. The air test is worked by the same apparatus, without the vaporiser. When applying the air test the gauge indicates the pressure on the drains. Demonstrations will be given showing the apparatus as in actual operation. Particulars can also be obtained from Messrs. George Jennings, Limited, 63 to 67 Lambeth Palace-road, London, S.E.

JONES & ATTWOOD, LIMITED.

(Stand 43, Row B.)

Messrs. Jones & Attwood, hydraulic engineers, Stourbridge, are exhibiting working models of their two principal types of sewage wheel distributor—one for rectangular and the other for circular filters. They point out that the advantage of rectangular filters is important when space is limited or provision has to be made for future extensions. This is a distributor which can be used for a short or long filter, giving facility for resting a part of it while the remainder is kept at work. It is often desirable to construct such a filter gradually to meet increase of population or to utilise local labour, and by simply adding further lengths of rail and feed trough the same distributor will do duty over the extended filter. Messrs. Jones & Attwood suggest that those who agree that the area of a filter is of more importance than its depth will construct shallow filters 400 ft. or 500 ft. long, and employ such a distributor as this to sprinkle over it, and so keep the total cost low and efficiency high. Some recent orders for their distributor for rectangular filters include sixteen for Southend-on-Sea, to cover 4 acres, and six more for Evesham, while for circular filters eight more of their rotary type for filters 101 ft. in diameter are on order for Cheltenham, in addition to many others for home and abroad. Mention may also be made of a new installation at Barrhead, where the contact beds have now been converted into percolation filters. The firm will also exhibit other sewerage ironwork goods and heating apparatus.

TAROADS SYNDICATE, LIMITED.

(Bay 10.)

Patented tar-spraying machines of various types, from 250 gallons to 1,000 gallons capacity, form an important section of the road engineering requisites which the Taroads Syndicate, Limited, 9 Victoria-street, Westminster, S.W., are bringing to the notice of visitors to THE SURVEYOR Section. These machines, it may be recalled, secured the gold and silver medals at the dust-laying trials held at Staines by the Roads Improvement Association. The firm's exhibit will afford an opportunity for an examination of their patented machines for the construction of bituminous macadam *in situ*, and attention may also be directed to samples of the Brodie (Liverpool) system of road construction, which the company contract to lay, and to typical sections of roads which have been surface-sprayed with the Taroads patent machinery and Tarco.

OTHER EXHIBITORS.

In next week's issue notices of the exhibits of the following firms will appear:—

Dibdin & Dibdin, 47 Victoria-street, S.W. (Stand 2, Row B).

Economic Fencing Company, Limited, Billiter House, E.C. (Stand 3, Row B).

W. E. Farrer, Limited, Star Works, Livery-street, Birmingham (Stand 5, Row B).

E. & R. Norman, Chailey, South Common, near Lewes (Stand 12, Row B).

Layton Timber Company, Trundley's-road, New Cross, S.E. (Stand 42, Row B).

Podmore & Co., Limited, 33 Charles-street, E.C (Stand 28, Row B).

J. Hutchinson, 11 Tothill-street, S.W. (Stand 28A, Row B).

MOTOR VACUUM ROAD CLEANSING.

DEMONSTRATION IN THE CITY OF LONDON.

On Wednesday Messrs. J. & P. Hill, Sheffield, gave a demonstration in the City of London of their patent motor vacuum road cleansing machine. In the morning, starting from Blackfriars Bridge, the machine was taken over the wood-paved surfaces of New Bridge-street and Farringdon-street, and after luncheon, at De Keyser's Royal Hotel, the demonstration was continued through Smithfield Meat Market (wood paving), Long-lane (granite setts and asphalt), Cheapside, Poultry and Mansion House-street (asphalt) and Queen Victoria-street (asphalt and wood).

The Holophane System of Illumination.—During the forthcoming Building Exhibition a short lecture-demonstration on the Holophane system of illumination will be given every evening in the lecture hall of the gallery at Olympia at half-past eight.

Building Exhibition at Olympia.

Opening by the Lord Mayor of London.

There are considerably over 300 standholders in the Building Exhibition at Olympia which, ceremoniously opened on Saturday last by the Lord Mayor of London (Sir David Burnett), bids fair, judging by the interest it has already evoked, to attract a record number of visitors, bringing, it will doubtless be hoped, something like a proportionate amount of business to the exhibiting firms. As announced elsewhere in this issue, "Municipal Engineers' Day" is fixed for to-morrow (Saturday), when THE SURVEYOR conference and the ensuing Eastern District Meeting of the Institution of Municipal and County Engineers may be expected to result in a large and representative gathering of surveyors to public authorities. Throughout the week, however, there has been a steady stream of officials from all parts of the country making the tour of the spacious gallery of the hall, where THE SURVEYOR section finds its customary place, and we reiterate the hope we have already expressed that the unique collection of municipal engineering materials and appliances on view will be seen at least once by all whose engagements permit of their spending a few hours at the exhibition—which remains open until Saturday, the 26th inst.

The Lord Mayor, accompanied by the Sheriffs of the City, reached Olympia last Saturday shortly after noon, being received on arrival by Mr. H. Greville Montgomery, and conducted round the body of the hall. His lordship said he had the greatest possible pleasure in being present at the inauguration of the exhibition, which he thought must be of the utmost advantage not only to all those connected with the building and allied trades but also to the general public. Declaring the exhibition open, the Lord Mayor added that he wished the enterprise the success it deserved.

At a luncheon held subsequently in the Pillar Hall, under the chairmanship of Mr. Montgomery, there were present, among others, the Lord Mayor, Mr. Edward Strutt, president of the Surveyors' Institution, Mr. Reginald Blomfield, president of the Royal Institute of British Architects, Mr. Henry Riley, president of the Quantity Surveyors' Association, Mr. E. P. Wells, president of the to the London County Council, Sir A. Brumwell Concrete Institute, Mr. Sydney Perks, F.R.I.B.A., City Surveyor of London, Mr. W. E. Riley, F.R.I.B.A., M.INST.C.E., superintending architect Thomas, F.R.I.B.A., Mr. H. Percy Boulnois, M.INST.C.E., president of the Institute of Sanitary Engineers, Mr. Ernest J. Brown, president of the Institute of Builders, Mr. Walter Lawrence, junr., president of the London Master Builders' Association, Prof. Henry Adams, M.INST.C.E., M.I.MECH.E., Mr. Edwin C. Pinks, F.S.I., Mr. R. J. Angel, A.R.I.B.A., M.INST.C.E., borough engineer of Bermondsey, Mr. H. Kempton Dyson, secretary of the Concrete Institute, Mr. P. N. Hasluck, secretary of the Institute of Sanitary Engineers, Mr. H. R. G. Montgomery, and Mr. Hugh C. Montgomery.

Mr. Reginald Blomfield proposed, and Mr. Edward Strutt seconded, a vote of thanks to the Lord Mayor for opening the exhibition. The seconder observed that he had a special interest in fulfilling the duty entrusted to him. The Lord Mayor was a distinguished member of his own (the speaker's) profession, and they felt he had done honour to their institution by attaining the high office of Chief Magistrate, and they had watched with great pride the way in which he was discharging the duties attached to the position.

In his reply the Lord Mayor said it was clear that while the exhibition which he had opened that day was unlikely to provide any considerable amount of instruction for the eminent representatives of the architectural, surveying and municipal engineering professions who were present on that occasion, it afforded a useful and practical illustration of how they could utilise modern inventions and make them fit in with the exercise of their art. He congratulated Mr. Montgomery upon the fact that this was an exhibition and not a show. It was a trades exhibition in every sense of the word, and its up-to-date character was in itself a proof of the enormous advantage it must be to builders and contractors, and to the members of the professions associated with the trade. In his early days, when they had not the advantages which they now possessed, so far as an ordinary private residence was concerned, the first thing the builder did was to dig a hole, and then he put a house in it. Now there was a desire to have a house which combined architecture, hygiene, comfort, economy of labour, refinement, and all at the minimum cost. The object of the exhibition was to show how that could be achieved, although it would not be able to show them that they could have good work unless they were prepared to pay an adequate remuneration. He commended the exhibition heartily to the public. If they came there they would find much to give them pleasure and certainly a great deal to instruct them.

Replying to the toast of his health, proposed by Sir Brumwell Thomas, the chairman said that in the exhibition they would find the very finest expression of the craftsman's art in woodwork, ironwork, steelwork, claywork, and even in concrete. They would find everything of the very best, to the exclusion of the cheap and

nasty exhibits that one got sometimes at so-called trade exhibitions. They would find material that would build the ideal £110 house of the Local Government Board, or material with which they could equip a new palace for the King. Everything, from the drains in the basement to the chimney-top of the house, could be seen and inspected.

In last week's issue we described the majority of the exhibits in The Surveyor section, and now give particulars of a number of the stands in the body of the hall.

SIEGWART FIREPROOF FLOOR COMPANY, LIMITED.
(Stand 1, Row A.)

Samples of floors and flat and sloping roofs constructed on the "Siegwart" system are shown by the above-named firm, whose address is Thanet House, 231 Strand, London, W.C. The advantage of this floor over *in situ* concrete is that no centering is required, thus dispensing with the considerable delay to other trades caused by propping having to remain in position until the *in situ* concrete has set. The beams are delivered to the site in a thoroughly matured condition ready for fixing. The method of fixing is simple. The beams are placed side by side on the supporting walls or joists below, and the joints then grouted in with cement mortar, when the floor is ready for use. *In situ* operations are therefore reduced to a minimum. In addition to the floor being fire-resisting, it is claimed to be sound-proof and economical in use.

IMPROVED SANITARY APPLIANCES COMPANY.
(Stand 25, Row C.)

Iron cantilever sink traps and adjustable cantilever water-closets are the specialities exhibited by the Improved Sanitary Appliances Company, Queen's College, Paradise-street, Birmingham. The firm's patent iron cantilever sink trap comprises bracket, trap, inspection arm and head. These four things are all in one casting, which forms a cantilever, and the building of this cantilever in the wall fixes all four at once. The traps are 2 in. in diameter, and $\frac{3}{16}$ in. thick. Sinks are frequently supported at one end by a corbel course of bricks from a copper, or a return wall, but a plain cantilever can be used if required. The patent adjustable cantilever water-closet can be set at any angle on plan required to suit position of the outside perpendicular soil pipe. It is entirely carried by the wall, resting on the bearing plate. It stands clear of the floor, can be swept clean underneath, and there is nothing to hold the dirt.

KERNER-GREENWOOD & CO.
(Stand 33, Row C.)

One of the most interesting exhibits of the show will be found at Stand No. 33, Row C — Pudlo — "the powder which makes cement waterproof," the sole makers of which are Messrs. Kerner-Greenwood & Co., King's Lynn. Pudlo is being used with very great success all over the world for flat roofs, damp walls, flooded basements (including stokeholes and garage pits), leaking tanks, reservoirs and swimming baths, concrete blocks, and preventing efflorescence in cement work. At this stand will be seen models made of actual building bricks rendered with Pudloed cement upon which jets of water are continually spraying. Visitors are able to see the interior of the models showing that (in spite of the drastic test of water playing on it) the interior of the model is bone-dry. There is also a model of a flat roof with the gutters in the parapet stopped up. This roof is filled with water, and here again the interior is open to view, and anyone who cares to examine it will find that both the ceilings and walls are dry. Anyone interested in damp-proof cement and concrete work will be well advised to inspect these and other models which are shown. A noticeable point is the ease with which Pudlo can be mixed. Being a powder, it is simply sifted with the cement, after which the sand and water are added. The average quantity required is about 3 lb. to every 100 lb. of cement, so that assuming that a builder was using three of sand to one of cement he would only require 3 lb. of Pudlo to every 400 lb. of mixture. A fine finish and texture in cement mouldings and renderings is obtained when Pudlo is used, the arrises being more pronounced and the work more dense and stone-like. Builders who use Pudlo say that it makes the cement work up smoother and more plastic even when 1 or 2 per cent of Pudlo is used. In pointing the amount of Pudlo required is very small, for pointing means little material plus much labour. The water tank illustrated herewith is a new tower at High Wycombe. This construction leaked rather badly, and although it was rendered inside with cement and sand about 1 in. thick it still leaked. It was then re-rendered with cement, sand and Pudlo, and a cure was effected. Pudlo has been largely shipped abroad, the makers having had large orders from Canada, Australia, South Africa, and supplied several parcels to the Indian Government and the Indian native princes, including the Gackwar of Baroda. We understand that during the show the makers are offering a special discount off their maintained prices so that everybody may have a chance of trying Pudlo on terms considerably under the ordinary selling price.

Water Tank at High Wycombe to which "Pudlo" has been Applied.

CAKEBREAD, ROBEY & CO.
(Stand 43, Row C.)

Drain machines and drain rods, fitted with either ordinary interchangeable or lockfast patent brass joints, are exhibited by Messrs. Cakebread, Robey & Co., Caroba Works, Wood Green, London, N. The stand includes drain and sweeps' cleaning machinery of every description, and other noteworthy items are the "Standard," "Eclipse," and other smoke test machines, drain-testing plugs, drain-testing bags, smoke rockets, clearing obstacle rods, and Sutton's patent lead collars for closet connections.

JOHN TANN, LIMITED.
(Stand 46, Row C.)

"Anchor Reliance" safes, doors, and locks claim attention at the stand of Messrs. John Tann, Limited, 117 Newgate-street, E.C., and Reliance Works, St. Stephen's-road, Old Ford-road, London, E. Party-wall and warehouse doors, to meet the requirements of the London County Council and the Fire Offices Committee, are a speciality of the firm which should not be overlooked by visitors to the exhibition.

A. HART.
(Stand 51, Row D.)

A variety of drain-clearing tools are shown by Mr. H. Hart, 29 Settles-street, Commercial-road, London, E., the appliances including rods fitted either with

ordinary brass joints or locking joints, with swivel collar. There are, in addition, steel cable drain rods, chimney-sweeping machines, smoke testing sets, expanding drain stoppers, "Ferret" spring drain cleaners, "Avecta" and drain-pipe cleansers.

GEORGE M. CALLENDER & CO., LIMITED.

(Stand 64, Row D.)

Messrs. George M. Callender & Co., Limited, 25 Victoria-street, London, S.W., show an interesting example of a reservoir rendered watertight with Callender's sheeting. This illustrates the original system of permanently waterproofing constructions, such as reservoirs, tanks, ponds, swimming baths, basements, sub-chambers, &c., by means of the sheeting invented by them nearly forty years ago. In the centre of the tank is a column of loose, porous bricks, under the top course of which, just above water level, is inserted a small piece of "Callendrite" dampcourse. Special notice should be taken of the dry bricks above the dampcourse. "Callendrite" dampcourse is supplied in rolls 24 ft. long, cut to suit usual wall widths up to 36 in. Callender's "Ledkore" lead and bitumen dampcourse, which forms a part of the exhibit, is composed of a core of sheet lead with a special bitumen covering both sides. It contains no coal-tar or pitch, and is recommended as an ideal dampcourse for all climates and purposes. A model shows the application of "Protex" to a brick surface which has afterwards been partly rendered with plaster, while another portion is covered with wall paper. The water jets playing on the back of the model practically demonstrate the effectiveness of "Protex" as a damp-resister. Another model shows the application "Bitubond" to a cavity wall. Poured hot into cavities formed by two brick or stone walls, "Bitubond" searches and fills every interstice in the inner wall faces, rendering the wall impervious, non-conducting, sound and temperature proof. It is stated to have enormous tensile and crushing strength, and to add considerably to the strength of walls to which it is applied.

ASPINALL'S ENAMEL, LIMITED.

(Stand 88A, Row E.)

This exhibit is in the form of an artistically arranged stand in white and pale green, finished entirely inside and out with Sanalene gloss and flat enamel. Various examples are shown of this high-class enamel, which will appeal to the practical decorator on account of its perfect finish, easy flow, and durability. In addition to Sanalene, Aspinall's are also showing examples of work done with their Special enamel, a high-class enamel paint at a moderate price, which, although recently introduced, is already in large and increasing demand, both at home and abroad. Other materials exhibited include their bath enamel, Wapicti, a washable distemper, sanitary paint, a glossy paint for indoor or outdoor work, and aluminium paint. Aspinall's Enamel, Limited, have standardised a colour card comprising sixty shades, for their Sanalene and special enamels, and sanitary paint, and this has been greatly appreciated by architects and builders. Colour cards and explanatory literature can be obtained at the stand.

VULCANITE, LIMITED.

(Stand 105, Row E.)

Models illustrate the application of the patent vulcanite roofing and Rexilite roofing of Vulcanite, Limited, 118 Cannon-street, London, E.C., and Belfast, Manchester, and Newcastle-on-Tyne. Bitumen bridge asphalt and standard asphalt for cavity walls are other productions of the firm which are being brought to the notice of visitors, in addition to Rexilite roofing, vulcanite sheet asphaltes for roofing and dampcourse, leatherite felts, vulcanite bitumen and vulcanite waterproof sheetings, "Reliance" brand of lead and bitumen dampcourse, "Bituna" brand of pure bitumen dampcourse, and "Mailon" non-inflammable bitumen solution.

RONUK, LIMITED.

(Stand 116, Row F.)

The exhibit of Ronuk, Limited, Portslade, Sussex, is designed to illustrate in a practical manner the advantages to be gained by the use of "Ronuk" sanitary polish in the treatment of woodwork of every description, and the superiority of the results as compared with those obtained by ordinary wax polishes. The stand is constructed entirely of oak, including the four handsome columns supporting the cornice and ceiling beams. One side only is closed, and is filled in with oak panelling. The remaining three sides are open, and it is thus possible to see the effect of the "Ronuk" treatment on the oak block flooring, which is fully exposed to view. The whole of the woodwork has been prepared and polished with "Ronuk" by trained workmen of the company's polishing contract department. Specimens of the company's manufactures are shown, with panels of various kinds of wood prepared to show the effect of different methods of treatment. The "Ronuk" patent floor polishing brushes and "Ronuk" steel shavings and wool for rubbing down floors are also exhibited.

ASSOCIATED PORTLAND CEMENT MANUFACTURERS (1900), LIMITED.

(Stand 120, Row F.)

Samples of the above-named company's well-known brands of Portland cement, including "J. B. White & Brothers," "Hilton Anderson & Co.," Francis' "Nine Elms," Knight, Bevan & Sturge's "Pyramid," "Anchor," "Burham," "London Portland," "Gillingham," Gibbs' "Diamond," "Eddystone," "Tingeys," "Vectis," "Robins," and their special "Ferrocrete" brand for reinforced-concrete construction, claim attention at this stand. It will be recalled that in 1900 the company acquired the works and businesses belonging to no fewer than twenty-two firms. The various properties owned by the company in the valleys of the Thames and Medway alone cover 4,000 acres. The river frontages, with their extensive docks and wharves, are more than 9 miles in length, and a fleet of over 200 vessels (steam tugs, lighters and barges) owned by the company is daily employed for the transport of materials and products to and from the various works. Several of the works have equal facilities for delivery by rail and water. The cask-making machinery at the company's cooperages is capable of turning out over 3,500,000 barrels a year, chiefly for export, the greater part of the cement for the home trade being supplied in sacks. At the numerous factories every approved method of mixing the raw materials and burning and grinding the cement are in operation, and experiments are being continually made to test any new process which may lead to improvement in quality. The largest of the company's works on the Thames are situated at Swanscombe, Northfleet and Grays, and on the Medway at Rochester, Halling and Burham. The annual productive capacity of all the works approaches 1,500,000 tons. The works at Swanscombe, Northfleet and Burham are the largest and most up-to-date in Europe, the manufacture being carried on by means of the rotary kiln process. The whole of the sales, finance and general organisation are controlled from the London offices at Portland House, Lloyd's-avenue, Fenchurch-street, E.C.

MOULE'S PATENT EARTH CLOSET COMPANY, LIMITED.

(Stand 122, Row F.)

A new departure in earth-closet construction, shown by Moule's Patent Earth Closet Company, Limited, 2 Guilford-street, Gray's Inn-road, London, W.C., is the "Pull-Out" Pedestal A. Every part but the hopper of unused earth is open to light and air. The closets are strong, and, being very compact, may be placed in chambers of small size. The seats and casing of hoppers are of varnished teak. The Pedestal B type is fitted with pull-up action apparatus. The plug is of large size, brass, in heavy brass sunk dish. The rim beneath the seat is of enamelled iron. A collection of models illustrate the company's system.

WM. HARLAND & SON.

(Stand 143, Row G.)

This stand represents a pavilion in the Renaissance style, with a projecting portico and Ionic columns. The exterior is treated with Harlands' sanitary flat enamel, and the columns are finished with Harlands' Snowite glossy enamel. Passing through the entrance, the visitor stands in a stately hall, with a domed roof representing the heavens. The decorative scheme here is a light biscuit colour, relieved with a soft blue, intermixed with white. Harlands' sanitary flat enamel is the material used, giving the soft and harmonious effect so essential in high-class decoration. This enamel has a dead flat finish, and can be scrubbed in the same way as ordinary paint work, while it may be applied to any interior decoration where paint and distemper are suitable. Placed round the

hall are several grilles finished with Harlands' silverine paint, which seems admirably adapted to the ornamentation of metal work in buildings. An attractive panel faces the entrance, embellished with the Royal Coat of Arms, and the Arms of various Colonies are portrayed in the spandril panels around. On the left the visitor may enter a room designed with panelling showing Harlands' grey glossite enamel, hand-polished, the filling, frieze and enriched ceiling being treated with Harlands' sanitary flat enamel of a lighter tone. A large projecting chimney breast, coated with Harlands' antique oak stain, and finished with Harlands' flatting varnish, shows how a solid and dignified effect may be obtained at a very small cost. A number of panels are arranged around the stand, representing Harlands' various specialities for the use of the painter and decorator. The whole of the decorative work on this stand has been prepared and filled up with Harlands' undercoating "Harlania," a new material combining the advantages of a paint film and a wood filler. Messrs. Harland and Son's works are at Merton, Surrey.

UNITED STONE FIRMS, LIMITED.
(Stand 147, Row G.)

All the stone and granite exhibited at the stand of the United Stone Firms, Limited, whose head office it as 2 Bristol Chambers, Nicholas-street, Bristol, are natural materials, obtained from the firm's own extensive quarries, and prepared at their own works. Most of the exhibits are actual portions of important works in progress in all parts of the country, and comprise the following: Portland stone from the firm's new quarries; Bath stone, of the Box Ground and Corsham Down series; grey Forest of Dean stone; blue Forest of Dean stone; blue Bristol pennant stone from the Fishponds and Stapleton districts; red Wilderness stone; Nailsworth stone, a new material in great demand; Ham Hill stone from the durable deep beds; Cornish granite from the celebrated De Lank quarries, and Dartmoor granite from the Merrivale quarries, near Tavistock. They provide the most beautiful range of stone and granite obtainable for architectural and engineering purposes; in fact, for every requirement and any atmosphere and climate. The quarries from which all these materials are gotten are extensively developed and equipped with all the latest and most modern machinery, so that any quantities and sizes can be obtained and prepared with promptitude. The firm have large works in all the quarry districts, also at Crown Wharf, Lots-road, Chelsea, and Stewart's-road, Battersea, for London trade. Surveyors' materials are exhibited at a separate stand—No. 16A Bay, in the gallery.

R. GAY & CO., LIMITED.
(Stand 148, Row G.)

A model paint factory plant, and a general exhibit of enamels and paints, have been placed on view by Messrs. R. Gay & Co., Limited, of Langthorne Works, Stratford Market, E., and Caxton House, Westminster, London, S.W.

PINCHIN, JOHNSON & CO., LIMITED.
(Stand 150, Row G.)

One of the most elaborate stands in the exhibition is that of Messrs. Pinchin, Johnson & Co., Limited, Minerva House, Bevis Marks, London, E.C. The Temple of Minerva—as it is called—consists of four sets of double columns, supporting a circular entablature and dome, the whole being surmounted by a choicely designed cupola. It is entirely finished with satinette enamel—gloss white and flat white—with the exception of the dome, which is gilt. A critical examination of the columns will, the firm suggest, convince the expert that there is justification for claiming that satinette enamel finishes like choice china—a perfectly white, smooth, and lustrous surface. It is further illustrated upon a panelled section of wall and a door, where the charming contrast of gloss white and flat white is revealed to considerable advantage.

JOHN JONES (CHELSEA), LIMITED.
(Stand 155, Row G.)

Messrs. John Jones (Chelsea), Limited, Carlyle Works, Chelsea, London, S.W., have arranged an attractive exhibit of their sanitary fittings, these including "Imperial" and "Ideal" bath-room and water-closet suites and lavatories of various types, to mention but a few of their productions.

EXPANDED METAL COMPANY, LIMITED.
(Stand 157, Row G.)

Examples of expanded steel sheet and bar reinforcement in footings, columns, flooring, roofing, and walling, expanded metal lathing and plaster ceilings, partitions, and encasing, "Exmet" brickwork reinforcement in brick structures find a place on the stand of the Expanded Metal Company, Limited, of York Mansion, York-street, Westminster, S.W., and West Hartlepool. Expanded metal, as manufactured by the Expanded Metal Company, Limited, has now been in successful and extensive use all over the world for some twenty years past. It is made from sheets of rolled metal of various thicknesses cut and expanded by machinery into meshes of various shapes, each of which is made in several strengths or weights, and all have their own catalogue number for billing purposes. The ¼-in. ⅜-in. and 7/16-in. mesh lathings, which are made from sheets of rolled steel, are particularly adapted to form a key for plaster in ceilings, steel work encasing, solid and hollow partitions, exterior walls, and other plaster work. Expanded steel sheets in their various meshes and weights, which are also made from sheets of rolled steel, are specially suitable as reinforcement for concrete in foundations, walls, floors, roofs, arches, bridges, grain silos, coal pockets, tanks, reservoirs, dams, retaining walls, piers, abutments, pipes, sewers, conduits, &c., a few weights of the 1½-in. and 6-in. diamond meshes being occasionally used for such work. The lighter weights of the ¾-in. and 1½-in. diamond meshes are frequently used in concrete for encasing steel work. Expanded steel bars in their various sections are suitable as reinforcement for concrete in both cast articles and structural work.

BELL'S UNITED ASBESTOS COMPANY, LIMITED.
(Stand 168, Row H.)

This exhibit shows the various products of Bell's United Asbestos Company's Poilite Works at Harefield, Middlesex, the first to be equipped in Great Britain for the manufacture of asbestos cement roofing tiles and building sheets, on the revocation of the British Patent No. 6455/22139 in 1909. Poilite is composed of two indestructible and everlasting materials, three-fourths being the best English Portland cement, and the balance consisting of selected asbestos fibre, winnowed free from all impurities. The works are equipped with the most modern machinery, and have a capacity for producing 5,000,000 sq. yds. of Poilite tiles and sheets per annum, the finished product being many times stronger than the same bulk of pure cement. The attractive building forming the company's exhibit shows the application of this fireproof material for roofing purposes and for wall and ceiling linings, and the staircases will permit of visitors making a close inspection of the method by which the tiles are secured to roof, boards or battens in their various patterns: "Poilite" standard roofing tiles, for fixing in the diagonal or Poilite method; "Poilite" asbestos cement building sheets; "Roman Roofing Tiles" (Poilite brand), an alternative to corrugated-iron sheets for large plain roofs of 25 deg. pitch and upwards. An opportunity will also be afforded to visitors of witnessing tests, illustrating the relative values of tiles of standard thickness as against those of thinner quality.

SHARP, JONES & CO.
(Stand 171, Row H.)

The rock-concrete sewer tubes which Messrs. Sharp, Jones & Co., Parkstone, Dorset, manufacture in sizes varying between 12 in. and 48 in. diameter, and exhibit at the above stand, will be of interest to municipal engineering visitors. For nearly forty years these tubes have been in use for sewers and for culverts under railways and roads. The larger sizes are also used, either horizontally or vertically, for water tanks, cesspits, and septic tanks. The firm's rock-concrete manholes with patent "Aquatite" base, comprising benching, channelling, and sewer connections, are also to be seen. These "Aquatite" bases are made to suit the varying conditions of the manholes in a sewerage scheme. They are claimed to present many advantages over *in situ* work, and are especially useful in water-logged ground. Other exhibits of interest are the rock-concrete road gully, salt-glazed stoneware pipes, made from the genuine stoneware clays of the Poole beds, and rock-concrete roofing tiles. These tiles do not require nails, and the double interlocking arrangement gives rigidity to the roof. They weigh only 7 cwts. a square, can

be laid at any pitch, and, being non-conducting; they preserve an equable temperature in a building.

RICHARD JOHNSON, CLAPHAM & MORRIS, LIMITED.

(Stand 173, Row H.)

On the large stand occupied by Messrs. Richard Johnson, Clapham & Morris, Limited, 24 and 26 Lever-street, Manchester, are displayed this firm's "Lattice" and "Keedon" system of reinforced concrete construction, and their "Bricktor" system of reinforced brickwork. Samples of "steel wire lattice," as supplied for the construction of reinforced concrete floors in well-known local buildings, are also exhibited. The attention of visitors is specially directed to an improved type of lattice, in which the wires where they cross are securely fixed together by a special form of link. 26,000 yds. of this material are at present being used in the construction of the new No. 8 dock transit sheds for the Manchester Ship Canal Company. The advantages claimed for steel wire lattice for concrete floors are the ease with which it can be handled and fixed, the continuity of bond (the material being made up to 200-ft. lengths), and its low cost. The wire used in its construction is of special strength, thus allowing of a minimum depth of slab being adopted, and saving space and dead weight of concrete. The system of reinforced brickwork is well displayed, and examples of walls built upon this principle are exhibited. In order to demonstrate the lateral strength imparted to brickwork by the insertion of this reinforcement, a heavily loaded test wall in the form of a slab supported horizontally has been erected on the stand.

THE (U.K.) WINGET CONCRETE MACHINE COMPANY, LIMITED.

(Stand 184A, Row H.)

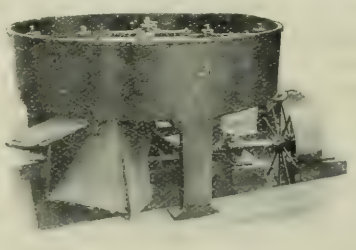
The (U.K.) Winget Concrete Machine Company, Limited, of 11 Star Buildings, Newcastle-on-Tyne, on a stand specially devoted to this tool, exhibit the Lumsden wood trimmer. A trimmer is, perhaps (after a morticing machine), a hand-operated woodworking machine which cannot be dispensed with in the workshops of joiners, cabinet makers and pattern makers in these times of exact and speedy work. The Lumsden hand trimmer is claimed to be the most perfect of its class, being constructed and finished in the best style of mechanical engineering work. It has many distinctive features, such

Lumsden Wood Trimmer.

as: Constant draw cut motion; vertical rising fence; adjustment on its vertical axis, so that it can be slewed round to any position in workshop; extremely adjustable length gauges, and no loose attachment to become misplaced or lost. The steady draw cut motion is always done by a pull, and is arranged so that it enables the operator always to do his work from one end of the machine, whichever fence is being used. Perhaps the most distinctive and useful improvement is the provision of a rising and falling adjustable fence on the table, which allows the piece of timber to be tilted, thus getting a cut at an angle. Thus two-bevel cuts may be made, a feature specially valuable to the pattern maker. The angles for cuts in every-day use are marked on the bed-plate.

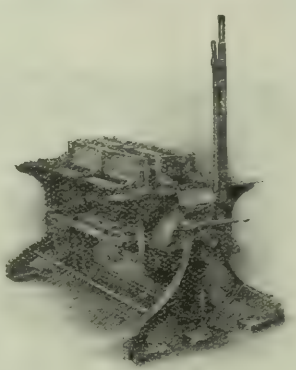
(Stand 193, Row J.)

The (U.K.) Winget Concrete Machine Company in 1911 had a double stand for the display of their concrete machinery, but on this occasion they occupy a still larger space. They are showing concrete block-making machines of various types, and hand and power concrete-mixing machines along with small accessories required in handling concrete. The office on the stand is built with "Winget" concrete blocks, and indicates how well they may be adapted for the erection of artistic buildings. The comprehensive dis-



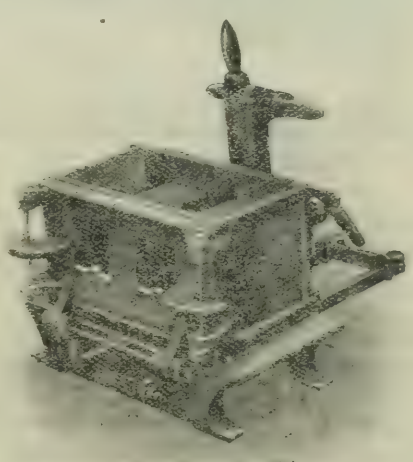
"Express" Concrete Mixer.

play of photographs of buildings of all kinds erected in all parts of the world shows how the use of "Winget" machines for the production of concrete blocks is taking a firm hold where either skilled or unskilled labour is available. The exhibit comprises a "Winget" concrete block-making machine in operation, making hollow and solid building blocks of a



"Winget" Concrete Block-making Machine.

maximum size of 32 in. by 16 in. by 9 in., of which size blocks as many as 500 per ten-hours' day have been made on this machine. A small and inexpensive block-making machine called the "Titan" is also shown. This makes hollow or solid blocks, 16 in. by 9 in. by 9 in., of plain or patterned face, there being



"Titan" Block-making Machine.

four of the latter available. This machine makes quoins or returns, half and quarter closers, and 16 in. by 9 in. by 4¾ in. blocks for partitions and cavity walls. It is an exceedingly handy machine, and can be operated by a man and a boy. The hollow blocks may have either 4-in. or 2-in. cores; like the

"Winget" it is portable, and no power is required. The "Express" concrete mixer is also shown in operation. It is a power mixer, and mixes concrete dry, semi-dry, semi-wet, stiff, plastic or sloppy at will, and is being largely used for concrete-block work and reinforced-concrete work. For the hand-power mixing of concrete the "Winget" hand mixer is shown. This machine has a capacity of 2 cub. ft. per batch (a barrowful), and is easily operated by one man.

BRITISH CERESIT WATERPROOFING COMPANY, LIMITED.

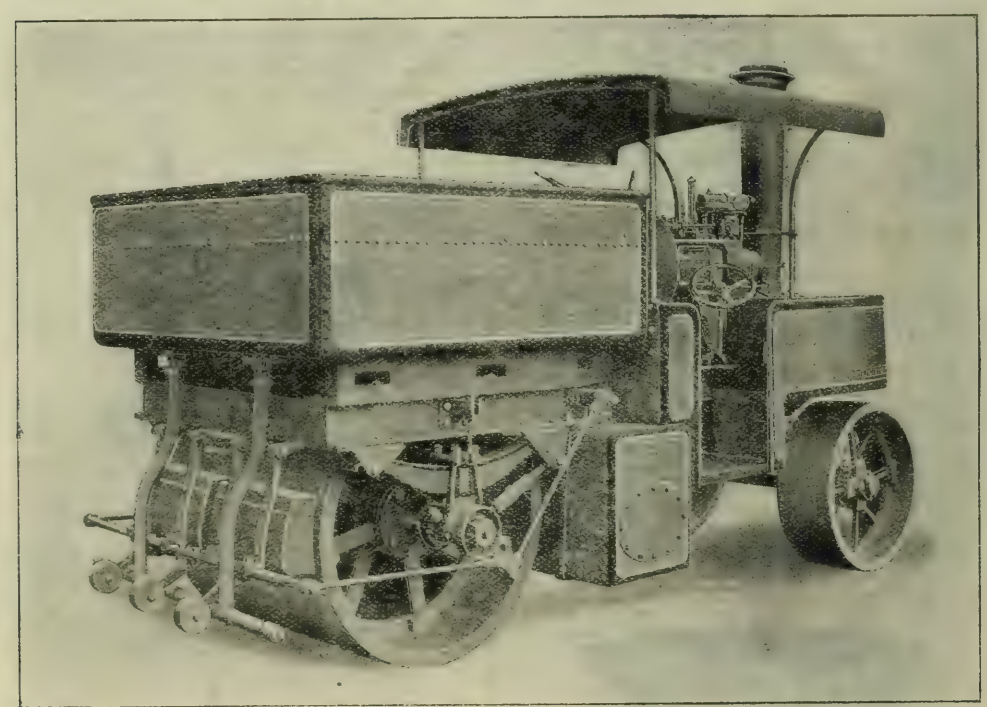
(Stand 210, Row J.)

"Ceresit" is a light-coloured paste of about the consistency of butter, which, when dissolved in water and thoroughly mixed with cement-mortar, will, it is claimed by the above-named firm, whose business address is 68, Victoria-street, London, S.W., render it impervious to water, even under highest pressure. A model house serves at the company's stand at the exhibition to illustrate the use of the material. In addition to preventing cement perishing during periods of extreme cold, "Ceresit" is stated to be a preventative of fungus and sweating, and as it does not colour the cement-mortar, it can be employed as a waterproof facing. Other advantages claimed for it are that it adheres to old brick or concrete walls, and can be painted soon after it is dry.

RANSOME-VERMEHR MACHINERY COMPANY, LIMITED.

(Stands 218 and 219, Row K.)

This company's exhibit comprises a variety of machines of particular interest to builders, contractors, and municipal authorities in any way interested in constructional work of all kinds. The machines shown include the No. 0. Ransome stone dryer, which has a capacity of 50 cub. yds. per day. This machine will be of special interest, as it embraces an entirely unique principle of drying stone for making tar-macadam. The machine is arranged in such a way that a batch of stone can be thoroughly dried every three minutes, and is capable of dealing with any size of stone, from the finest up to the largest ever used for road metalling. It is interesting to note that these machines can be supplied with tar-macadam mixer mounted on the same underframe, thus forming a complete portable unit. The company are exhibiting a number of their concrete mixers of different sizes, including a No. 0. mixer with direct-coupled petrol engine and elevating hopper. This is a type of particular interest, as large numbers are at the present time being used for street construction. The machine, as shown, is exactly similar to the one recently supplied to the Bradford Corporation for street work. In addition to other power machines the company's compact hand mixer with charging skip and automatic water tank, is also shown. Sections of type D steel piling are shown, and should be inspected, as this type of piling has been designed to combine a maximum strength with a minimum weight of material. Thousands of tons are at the present time in use on various contracts, including the Rosyth Naval Base, the new Port of London Dock improvements, and the new Smith's dock at South Bank. The section is extremely easy to drive, can be withdrawn and used repeatedly, and, moreover, is watertight when in position without caulking or clay puddle. An entirely new departure in the method of withdrawing piles on an economical basis is represented by the Ransome extractor, which is included in the exhibits at this stand. Readers are reminded that at Bay 26, in THE SURVEYOR section in the gallery, the company show a working model of the new Ransome continuous filter, reference to which was made in last week's issue.



MANN'S STEAM PATCHING ROLLER.

MANN'S PATENT STEAM CART AND WAGON COMPANY, LIMITED.

(Stand 228, Row K.)

Surveyors should not miss the exhibit of Mann's Patent Steam Cart and Wagon Company, Limited, Pepper-road Works, Hunslet, Leeds, and Fenchurch-avenue, London, E.C. The firm's steam patching roller is being extensively used for patching, trench rolling, and resurfacing roads with tar-macadam where an even distribution of weight is required over the whole surface. The machine is provided with a compound engine mounted on top of a locomotive type boiler, and has the firm's patent reversing gear to give a rapid action, and so permit of quick reversing and a rapid consolidation whenever rolling small patches. The body above the hind roller is fitted with a tank in the front end of it, and the rear portion is available for the conveyance of road materials, so that the machine is a complete repair outfit in itself. These machines are also built so that the rollers can be removed and replaced by road wheels, thus converting the machine into a steam wagon, and

the body can then be replaced by a water tank containing 1,000 gallons for road watering; thus the machine need never be idle, being capable of hauling and rolling or street watering, according to the season of the year. They are built in varying weights, from 5 tons to 10 tons, and have now been adopted by a large number of local authorities at home and abroad. The engine at the exhibition has been built to the order of the Metropolitan Borough of Lambeth, and a similar machine is now on order for another London borough, East Ham, both of these authorities having carefully noted the work done by similar machines in and near London. Sometimes where a dock or stream is easy of access a centrifugal pump is fitted for filling the tank, this being the case with machines supplied to Portsmouth Corporation and for some of the Indian municipalities.

BARFORD & PERKINS, LIMITED

(Stand 225, Row K.)

The above well-known Peterborough firm exhibit their patent water-ballast motor road roller, new size E.3 S., weight empty 6¾ tons, weight full 8¾ tons approximate. The machine is fitted with water tank and sprayers to both front and back roller cylinders. This roller is specially adapted for tar-macadam road repairs and patching. Their larger size roller, No. G., which is also shown, has a weight when empty of 10 tons, of approximately 11 tons filled.

CAKEBREAD, ROBEY & CO.

(Stand 231, Row K.)

The fine display of Cakebread, Robey & Co., Caroba Works, Wood Green, London, N., at Stand 231, includes porcelain enamel baths, lavatory sets and sanitary ware, in extra hard and durable porcelain; modern designs in mantel suites, mantels in hard and white woods and special hearth fires. Locks and latches with furniture; door, sash and casement fittings in brass, gun metal, bronze, copper, oxidised silver and other metals; reproductions from antique models of hinges, latches, &c., in malleable and wrought iron; sanitary and plumbers' brass work in nickel-plated and other finishes, are also to be seen here.

"THE SURVEYOR" SECTION.

Notices are appended of a number of exhibits in The Surveyor section which we were prevented from dealing with in last week's issue, and of some few others in regard to which we desire to supplement the particulars already given.

ANGLO-MEXICAN PETROLEUM PRODUCTS COMPANY, LIMITED.

(Bay 9.)

An admirably produced booklet which is being issued by the Anglo-Mexican Petroleum Products Company, Limited, Finsbury-court, Finsbury-pavement, London, E.C.—a view of whose stand in The Surveyor section is reproduced herewith—should be read by all who desire to obtain particulars of "Fluxphalte" and "Mexphalte," the two well-known products prepared from Mexican bitumen for road purposes. "Fluxphalte," which is the more fluid of these materials, is marketed especially for road spraying as a dressing and binder, and contains over 60 per cent of pure bitumen. "Mexphalte" is a solid bitumen, particularly adapted for city roads and pavements, and is practically 100 per cent pure bitumen. We have no doubt that visitors to the exhibition will gladly be supplied with copies of the booklet on application to the company's representative at Olympia.

Anglo-Mexican Petroleum Products Company's Stand in "The Surveyor" Section.

LONDON ENGINEERING COMPANY, LIMITED.

(Bay 16A.)

The London Engineering Company, Limited, 7 Victoria-street, Westminster, are showing their "Jointing Mastic," which is claimed to be a perfect substitute for red or white lead. This material is, we understand, extensively used by Government departments as well as the principal corporations; also railways, gas companies and engineering firms. Jointing Mastic, apart from its cheapness and efficiency, has the distinct advantage of being non-poisonous.

ROCMAC, LIMITED.

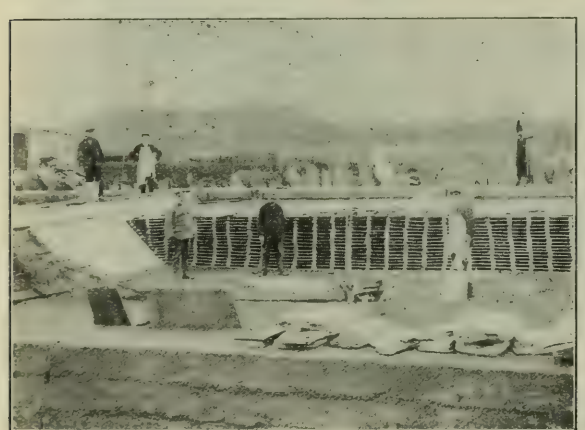
(Bay 25.)

In our last issue we were able only to make mere mention of the fact that this company had an im-

portant exhibit in The Surveyor section in the gallery. Supplementing this notice we would now add that the well-known "Rocmac" is a waterproof binder for macadam, and that the three main points which, it is claimed, differentiate it from other waterproof binders are: (1) The vastly important consideration that it can be laid in any weather; (2) it affords a good foothold for horses in any weather or on any gradient, and (3) it binds granite as well as tar or bituminous binders bind softer or more porous material. The binder itself is a silico-saccharate-carbonate, and is formed by the combination of "Rocmac" solution with carbonate of lime. As to price, its first cost may be from 20 per cent to 40 per cent more than that of a water-bound macadam road laid with the same aggregate; but, on the other hand, when used it doubles or even trebles the life of the aggregate bound with it. Moreover, it can be bound as easily as a water-bound road, and its cost of maintenance is very low. That its merits have been appreciated is shown by its use in this country by at least thirty county councils, considerably over 100 municipal corporations, a great number of urban and rural authorities, and most of the principal railway companies. Abroad its use is proportionately extensive, as it is unaffected by climatic changes. The company's conspicuous exhibit in Bay 25 is in the care of Mr. Leonard Cooper, whose ever-genial courtesy is only surpassed by his expert experience of road-engineering materials in general—and "Rocmac" in particular.

DIBDIN'S BIOLOGICAL SLATE BEDS.
(Stand 2, Row B.)

At this stand are shown a large number of photographs of sewage purification works, which include Dibdin's slate beds, among these being the Faversham works, the new works at Harpenden, and those at the Curragh Camp. This system has been in successful operation for over ten years, and photographs are shown of works such as adopted by the War Office, the Home Office, and H.M. Office of Works. Samples of mud taken from the slate beds in various towns are exhibited, these showing the marvellously numerous and active little worms which play such an important part in the destruction and purification of the solid matters in sewage. In this system these are deposited upon the mud supported by the slates while the sewage is standing in the beds, and rise to the surface of the mud for a fresh supply of oxygen after the effluent has been drawn off, and while the beds are resting full of air. It will be remembered that the self-cleansing properties of slate beds are almost entirely due to the activities of these worms, which throw up the broken-down residue from the digested organic matter from the lower portions of the mud deposits in the form of worm casts which are washed out from the beds with the effluent, thus maintaining the normal depth of about ¼ in. on each slate. The various kinds of organisms of a microscopic character can also be seen on the stand under the microscopes provided. Sections of full-size slate filling as built in works are erected, showing various spaces between the slates for use for different kinds of sewage and varying conditions of flow, and ringed slates are shown for use in works where stale or slowly flowing sewage is arriving at the works, and in collecting chambers for small schemes. These rings are fixed on the under sides of the slates, and trap air as the beds fill, thus keeping the effluent well aërated while the beds are slowly filling. A method of slate filling for storage reservoirs and for the lower portions of storm-water beds is shown. In this the upper layers of slate are laid in furrows formed by stepping the slates up to ridges, so that solid matters depositing on the surface will not form a continuous layer, but will be broken up into sections, and be washed by the flow of the water into the slate filling. Particulars are also given of numerous schemes for country houses and public institutions, these indicating various arrangements and designs for dealing with the peculiar circumstances of each case.



Slate Filling, Curragh Camp, Ireland

ECONOMIC FENCING COMPANY, LIMITED.
(Stand 3, Row B.)

"Peignon" chestnut pale fencing calls for attention at this stand. The Economic Fencing Company, Limited, of Billiter House, Billiter-street, London, E.C., announce that they have further extended their works, and are now in a position to complete orders of from 500 yds. to 1,000 yds. and upwards in about ten days from the receipt of order, when necessary. The fencing is machine-made, in rolls of 5½ yds., and it is claimed to have the life of an oak fence. The piles are hand-split with the grain from hard Spanish chestnut wood, bound together (by machinery) with galvanised strand made of four wires, each about ⅛ in. circumference, thus dispensing with cross-bars, also with bolts, nuts, wedges, and nails. The strainers and struts are oak, and the intermediates chestnut. The fencing can be supplied unclimbable. For hunting districts, square-topped pales without points are often preferred, and can be supplied without extra charge if specified at time of ordering.

WILLIAM E. FARRER, LIMITED.
(Stand 5, Row B.)

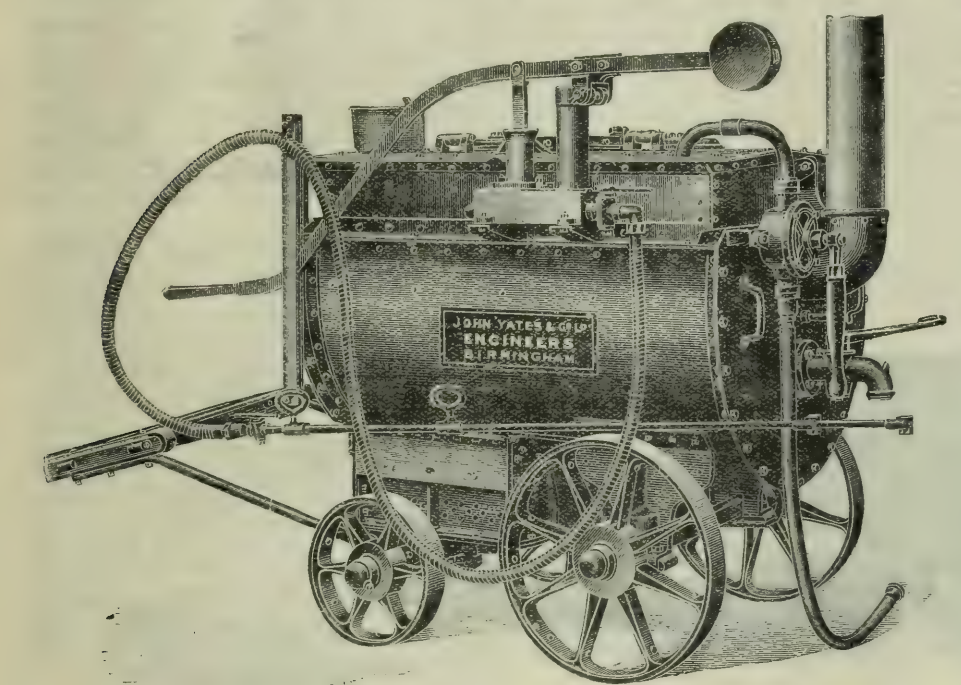
As usual, Messrs. William E. Farrer, of Birmingham, are showing two distributors at work. The articles are the actual apparatus, such as would be supplied to a scheme of proportionate dimensions, and are not specially prepared in any way whatever for exhibition. The primary exhibit is one of their improved rotary sewage distributors, "P" type, arranged to take a varying flow at varying heads. Compensating arms are provided to deal with the various fluctuations, and these are readily arranged to suit the local conditions. They are adapted for either continuous flow schemes, or may be arranged for dosing by means of an automatic syphon or intermitter. This distributor is made of heavy cast-iron, and includes an improved combination ball race accurately mounted on brass mounts and working in an oil bath. The arms are of heavy wrought-iron, and the ends are provided with heavy brass stop ends, having bayonet joints. Strong galvanised tie ropes and cross stays are provided, with Farrer's improved clips and straining eyes. The firm also show a sample set of their improved automatic distributor under working conditions, this being suitable for a bed 10 ft. long by 4 ft. wide. It comprises a strong, galvanised, double section tipping trough, mounted upon gunmetal bushed bearings, with combined buffers having phosphor bronze springs, and the liquid is discharged over the bed by means of converging chutes and distributing channels, as shown. The head necessary for this apparatus varies from 12 in. to 1 ft. 6 in., according to the size of the distributor, and the article is one which is stated to give a very good standard of equality of distribution. Messrs. Farrer also show the body of their patent "Facile" rotary sewage distributor, which is an exact counterpart of those supplied to so many schemes. The principal parts are of heavy cast-iron, and the arms would be of heavy wrought-iron welded tube. The ball race, which is of their improved combination type, may be readily got at, while all parts are readily accessible, inspection caps being provided wherever necessary for cleansing purposes. This exhibit is one which certainly merits the attention of municipal engineers and all interested in the carrying out of works of sewage disposal.

MATTHEW KEENAN & CO., LIMITED.
(Stand 10A, Row B.)

Messrs. Matthew Keenan & Co., Limited, of Armagh Works, Tredegar-road, Bow, E., and 80 Great Wellington-street, Glasgow, have, in the gallery, a comprehensive display of non-conducting coverings in every form, embracing "Keenan's" patent non-conducting composition, asbestos plastic compositions, asbestos mattresses, asbestos rope, sectional magnesia, sectional cork for hot and cold water pipes, refrigerating plants, &c., and their special light "Aero" and "Keenos" sectional coverings. Engineers and all those interested in steam plant will be well advised to visit this stand, where every opportunity will be afforded by the management to go thoroughly into the matter of using the most suitable form of covering, and to discuss all questions relating to heat insulation and non-conducting coverings.

E. & R. NORMAN.
(Stand 12, Row B.)

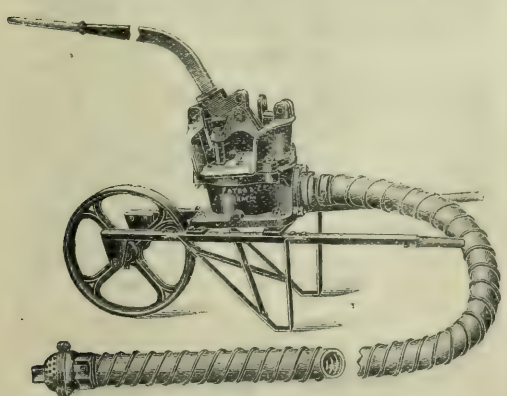
An interesting departure in saltglazed bricks is shown by Messrs. E. & R. Norman, Chailey Potteries Brick and Tile Works, South Common, Chailey, Lewes. These bricks are now being produced in blue and autumn green, the colours offering a pleasing variation to the ordinary brown, and permitting of a colour scheme being carried out entirely in saltglaze. This, it will be agreed, produces a better effect than when ordinary saltglazed bricks are used in conjunction with coloured enamel bricks. The glaze in these new colours, it is claimed, retains all the well-known qualities of durability, hardness, and resistance to atmospheric conditions of the ordinary brown saltglaze.



John Yates & Co.'s Tar-boiler, Fitted with Spraying Apparatus.

JOHN YATES & CO., LIMITED.
(Stand 15, Row B.)

We are able to give this week an illustration of the 80-gallon horizontal tar-boiler, fitted with spraying apparatus, which Messrs. John Yates & Co., Limited, Aston, Birmingham, are exhibiting in The Surveyor section. The machine, it may be pointed out, has self-oiling wheels for quick and easy traction, and to allow of full advantage being taken of the high capacity of the boiler. Another feature of their stand, to which reference was made in last week's issue, is the 3-in. diaphragm pump, the "Contractor," which can be seen in operation by visitors. This pump can be supplied fitted on a steel barrow complete with hose, foot valve, &c., at a remarkably low price.



John Yates & Co.'s Diaphragm Pump on Barrow.

A. E. PODMORE & CO.
(Stand 28, Row B.)

Messrs. A. E. Podmore & Co., 34 Charles-street, Hatton Garden, London, E.C., are well-known specialists in street lighting, the lighting of public buildings, warehouses, and shops, as well as in interior semi-indirect lighting, and their exhibit in the gallery is thoroughly deserving of inspection.

JOHN HUTCHINSON.
(Stand 28A, Row B.)

Surveyors will be interested to compare at this stand instruments and apparatus as used in the United States with those of British design. A Penetrometer, the invention of a metropolitan borough engineer (Mr. Francis Wood, Fulham), can be seen alongside the Ricardson Penetrometer from the New York Testing Laboratory. From the same laboratory the Viscosity Float Tester may be compared with Hutchinson's Tar Tester. Thermometers of all types and patterns, as used in tar and asphalt work, specific gravity apparatus for stone aggregates, as well as for tars, liquid asphalts and oils, melting and flash point testers are among the other exhibits.

LEYTON TIMBER COMPANY, LIMITED.
(Stand 42, Row B.)

The above firm of horticultural and rustic specialists, of New Cross, London, S.E., show a variety of their excellent productions, arches, flower stands, seats, and vases being among the goods exhibited.

REINFORCED CONCRETE FENCING FOR PUBLIC PARKS.

Tidnam's patent reinforced concrete posts have been used for fencing round the lake in the picturesque new park at Grovelands, Palmers Green, which was opened to the public on Saturday last. The posts are of York stone chippings and Portland cement-concrete, 5 ft. long and 5 in. square, and have a neat cap of ornamental design. Posts are placed 8 ft. 6 in. apart, but closer on sharp curves. They are reinforced with rib mesh expanded steel, supplied by the Expanded Metal Company, Limited, of London and West Hartlepool, bent into column form, and are very strong and durable.

For situations near water these posts are especially suitable, as they are impervious to rot or decay, and, indeed, it is claimed, become stronger with age. The posts carry a 1½-in. by 1½-in. square iron bar, set anglewise in the posts, the appearance of the fencing being very pleasing. The posts never vegetate, but retain the natural stone colour, and there is no

GROVELANDS PARK FENCING.

necessity to paint them, so that for all kinds of park or roadside fencing they provide a most economical fence.

The fencing has been carried out by Messrs. Tidnam & Co., concrete specialists, of Wisbech, from the designs and under the superintendence of Mr. C. Griffin Lawson, ASSOC.M.INST.C.E., the engineer and surveyor to the Southgate Urban District Council.

Housing at Morpeth.—The corporation of Morpeth owns a considerable amount of land in West Greens and Middle Greens, and in 1908 a commencement was made in the former area with the erection of ten self-contained cottages, at a cost of £1,521, and twenty houses in flats at a cost of £2,250, or £112 10s. per flat. In 1911 another lot of self-contained cottages were built at a cost of £1,450. Last year a commencement was made with an additional thirty-one self-contained houses in the West Greens and Middle Greens area, which are now nearing completion; and on some spare land near by two self-contained houses containing five rooms and a scullery, the former at a cost of £175 per house and the latter at a cost of £225 per house. The self-contained cottages have a living-room and scullery downstairs, and two bedrooms upstairs, with, of course, the usual yard and conveniences. The rent is 5s. per week inclusive. In the flats there are four rooms upstairs and three downstairs, with separate yards, and they are let at a rental of 3s. 9d. and 3s. 6d. per week respectively. In the later scheme the houses are a trifle larger owing to the money having been borrowed on more favourable terms. The rents are sufficient to repay the principal and interest on the loans, to pay local rates and taxes, and the cost of collecting the rents, leaving a balance of between £70 and £80 to cover the cost of repairs and other incidental charges.

THE STATUS OF ENGINEERS AND ENGINEERING.

A PRIZE ESSAY.

At a meeting of the Society of Engineers held on the 7th inst., Mr. William Ransom, ASSOC.M.INST.C.E., read his essay on "How to Improve the Status of Engineers and Engineering, with Special Reference to Consulting Engineers," which was awarded the second prize in the Status Prize Competition last year, no first prize having been awarded.

The author pointed out that the civilisation of to-day had become possible only because of the efforts of the engineer, but that the public did not sufficiently appreciate the advantages they had gained or the men whose work had secured those advantages. Engineers had many lessons to learn from the legal and medical professions, both of which excluded unqualified men and exercised a benevolent professional control over their members, and the State should recognise the engineering profession by giving it an official standing equal to that of other professions. The State should require engineering aspirants to pass a qualifying examination, and should give facilities to pupils and assistants for inspecting large engineering works.

Admission to the profession required to be carefully guarded, and the number of pupils allowed to an engineer should be regulated by the extent of his practice, while the climax of the period of pupilage should be a State examination. Much more might be done to make examinations of practical value to those who prepared for them, but no other form of test was possible. When State recognition was obtained for engineers, the members of the profession would constitute one great society, amalgamating the existing societies into one body, which should have the control of professional matters and be the mouthpiece of the profession. Such a society would necessarily have sub-sections dealing with special branches of the profession. While the growth of specialisation must be recognised, it was essential for those who were beginning their training for the profession to acquire a sound general scientific knowledge before they began to specialise.

The engineer should not be behind his brethren of the legal and medical professions in regard to professional conduct and etiquette, while the society that represents him should maintain a high standard of professional honour, and must have power to enforce its regulations. The State should fix a scale of minimum professional fees. Consulting engineers were comparatively few in number, and on that account the public placed a high value upon their services. They played an important part in forming public opinion on the profession, and the ideals they now placed before themselves would make their impress on the younger generation of engineers.

The tone of the profession could not be set by the professional societies, but every individual must live up to a high code of professional conduct. The public estimate of the profession was based, not on the conduct of the best members, but that of the average member, hence the importance of every engineer setting an example of lofty ideals before his staff, his clients, and the public.

Summer School of Town Planning.—As has been already announced, it has been decided that, in view of the success of the Summer School of Town Planning held at the Hampstead Garden Suburb in August last, a second school on similar lines will be held at the same centre this year from August 2nd to 16th inclusive. A representative committee is arranging the details of the programme; it will appeal especially to municipal architects, engineers, and surveyors, and will be of interest to all who are concerned in the scientific planning of towns and town extensions. Although it is still early in the year, a considerable number of students have signified their intention of attending the summer school, and it is probable that next August's meetings will be even more successful than those of last year. Arrangements are being made with a number of well-known authorities on the subject of town planning to give courses of lectures, and copies of the syllabus will be sent to all who are interested, on application to Mr. J. S. Rathbone, hon. secretary, Summer School of Town Planning, The Institute, Hampstead Garden Suburb, N.W.

Office Conversations.

MORE OR LESS IMAGINARY.

[*Contributed.*]

XI.—The Germ Theory: Precept and Practice.

No, doctor, I don't agree. Germs and bacilli and all those sort of things are much too elusive to be dealt with in such rough-and-ready fashion. Here'll be a scientist who'll tell us that some hundreds of thousands of millions can find seating accommodation on a square inch, and there'll be a medical officer of health—you'll excuse the personal reference—who feel he's done his complete duty when he pastes up the door and windows of a room and lights a couple of candles which give off carbon dioxide. Did you ever go into a room after such an operation? No? I thought not. Your inspector does, of course, and I suppose he's given you a true report of what he's seen. No? You never asked him to? The room fumigated, no useful purpose would be served? There again I differ, and I'll tell you why. You might make a note of the information. I *have* been in rooms after your inspector has opened them up, and I've seen, fully alive, scores of dear little flies on the ceiling, where they've been driven by the fumes of the gas. Nonsense? Nothing of the kind—I've seen it, I tell you. Must have been a very heavy gas and the work very badly done? That I can't go into. All I know is that the flies were quite brisk and cheerful, after having been sealed up for twenty-four hours in company with a deadly gas. If the flies survived, what about the germs? A fly won't stand boiling to 400 degrees Fahrenheit, you know!

* * * *

Yes, you're quite right. The sanitary work of the district is not my department—and I'm glad of it. I do escape a lot of the unpleasantness which always comes from treading on the corns of the small property owner, and I do escape coming into contact with infectious cases. Not that I should think there's the least danger in the latter, mind you. If a man keeps in decent condition, eats his fill (not an overfill ever) and drinks just in moderation, he needn't fear the most deadly germs. Yes, I do think so. Don't know anything about it? Well, I don't suppose I know very much; but answer me, how do you escape? You visit all manner of cases, after going direct from one to another, and I've never known you contract anything yet. You take precautions? You'll excuse me being so insistent, but what precautions? Come now, you called at Wenstead's this morning. There's scarlet fever there, and I saw you leave the house and go straight into Benstead's. No, don't get cross, doctor. It's only a friendly chat. Well—all right—I won't press the point, but——

* * * *

You'd like to know what I'd do if I had a free hand? Hum, it's difficult to say right off. Really, I've not so much faith in the germ theory as some people, and my precautions would amount to very little in the ordinary sense of the word. I was chatting the other day with a friend who's an analytical chemist. We touched upon the question of infection and all that, and he rather staggered me in one thing. I asked him how people could go about chokeful of deadly germs and yet be in perfect health, and he smiled and said that the deadliest germs were quite harmless so long as they themselves were in a healthy state. You don't follow me? Well, I didn't quite follow him, and I asked him for an illustration. Take the typhoid bacillus, he said. Now if the bacillus hasn't got typhoid, he's quite harmless—— Bosh? No, I don't think it's quite that, doctor. It's disquieting for the profession, I'll confess. No, my friend and I didn't carry the argument any further. The typhoid gentleman seemed to me to have advanced the case far enough.

* * * *

Assuming I accepted the germ theory, and the theories of infection and contagion, in their entirety? It'd be a large assumption, but—— Well then, for the sake of argument, I do. Put me down as a believer; what's the question? Oh, the old one—what would I do if I had a free hand? Well, it'd be a case of one doctor one patient. Directly a doctor entered an infected room he'd have to stay there. He couldn't consistently be allowed to leave the room in a germ-laden condition. He might have millions on him. Wash himself? Yes, he might wash himself and boil himself and all his garments, but where could he do it? If he did it in the infected room he'd have a fresh million or so on him immediately he dried and dressed himself, and if he did it outside the room he'd infect whatever other room he entered. No, there is only one logical course—hermetically seal up the doctor and the patient, then disinfect and fumigate them both together, and—— It'd kill them? Of course, it would, but—the germ theory being true—that'd be better than polluting a neighbourhood! Doctor and patient being disposed of, there'd still remain the infected house, for a germ or two would be sure to have escaped from the room, and really I can see no course other than to burn the house down. There still remain the other inmates, and as regards them I——

* * * *

You've heard enough? Somehow I thought you had; but you must confess my arguments are logically sound. Why, one of the hairs on your head or your face—clean-shaven as you are—would afford lodgment for thousands, while your eyebrows and eyelashes and the hairs of your head—— Heavens, they'd carry enough germs to infect the solar system! No, doctor, you'll have to give in. You won't? Well, of course, I knew you wouldn't. My remark was only a figure of speech. But think over what I've said. Not worth it? Come, come, don't talk like that. It's between ourselves, and what's said here in my office never goes farther. I wouldn't talk to your inspector in the same way. He's an excellent chap, but not quite of that soil in which revolutionary ideas can with safety be planted. Joking aside, I recognise the value of your work, but after all it's sanitation that's stamped out so much infectious disease. Isolation and the use of proper disinfectants have done a lot, but dabbing a bit of pink powder around a foul gulley is not half so good as giving it a good scrub. Money's better spent upon a sewerage scheme than upon a small-pox hospital. By the by, what *is* the actual cost per patient per annum in small-pox hospitals? A thousand or two, isn't it? You don't know—must be going? Well, good-bye, doctor—glad to 've seen you—good-bye.

* * * *

Who? Brown? Ask him in. Well, Brown, and what can I do for you? Want my advice? All right, sit down and fire away. Mr. Gunn tells me you're doing very well and that your length is one of the best in the district. Keep on like that and I'm sure *we* shan't fall out. Now, let's have your special trouble. Your grandchild—scarlet fever? Just came from the house? Here, I say, you know you shouldn't do that. Why, you might infect the whole office. You haven't been near the patient? Only just looked in at the door of the bedroom? Heavens, man, why you may be fairly reeking with disease germs! Open that window wide and sit down there right between the window and the fireplace. Sorry? Yes, and you ought to be. Surely a man of your age ought to know better than to come straight from an infected house like that. The doctor? He does the same? Now, look here, I can't listen to that nonsense. Your doctor takes every possible precaution; of that I am assured. Why, his very living depends upon him doing so! But what's made you come to me? They want to move the child to the hospital? Well, and why not? You don't think it right to take a child out from a warm room into the open air in a high state of fever? Then I differ. The child 'll be better off in the hospital than at home, where it'll be a source of danger to all the others. What mischief there is to be done is done already? No, I don't think so, and directly the child is taken away the inspector 'll come round and disinfect the room. Not much in that? Brown, Brown, you're incorrigible—I never met a more obstinate man. Hoped I'd use my influence to prevent the child being removed? Sorry, but I couldn't do that. That's a battle you must fight yourself. No, I couldn't possibly. Very sorry, and I hope the child 'll soon get well. Good-day, Brown.

* * * *

That you, doctor? Hullo, there! Just had a most annoying thing happen. Brown, one of our roadmen,

called to see me and told me in conversation that he'd just left his grandchild, who's got scarlet fever. Been here, right in my office, sitting under my very nose. Eh? What say? Needn't worry? Hang it all, doctor, it's no laughing matter. It's not myself—it's the wife and the kids and—— What can you do? There's a question to ask me. Hang it, doctor, the office ought surely to be fumigated or something. Couldn't Mr. Bankes come round and do it? Oh, hang the flies! Can't a man have a joke without—— Hullo, hullo—are you there? Well, you will send round, won't you? There's a good fellow! Will I confess *what*? Eh? The 'phone's terrible this end. Speak up louder—that's better. Yes, I'll give in, doctor; you've got me this time. Something in the germ theory after all? Afraid so. Good-bye, doctor—send at once, there's a good fellow.

The New Delhi.—In the House of Commons on the 8th inst. the Under-Secretary for India was asked whether the Government of India had now definitely decided on the southern site for the new capital of Delhi; whether he could state the extra cost likely to be incurred by the choice of the northern site, and whether he had official information showing which site would be the more advantageous from the sanitary and health point of view. Mr. Montagu said the reply to the first question was in the affirmative. The Secretary of State could not answer the second part of the question, but the additional cost for Government headquarters on the same scale would be undoubtedly heavy; as regarded the third part of the question, the southern site was overwhelmingly more advantageous from the health point of view.

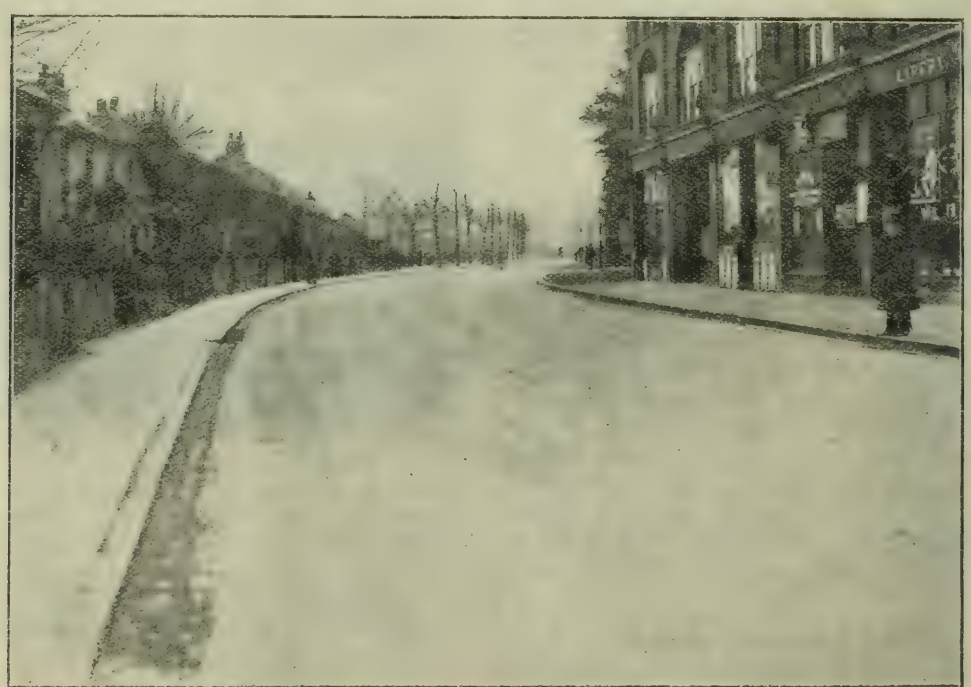
British Fire Prevention Committee.—The British Fire Prevention Committee have decided to issue an exhaustive report on the fire protective organisation of Russia, this volume to be partly the outcome of a visit of a deputation from the committee to St. Petersburg, Moscow, and Warsaw, and partly a summary of data obtained from official sources. The report will be in the form of a quarto volume of 120 pages, compiled by Mr. Edwin O. Sachs, F.R.S.ED., with some 160 illustrations, and is to be issued at the end of April. The committee are also shortly publishing a volume dealing with the results of their fire tests on sixteen different forms of partitions, this volume to be a complementary volume to two already published on the result of fire tests with twenty-eight floors and sixty fire-resisting doors.

"MEXPHALTE" AT HORNSEY.

We are informed by the Anglo-Mexican Petroleum Products Company, Limited, that important works in connection with their asphaltic bitumen, sold under the trade name of "Mexphalte," can be inspected in course of progress at Muswell Hill, in the borough of Hornsey, where work of considerable area is being constructed under the direction of the borough engineer, Mr. E. J. Lovegrove, M.INST.C.E. The work in question is of great interest to Metropolitan engineers and those engineers who have to deal with roads subject to considerable traffic.

The road now under construction—which is nearly completed—is subject to a motor-'bus traffic of over 800 'buses per day, and certain sections of the work, which can be inspected, have had to deal with a total traffic of about 100,000 motor 'buses since it has been laid. Numerous engineers, not only from this country, but from the Continent, have inspected the work recently, and we are assured that complete satisfaction has been expressed at the results obtained.

The Praed Road Construction Company, who are carrying out the contract, have in hand for this season a very considerable amount of work, and it will probably be of interest to road engineers generally to know that during the whole of next week the company will be constructing a section of roadway adjoining the recent Road Board trials at Sidcup, which work is being carried out to the order of the Metropolitan Borough of Woolwich, under the supervision of their engineer, Mr. J. Rush Dixon. The two companies above mentioned will have representatives in attendance between the hours of 2 p.m. and 4 p.m. during the whole of the week at Sidcup, and surveyors and engineers generally will have an opportunity of inspecting what is certain to become an important factor in modern road construction.



"Mexphalte" Road at Muswell Hill.

An American Sidoup.—The State of Washington, which will this year spend £1,600,000 on road construction, is having constructed at Olympia, Washington, a stretch of roadway which will be made by various paving companies, each of which is laying a sample of roadway, 16 ft. wide and 100 ft. long, according to its own plans and specifications, which are filed with the State Highway Department.

THIRD INTERNATIONAL ROAD CONGRESS

INTRODUCTORY SURVEY OF SUBJECTS.

FULL TEXT OF GENERAL REPORTERS' RESOLUTIONS.

THE EXHIBITION OF ROAD MAKING APPLIANCES & MATERIALS.

In historic sequence, the International Road Congress which is to be held in London from the 23rd to the 28th of June is the third of a series which was begun at Paris five years ago, and was continued at Brussels in 1910. It has been convened by the British Government, which has extended to all the States interested in improved methods of road construction and maintenance an invitation to send representative delegates. That this invitation has received wide acceptance is to be gathered from the fact that at least thirty-six countries have agreed to send delegates to the congress. The organisation, it should be stated, is in the hands of the Permanent International Association of Road Congresses, which had its origin in Paris in 1908, assisted by an Organising Committee of the United Kingdom, elected from the various professional, scientific, and administrative bodies interested in and intimately concerned with the roads of this country. His Majesty the King is the gracious patron of the movement, and the hon. presidents consist of the Chancellor of the Exchequer, the Secretary of State for War, the Secretary of State for the Colonies, the President of the Local Government Board, and the First Commissioner of Works. The list of hon. vice-presidents is large and representative, and the chairman of the Organising Council is Sir George H. Gibb (chairman of the Road Board), while Lord Montagu of Beaulieu, Mr. W. Joynson-Hicks, M.P., and Mr. F. H. Berryman act as vice-chairmen. For the rest it need only be stated that an excellent choice has been made in the selection of Mr. W Rees Jeffreys (secretary to the Road Board) and Mr. G. Montagu Harris (secretary to the County Councils Association) to the responsible and arduous offices respectively of hon. general secretary and deputy hon. general secretary. The Hon. Arthur Stanley, M.V.O., M.P., fills the post of hon. treasurer, and the membership of the General Organising Council includes the names of gentlemen associated with almost every institution and association identified with road administration and practically every form of road traffic. The list of committees includes a general committee, executive committee, entertainments committee, exhibition committee, traders committee, and the London (Municipal Officers) Reception Committee.

The movement in favour of road improvement, as our readers are aware, has made phenomenal strides since the second congress concluded its labours in Brussels, and the past three years have been a period of constant activity. The problem of treating roads with bituminous materials has been advanced from the experimental to the practical stage, and has now attained an assured position. Experience has proved that roads can be built of bituminous materials which are not only practically dustless but are also capable of carrying the heaviest ordinary traffic. It has further become clear that the longer life of bituminous bound macadam roads will frequently balance the increase in initial cost, and may even result in many cases in a reduction in the annual charge for renewals of surface coatings, and, as their quality is in every way superior to that of the ordinary macadam types, the chief consideration which now remains is one of finance. The questions to be discussed by national and departmental road authorities have become mainly administrative, and for the first time, therefore, administration assumes a prominent position in the programme of the congress, whereas the Paris and Brussels conferences confined themselves entirely to the technical aspects of the subject.

The formal proceedings of the congress will be opened by Mr. D. Lloyd George, Chancellor of the Exchequer, at a General Assembly which will take place at the Central Wesleyan Hall, while the First Commissioner of Works, Earl Beauchamp, will inaugurate the Road Exhibition which has been arranged at the Royal Horticultural Hall. This exhibition will be of a most comprehensive character, and will enable the public to see a representative display not only of materials used in road construction, but also the heavy and expensive machinery which has now become necessary to modern road-building methods.

Receptions and conversaziones for the members of the congress will be held at the Guildhall of the City of London; at the Albert Hall, by invitation of the Institution of Civil Engineers; and at the Royal Automobile Club, while there will be a banquet, by way of conclusion to the congress week, at the Hotel Cecil.

A large number of interesting excursions, on several of which many types of road construction will be seen, have also been arranged. These will include a visit to Windsor Castle, on the gracious invitation of his Majesty the King; another to the Garden City at Letchworth, and one to the National Physical Laboratory at Teddington, as well as a trip to Hampton Court Palace, an up-river trip, and various inspections of roads in the home counties. The Surveyors' Institution will give a garden-party at the Royal Botanical Gardens, and special invitations will also be issued for performances at representative London theatres.

The programme of tours arranged for the present week comprises excursions in Kent and the South-West of England, while those which follow include visits to Eastbourne, Brighton, Folkestone, Chester and North Wales, the Midlands, the English Lakes, and Scotland.

SUMMARY OF GENERAL PROGRAMME.

On Monday next members of the congress will be able to obtain tickets, badges, programmes, &c., at the Surveyors' Institution, Great George-street, between 9 a.m. and 6 p.m. The opening meeting of the congress will be held at 2.30 p.m., at the Wesleyan Central Hall, Westminster, a new building on the site of the old Aquarium. The reception of members of the congress, by the Right Hon. Earl Beauchamp, will take place at the Royal Horticultural Hall, Vincent-square, Victoria-street, at 5.15 p.m. The reception of members of the congress by the Lord Mayor and Corporation of the City of London will take place at the Guildhall, at 7.45 p.m.

MEETINGS OF SECTIONS.

The following notes are intended as a convenient reminder of dates and hours. Receptions and excursions are for limited numbers of members who have obtained the special tickets necessary.

Question 1—(Planning new streets and roads).—June 24th, 10 a.m., Main Hall, Caxton Hall.

Question 2—(Types of surfacing to be adopted on bridges and viaducts).—June 24th, 2.30 p.m., Main Hall, Caxton Hall.

Question 3—(Construction of macadamised roads bound with tarry, bituminous or asphaltic materials).—June 25th, 10 a.m. and 2.30 p.m., Main Hall, Caxton Hall.

Question 4—(Wood paving).—June 25th, 10 a.m., Surveyors' Institution.

Question 5—(Methods of lighting public highways and vehicles).—June 24th, 10 a.m., Institution of Mechanical Engineers.

Question 6—(Observations since 1908 as to various causes of wear and deterioration of roadways).—June 24th, 2.30 p.m., Institution of Mechanical Engineers.

Question 7—(Regulations for fast and slow traffic on roads).—June 25th, 10 a.m. and 2.30 p.m., Institution of Mechanical Engineers.

Question 8—(Authorities in charge of construction and maintenance; functions of central and local authorities).—June 24th, 2.30 p.m., Surveyors' Institution.

Question 9—(Finance of construction and upkeep, and provision of revenues).—June 25th, 10 a.m., the Lounge Hall, Caxton Hall.

COMMUNICATIONS.

1 and 2—(Improvements; tests of materials). June 24th, 2.30 p.m., Main Hall, Caxton Hall.

3 and 4—(Construction of water-bound roads; different types of roads). June 25th, 2.30 p.m., Main Hall, Caxton Hall.

5—(Types of stone paving).—June 25th, 10 a.m., Surveyors' Institution.

6 and 7—(Sign posts; self-propelled vehicles).—June 25th, 2.30 p.m., Institution of Mechanical Engineers.

8, 9 and 10—(Qualifications of officials; wages; cost).—June 25th, 10 a.m., the Lounge Hall, Caxton Hall.

Further meetings of sections which have not completed their business will take place at 10 a.m. on June 27th.

RECEPTIONS, ETC.

By the Institution of Civil Engineers, at the Albert Hall, June 25th, 9 p.m.

By the Royal Automobile Club, June 26th, 9 p.m.

At the Hotel Cecil, June 28th, 9 p.m.

Garden Party, by the Surveyors' Institution, at the Royal Botanical Gardens, 4 p.m. to 7 p.m., June 27th.

Theatres (His Majesty's, the Gaiety, the Coliseum), the evening of June 27th.

Visit to Windsor Castle, June 26th; Paddington Station 1.50 p.m.

River party, June 26th; Paddington Station 10 a.m.

Hampton Court and the National Physical Laboratory, June 28th; leave the Horticultural Hall at 10.30 a.m.

Sidcup, June 21st and daily, by motor 'bus or train.

INSPECTIONS AND EXCURSIONS.

The arrangements for these are as follow:—

June 21st. Duration of excursion, 3-4 hours.—Leave Victoria Station for Sidcup by motor 'bus, at any time. Inspect typical roads through South London and the trial lengths at Sidcup. Return from Sidcup to Charing Cross by train.

EXCURSIONS DURING THE WEEK OF THE CONGRESS.

June 26th. Duration of excursion, 1 day.—London, Romford, Chelmsford (lunch), reception by Mayor of Chelmsford; visit to Marconi Wireless Works (tea), Epping Forest, London. Limit of party 50. (In motor cars.)

June 28th. Duration of excursion, 1 day.—London to Hampton Court, *viâ* Fulham and Wandsworth (inspection of experimental lengths), Kingston. Hampton Court Palace, National Physical Laboratory (inspection of Road Board Laboratory at the N.P.L. at Bushey). Limit of party 200. (In motor 'buses.)

June 26th. Duration of excursion, 1 day.—London to Windsor by special train. Visit Windsor Castle. Tea in the grounds at the invitation of His Majesty the King. Return London 6 p.m. Limit of party 1,000.

June 26th. Duration of excursion 1 day.—River trip. Special train from Paddington to Windsor. By launch from Windsor to Marlow and back. Lunch and tea on board. Return by train to London. Limit of party 120.

June 28th. Duration of excursion, 1 day.—Visit to Letchworth Garden City, leaving London at 11.10 a.m. At Letchworth—Demonstration of gyratory traffic, lunch, afternoon drive, tea. Return to London. Limit of party 100. (By train.)

June 26th. Duration of excursion, 1 day.—Visit to Berkshire. Leave London by train for Maidenhead. Motor chars-à-banc to Windsor, Ascot and Reading. Lunch town hall. Maidenhead train to London. Limit of party 100.

June 28th. Duration of excursion, week-end (2 or 3 days).—London, Croydon, Purley, East Grinstead to Eastbourne. Return to London by rail. Limit of party 50. (By motor car and train.)

June 28th. Duration of excursion, week-end (2 or 3 days).—London, Croydon, Epsom, Leatherhead, Dorking, Horsham to Brighton. Return to London by rail. Limit of party 50. (Motor car and train.)

EXCURSIONS DURING THE WEEK FOLLOWING THE CONGRESS.

June 30th. Duration of excursion, 5 days.—London to Chester. Visit to Eaton Hall (tea on invitation of Duke of Westminster), cathedral, and other places of interest. By motor char-à-banc to Llandudno (stay night). Penmaenmawr (lunch), visit quarries. Bangor to Carnarvon (stay night), Bettwys-y-Coed, Llangollen (stay night) to Shrewsbury. At Shrewsbury luncheon. Return to London by rail. (Inspection of 130 miles of roads.) Visit Hawarden and Rhuddlan Castles, Bangor Cathedral and Chirk Castle. Limit of party 50.

June 30th. Duration of excursion, 6 days.—London by train for Liverpool (stay night). Sail on Mersey: luncheon at invitation of Lord Mayor; inspect roads, &c. Train to Southport; dinner by invitation of Mayor and Corporation of Southport (stay night). Carnforth, the Lakeside to Ambleside (stay night). By coach to Grasmere, Thirlmere, Keswick, rail to Penrith, coach to Pooley Bridge, steamer to Patterdale, coach to Kirkstone Pass and Ambleside (stay night). Return to London by train. (Visit to Liverpool docks and Southport tar-macadam plant. Inspection of 120 miles of roads.) Limit of party 50.

June 30th.—Duration of excursion, 6 days.—London to Glasgow; dinner at the invitation of the Lord Provost and city council (stay night). By motor car to Stirling, lunch by Provost and town council, Pitlochry (stay night). Braemar or Glyn Lyon and back to Pitlochry (stay night). Oban, steamer cruise and tea by Provost and town council (stay night). By car to Inverary, thence to Glasgow by steamer on the invitation of the Scottish Automobile Club. Morning drive in Glasgow, rail to Edinburgh. Dinner by Lord Provost and city council. Limit of party 50.

June 30th. Duration of excursion, 3 days.—London to Sheffield by special train. Inspection of Hadfield's Steel Foundry. Sheffield to Nottingham (stay night). By car *viâ* Fosse Way to Enderby quarries, near Leicester (lunch). Inspection and dinner at Leicester by invitation of Leicester Automobile Club (stay night). Leicester to Tarmac works, Wolverhampton (lunch). Inspection and dinner at Birmingham, Midland Auto Club (stay night). Birmingham to Stratford-on-Avon; visit Shakespearian memorials (lunch). Visit Warwick Castle, Leamington. Inspection of Daimler motor-car works at Coventry (tea). Return from Coventry by rail to London. Limit of party 100.

June 30th. Duration of excursion, 2 days.—London to Folkestone (stay night). Canterbury (lunch and visit cathedral). Return to London. Limit of party 50. (By train.)

RESOLUTIONS TO BE SUBMITTED TO THE CONGRESS.

Appended is the full text of the resolutions proposed by the general reporters for submission to the congress.

1st SECTION—CONSTRUCTION AND MAINTENANCE.

1st Question—Planning of New Streets and Roads.

General Reporter—PROF. S. G. ADSHEAD.

(1) As a general principle, it is better that new main roads be constructed to pass outside rather than through towns, and that where an existing main road passing through a town is unsatisfactory for through traffic it is better to construct a new by-pass route in preference to widening an existing narrow main road through the centre of a town.

(2) Wherever possible, gradients on new roads should be limited to 5 per cent, and that they should be less where there are curves, trams, or a preponderance of heavy traffic.

(3) The radii of curves in roads used by fast traffic should, where practicable, provide an unobstructed view of 100 yds. ahead, and that where this is not possible, the curve being of too short a radius, means should be provided whereby the approach thereto is in some way clearly indicated.

(4) Except where it is possible to provide special reserved spaces, tram tracks are best placed in the centre of the roads, and that where so placed it is desirable to provide space on either side for two tracks for vehicles.

(5) The main traffic roads should be so designed as that spaces are provided for tram tracks, fast and slow traffic, and standing vehicles; and in such a way that they can proceed without unduly intermixing. In fixing building lines along what may ultimately become main roads, regard should be paid to ultimate requirements. Adequate space should be provided between the buildings, and powers for enforcing this should be held by all authorities who decide the widths of roads.

(6) That the planning of main road communication is a matter of national importance in regard to which some initiative should rest with a central State authority, and the action of local authorities should to some extent be regulated or supervised by central State authorities.

2nd Question—Types of Surfacing to be adopted on Bridges, Viaducts, &c.

General Reporter—DR. P. C. COWAN.

(1) The choice of road surfacing for bridges depends on the nature and intensity of the traffic, the local conditions, such as permissible first cost, kinds of material readily available, and climate. For light bridges the choice is largely influenced by the weight of the surfacing. Public safety and convenience should be first regarded rather than questions of comparative cost.

(2) On short bridges in town or country, it is desirable that the surfacing should be the same as that on the adjoining streets or roads.

(3) In forming the roadway on bridges, special care should be taken to secure proper drainage, and to prevent the harmful percolation of water. With longitudinal gradients of at least 1 in 50, the cross-section of the surface may be made nearly flat and the dead load thus reduced.

(4) As a general rule, the surfacing of a bridge should be as smooth as possible, without being slippery. It should be waterproof, capable of resistance to wear, durable, and of a weight appropriate to the structure of the bridge.

(5) Plank surfacing on bridges is light, and its first cost is low. Its cost of maintenance is, however, excessive, except where the traffic is light. Its extreme liability to damage by fire is a serious disadvantage. It should not be adopted, except in remote districts in which there is an abundance of cheap timber, and where a more desirable form of surfacing is not easily obtainable. Single plank floors are only suitable for very light traffic. For moderate or heavy traffic, two layers of planking, the lower of which is creosoted or otherwise protected from rapid decay, should be used.

(6) Macadam, or ordinary broken stone surfacing, on timber planking, is not satisfactory, on account of its great weight and its permeability. It is, however, quite satisfactory for massive bridges in rural districts, if the substructure has a proper dampcourse.

(7) Macadam, bound with tar or other waterproof and elastic material, is useful and economical for the surfacing of rural bridges with moderate traffic, when the spans are short or the structure is massive.

(8) Wood-block paving, 3 to 5 in. thick, is an ideal surfacing for bridges in most cases. It is light and durable and can be laid on concrete, or, when weight must be minimised, on a timber sub-floor, which should be creosoted. Special care should be taken in the selection, treatment and laying of wood blocks for bridge paving, to avoid troubles due to expansion and contraction of the blocks or of the metal structure.

(9) Asphalt, in various forms, is an excellent surfacing material for bridges with easy gradients, on which the traffic is not confined to definite lines or very heavy.

(10) Stone paving, carried out either with ordinary hand-dressed setts or with small setts (Durax; Kleinpflaster), laid on concrete and bound with cement or pitch, makes excellent and economical surfacings for bridges with heavy traffic. However, it is only suitable in cases where questions of the weight of the surfacing or of noise are of no importance. The thickness of the layer of sand interposed between the setts and the foundation will be decided in the same way as with an ordinary carriageway, in town or country, as the case may be.

(11) For movable bridges, and for non-rigid suspension bridges, the surfacing should be light and easy to attach to the bridge platform. The trials made in France and Belgium with old mine cables, or other fibrous substances of even less cost, and with such materials impregnated with tarry, bituminous or asphaltic materials, should be encouraged.

3rd Question—Construction of Macadamised Roads bound with Tarry, Bituminous, or Asphalt Materials.

General Reporter—J. WALKER SMITH, M.INST.C.E.

By the use of tarry, bituminous, or asphaltic binders, we may obtain a number of different forms of road crust, which may be employed with advantage, according to the various conditions of the road as regards traffic, locality, and climate.

The exact value and duration of life of these various road crusts, taking into account traffic and climate conditions, remain to be determined.

For this purpose it is advisable to draw up a uniform system of tests, measurements and records, under the following headings:—

(1) Physical and local conditions. (Plans, cross-section, slopes, camber foundations, subsoil.)

(2) Materials employed, petrological analysis, dimensions, composition of the binding agent.

(2A) Method of construction, date of construction.

(3) Census of traffic on the section under review.

(4) Climatic conditions affecting the road.

(5) Periodical measurement of wear.

(6) Periodical examination of the state of the road crust.

(7) Actual cost of the road crust—(*a*) as regards cost of construction; (*b*) as regards maintenance cost.

PARTICULAR CONCLUSIONS.

(1) *Foundation and Drainage.*

Confirming the conclusions adopted in 1910 by the Second Congress (Brussels, 2 Question), which called attention to the advantages of a dry foundation and a sound subsoil, the congress especially insists upon the great importance of efficient foundations in the case of road crusts bound with tarry, bituminous or asphaltic binders, for the following reasons:—

(1) The road crust being expensive, it is important to give it a base which secures stability.

(2) As the weight, speed and intensity of the traffic continually tend to increase on roads considered worthy of such a crust, it is best to provide a foundation which has been so constructed as to secure the best possible conditions of resistance to wear.

DIMENSIONS AND SHAPE OF METALLING.

(1) When an ordinary macadamised road crust is constructed with a view to being tar-sprayed, it should be constructed of hard metal, with sharp edges, and

broken as nearly as possible to a cube of the dimensions of from 4 to 6 centimetres.

(2) In the case of tar, bituminous or asphaltic macadam, carried out by the mixing process, the dimensions of the metal must be so selected and graded as to form a compact road crust with the fewest possible voids. The dimensions of the largest metal may vary according to the nature of the stone and of the traffic. When the process of construction employed requires more than one layer of material, the upper layer or wearing crust must be formed of smaller metal.

(3) In respect of tarry, bituminous or asphaltic road crusts constructed by the penetration process, the trials and tests now being carried out in various countries should be continued, taking care only to employ metal of as cubical a shape as possible, and with sharp edges, at any rate, for the portion of the road crust nearest the surface.

EMPLOYMENT OF PARTIALLY USED METAL.

By carefully eliminating all particulars of mud and organic matter, it is possible to successfully make use of partially worn materials, on condition that they are not employed for the surface of the road crust.

RELATIVE IMPORTANCE OF PATCHING.

It is agreed that it is absolutely necessary to carry out repairs, in the case of all tarry, bituminous and asphaltic road crusts, immediately the necessity for them arises.

PERMISSIBLE WEAR.

The complete renewal rendered necessary by wear must be carried out immediately the depth of the road crust is below a given limit of safety, or when its waterproofing qualities have become so poor that the road will unduly suffer from climatic conditions.

TESTS AND CHEMICAL ANALYSIS.

The advantages of analyses and methodical laboratory tests, and their necessity in the case of bituminous binders, are unanimously recognised.

It would be of advantage to obtain uniformity—

(1) As regards the specification of the principal characteristics of these binders.

(2) As regards the methods of testing.

CLIMATIC EFFECTS.

It appears to be generally agreed that certain tarry, bituminous or asphaltic road crusts (as is also usually the case with all smooth and waterproof road surfaces) may become slippery under certain conditions of weather.

This may be remedied by strewing the surface with coarse sharp sand; and in most cases a good cleansing of the surface will usually prevent the carriageway becoming slippery.

EFFECTS ON PUBLIC HEALTH, ETC.

Sufficient information is now available to enable engineers to select and specify bituminous binders which will have no prejudicial effect upon public health, fish life, or vegetation; but which, on the contrary, will conduce to conditions of considerable hygienic advantage.

CLEANSING AND WATERING.

It is recognised that carriageways properly treated with tarry, bituminous or asphaltic materials require less sweeping and watering than ordinary water-bound macadamised roads, and that they allow of considerable economy being effected under this head.

4th Question—Wood Paving.

General Reporter—H. PERCY BOULNOIS, M.INST.C.E.

(1) Where gradients permit, wood block pavements, laid on proper concrete foundations, are the most suitable for streets where traffic is great, but is not of the exceptionally heavy character usually existing on streets near docks or similar centres of industrial traffic.

(2) Great care is necessary in the selection of the proper timber for the purpose, and all soft wood blocks should be thoroughly impregnated with a well-proved preservative before being laid.

(3) In view of the varying results given by wood pavements, according to local circumstances, it is desirable that further investigations and laboratory experiments should be carried out in connection with the selection of the timber and of the impregnating preservative.

(4) Every precaution should be taken in laying the blocks to prevent, so far as possible, the entry of water through the joints.

(5) Subject to certain precautions, such as impregnating of the wood, waterproofing of the joints and surface, frequent cleaning of the roadway, &c., there is no objection to wood pavement from the sanitary point of view.

(6) The spreading of gritting is necessary under certain conditions and in certain weather (especially on hard wood paving) to prevent the surface becoming slippery, but the gritting should be done with suitable small gravel or chippings, so as to avoid, as far as possible, any injury to rubber tyres.

(7) Where hard woods are adopted for paving, the "sectional block" system or some other effective system should be employed, in order to avoid the objections which have been found in hard wood pavements.

2nd SECTION—TRAFFIC AND ADMINISTRATION.

5th Question—Methods of Lighting.

General Reporter—COL. HOLDEN, F.R.S.

(1) For the purposes of a general determination of methods of lighting highways may conveniently be divided into three classes as follows:—

1—Important streets in cities, towns or other urban areas in which the traffic after dark is considerable in volume.

2—Important suburban roads in the vicinity of large towns.

3—Rural roads.

And having regard to modern conditions of traffic it is essential that adequate lighting by means of fixed lights should be provided in classes 1 and 2.

(2) As a general principle in the lighting of all highways which require to be lighted by means of fixed lights, the method of lighting to be adopted should be such as will provide an illumination as uniform and free from glare as possible. The amount of illumination and the position of lamps must be determined with reference to local circumstances.

(3) It would be impracticable to light rural roads generally by similar methods to those adopted in urban streets or suburban roads, and the lighting of vehicles using rural roads at night is therefore of the highest importance.

(4) 1—All vehicles whether standing or moving on the road should be compelled by law to carry either suitable lights in front and in rear or lighted lanterns, so constructed and fixed that the beams shall as far as practicable be visible both from the front and the rear.

2—Every motor car must carry after nightfall two lighted lamps in front, and one at the back; if it is able to move at a high speed it must also be fitted in front with a head-light of sufficient illuminating power to light up the road or path for at least 50 yds. to the front. In inhabited places where the ordinary lighting is sufficient to allow motorists to see their way and to be easily seen, the light of the head-lights must be limited to that of the ordinary lamp.

(5) It is desirable that all obstacles across a road such as gates, and particularly gates at railway level crossings, should be painted white and should be clearly lighted at night by means of fixed lights, preferably of a red colour, to indicate danger.

2—It is desirable to paint with white paint, or indicate by some other method all danger signal posts, direction posts and other posts, milestones, wheel kerbs, bridge abutments, &c., or other special features, the indication of which would aid travellers or conduce to safety.

(6) Red should be universally adopted as the colour for danger signals.

6th Question—Observations noted since 1908 as to the Various Causes of Wear and of Deterioration of Roadways.

General Reporter—GIBSON THOMPSON.

(1) Weather conditions are among the most powerful influences which cause deterioration of roads, and the destructive effect of weather can be minimised by effective waterproofing of the road surface.

(2) Any considerable volume of traffic consisting of either heavy motor vehicles or high speed light motor cars has a seriously damaging effect on water-bound macadam roads. The damage caused is effected by the balancing of the vehicle; the ratio between propelling power and adhesive weight; the weight of unsprung portions of the vehicle; the continuity of action of the brakes; the system of springing; the type

of tyres employed, the diameter of the wheels, the width of the rims and other factors.

(3) The damaging effect of heavy motor vehicles can be minimised by the use of wheels of large diameter; tyres of a width properly adapted to the weight of the axle load; rubber or elastic tyres and suitable springs and that all reasonable means of reducing the damage to roads caused by such vehicles should be enforced.

(4) Light motor car traffic does not cause serious or exceptional wear or damage in the case of properly made macadam roads which have been properly treated or bound with tarry, bituminous or asphaltic materials.

As regards horse-drawn vehicles it is desirable also to study the relations between load, width of rims and diameter of wheels and more especially the system of shoeing horses.

(5) There is still a great lack of precise information in regard to the various causes of wear and deterioration of roadways, and that it is desirable to collect more information compiled on carefully devised scientific methods standardised as far as possible for the purposes of comparison, and to make further systematic study of these causes. The International Permanent Commission is charged with the preparation of a programme of observations, studies and experiments.

7th Question—Regulations for Fast and Slow Traffic on Roads.

General Reporter—LORD MONTAGU OF BEAULIEU.

(1) That all regulations for the control of road traffic should be based on the principle of facilitating the maximum practicable speed for each different kind of vehicle consistent with public safety and general convenience.

(2) That regulations for the conduct of fast and slow traffic should be as few and simple as possible, and should be such as can and ought to be universally adhered to and enforced.

(3) That in all large cities there should be a traffic authority on whom should be charged the duty of studying and dealing with street traffic problems, the powers of such authority and the co-ordination of such powers with those of other public authorities being matters of detail which must be settled by Government on consideration of the circumstances and conditions of each large city.

(4) That there should be ample provision of traffic controllers (such as the police in London) with adequate powers to regulate the traffic, not only at congested points, but throughout the course of crowded streets.

(5) That fast traffic should always be as far as practicable from the kerb so as to minimise the risk to pedestrians who may intentionally or thoughtlessly step from the footpath on to the carriageway.

(6) That having regard to the increased danger which is necessarily created by the conditions of modern traffic it is important that drivers should be carefully and systematically trained, and that children should be specially taught how to provide against the dangers of the road.

(7) That except where local circumstances render it absolutely necessary, no obstructions, such as lamp-posts, tramway standards, &c., should be placed in the centre of a road, except necessary refuges for pedestrians crossing.

(8) No obstruction of the public highway should be permitted either by vehicles standing unreasonably, or by things placed on the highway. Exception must, however, be made for depots required for the work of maintenance or repair of the road, or for work being carried out by duly authorised and competent authorities, but in every case, all necessary steps must be taken to ensure the safety of traffic.

8th Question—Authorities in Charge of the Construction and Maintenance of Roads. Functions of Central Authorities and Local Authorities.

General Reporter—W. REES JEFFREYS.

The system of road administration in any country must be in harmony with the general system of government prevailing in that country and the political genius of its people. It is impossible, therefore, to lay down any general rule of universal application as to the extent to which the road organisation of any country should be centralised or decentralised.

In countries where maintenance of roads by local authorities has hitherto been the prevailing system, the modern engineering problems of road construction raised by the increased motor traffic are creating a tendency to greater centralisation, and it is desirable that there should be a further development of State assistance and supervision.

In those countries where centralised systems of administration already exist, it is desirable that these systems shall be developed and perfected.

A principle that can be laid down as of universal application is that the unit of highway administration shall be sufficiently large and command sufficient resources to employ and adequately remunerate a competent administrative, engineering, and accounting staff.

It is desirable that the engineering staff shall be organised on a national basis, and shall consist of—

(1) Chief engineers, having jurisdiction over the area which shall be selected as the unit of administration;

(2) Divisional engineers in charge of divisions of the unit and responsible to the chief engineer;

(3) Assistant engineers, recruited by examination from engineering students who have received a practical training following upon a good general education, and an engineering education at some recognised engineering school or university. Promotion shall be by merit.

9th Question—Finance of the Construction and Upkeep of Roads. Provision of Revenues.

General Reporter—G. MONTAGU HARRIS.

(1) The expenditure on the maintenance and improvement of

(*a*) the roads which serve as main routes of communication between important places in any country, or

(*b*) roads which are used mainly by long distance traffic,

unless such expenditure is borne wholly out of the national revenues under a system of State administration of roads (which system is practicable and suitable in the case of some roads in some countries) should be mainly paid for out of national revenues, whether or not such roads are locally administered and maintained, subject, where local administration prevails, to the supervision of a central government authority both as to efficiency and expenditure.

(2) It is desirable to abolish, so far as possible, all tolls on public roads, but it is equitable that the owners of vehicles which, on account of their weight, or weight combined with speed, or any other exceptional circumstances connected with either the vehicle or use of the road, cause special damage to roads beyond the wear and tear of the ordinary traffic of any district, should be subject to special taxation, the proceeds of which should be earmarked for expenditure on roads.

(3) Borrowing money for new road construction and for the periodic renewal of the surface coating of a road is consistent with sound financial principles, provided that the loan period in the case of loans for renewals is kept well within the life of the surface coating.

THE ROAD-MAKING APPLIANCES AND MATERIALS EXHIBITION.

As already stated, this exhibition will be at the Royal Horticultural Hall and the adjacent ground in Vincent-square, Victoria-street, S.W. A reception of the members of the congress will be held on Monday, June 23rd, at the Horticultural Hall, at 5.15 p.m., by the president of the Exhibition Committee, Earl Beauchamp, K.C.M.G., First Commissioner of Works. The exhibition will be open each day from 9 a.m. to 6 p.m., and members and associate-members of the congress will be admitted free on presentation of their cards of membership. Other visitors will be admitted on payment of 1s. The exhibits will be divided into four classes, as follows:—Class 1., materials and tools; 2nd class, traffic; 3rd class, models, maps, drawings, and publications; and 4th class, historical. The first class will be in two sections, for materials and machinery respectively. Section 1 will include samples of stone broken and chipped, tars and pitches, bitumen, and asphalt, various surfaces,

and testing apparatus. Section 2 will comprise rollers, steam dryers, tar macadam mixers, breakers, and scarifiers.

There will be three sections in Class II. Section 1 will consist of mechanical vehicles for the transport of road materials; wheels and tyres designed to carry heavy weights without damage to the roads; non-skid apparatus not damaging the roads, and light railway and tramway tracks. Section 2 will be devoted to horse-traction exhibits, such as wheels and tyres, non-injurious horse-shoes, and shoeing with special reference to securing foothold. Section 3 will include exhibits of appliances for highway and vehicle illumination. Class III., in addition to exhibits defined in the title, will comprise statistics, forms of account, meteorological records, &c., while in Class IV. will be shown specimen sections of road construction, old and new, and various historical exhibits. The interior section will be devoted to materials and light machinery, while in the exterior section heavy machinery will be exhibited.

The Road Board exhibit will include specimen sections of hard and soft wood paving, granite setts and cubes, granites coated with tar, slags coated with tar, compressed asphalt, asphalt macadam, cork asphalt, Mexphalte, Cormastik, Tarlithic, Tarmac, Camarco, Ferromac, Plascom, Quarrite, Roadamant, Taroomba, Tarvia, Rocmac, Roadoleum, single pitch grouting, double pitch grouting, in addition to specimens of practically every other form of road construction, either of an asphaltic, bituminous, or other nature, used in this country.

One of the sections of the exhibition will be devoted to road maps. It has been organised by the Automobile Association and Motor Union of Great Britain, in co-operation with the Ligue Internationale des Associations Touristes.

The lecture-room on the first floor of the hall has been set apart for this purpose, and in this will be shown an unique collection of maps of interest from the point of view of the motorist, the municipal engineer, and the military engineer. In addition to a comprehensive selection of the best road maps issued of the various countries of Europe, the exhibition will contain specimens of maps from the following countries:—The United States, Canada, Mexico, Central America, Jamaica, Barbados, Colombia, British Guiana, Uruguay, Egypt, Somaliland, Nigeria, Lagos, Natal, Orange River Colony, India, Ceylon, Malay Peninsula, China, Japan, Australia, Tasmania, and New Zealand.

With a view to securing a type or types of direction posts and plates which can be generally adopted by highway authorities, the London Organising Council recently offered prizes to the value of £35 for the best designs and models for direction posts and plates submitted. A selection of the models submitted will be exhibited on Stands Nos. 32 and 33 in the interior section of the exhibition.

With the co-operation of traders and engineers, a collection of specimens of many forms of road-surfaces which are in use in the United Kingdom will be exhibited in Room No. 2, on the first floor of the hall.

The gangways of the outside section have been paved by the undermentioned firms (index plates denote the various materials and the firms by whom they have been laid):—Messrs. Brookes, Ltd., Messrs. Constable, Hart & Co., Messrs. Durax Dustless Roads, Ltd., Messrs. The Enderby and Stoney Stanton Granite Co., Ltd., Messrs. The Limmer Asphalte Paving Co., Ltd., Messrs. A. and F. Manuelle, Messrs. Roadamant & Co., Ltd.

It is intended that this exhibition shall be the daily rendezvous for members of the congress, and the place for which appointments may be made. With this object in view, the committee have arranged that afternoon tea shall be served each day to members and associate members during the congress week, between the hours of 4 and 6 p.m. Those desiring tea, which will be served in a tent in the exterior section of the exhibition, must present vouchers, which can be obtained from the attendants at the entrance to the tea-tent, on presentation of a membership ticket.

Interpreters, for the assistance of foreign visitors, will be availab .he exhibition, who will render their services free of charge. Application for their services should be made at the manager's office, Room No. 3.

INTERIOR SECTION: MATERIALS AND LIGHT MACHINERY.

ROADS IMPROVEMENT ASSOCIATION.

(Stand 1.)

Established in 1886, and formally incorporated in 1898, the Roads Improvement Association, which will be represented at this stand, has for over twenty-six years promoted the movement for better, wider, dustless and more conveniently planned roads and footways. It is the national and representative organisation of all classes of road users, and its fundamental aim has been to unite all forms of road traffic in the common cause of obtaining improved roads and additional facilities for traffic thereon. To-day the association numbers among its constituent and supporting bodies the national organisations representing owners and users of pleasure motor cars, horse-drawn conveyances, cycles, motor cycles, commercial motor vehicles, motor cabs, public service vehicles and traction engines. Over 200,000 users of the public highways are represented by the association.

CROMPTON LABORATORY.

(Stand 3.)

Among the exhibits of the Crompton Laboratory, Thriplands, Kensington-court, W., will be designs for the following: (1) Fixed, or semi-fixed, crushing, drying, heating, sorting and mixing plant for turning out 200 tons of bituminous concrete, or 150 tons of material for sheet asphalt pavement per diem; (2) portable plant carried on one vehicle, suitable to be carried on a railway well-truck, within the loading gauge, for drying, heating, sorting and mixing 80 tons of bituminous concrete, or 50 tons of material for sheet asphalt per diem; (3) three-axle road roller to roll road surfaces correctly, free from undulations or waves; (4) steam wagon for repairing sheet asphalt or bituminous pavements; (5) steam wagon with tipping body for carrying hot bituminous concrete, or hot material for sheet asphalt; (6) improved viagraph. The apparatus shown on the stand will include: (1) Set of measuring machinery, complete with sockets, for measuring the wear of experimental roads; (2) the late Mr. John Brown's original viagraph; (3) new form of penetrometer to determine penetration for pitches, bitumens, &c., which allows the rate of penetration to be observed throughout the test; (4) set of cylinder moulds and testing hammer for testing the material for sheet asphalt paving in the form of cylinders. The test hammer serves as a toughness test; (5) specimens of test cylinders made up to various specifications showing toughness ranging, as measured by number of blows, from 1 to 1,200 blows, each blow being that given by a weight of 2·2 lb. descending through a stroke of 9 in., equal to 1,000 grammes by 23 centimetres; (6) slabs and test briquettes made up with various aggregates and percentages of binder as per tickets attached to each, tickets showing results of tests for transverse strength in each case; (7) two sheets of curves showing viscosity and consistency of various pitches and bitumens, from 0 up to 30 deg. Cent., or from 32 to 86 deg. Fahr.

JOHN HUTCHINSON.

(Stand 7.)

Instruments and apparatus for the practical testing and standardisation of bituminous materials will form an interesting exhibit at the stand in the occupation of Mr. John Hutchinson, 11 Tothill-street, Westminster, S.W. The various appliances will include: (1) Hutchinson's tar tester, for measuring the viscosity (stickiness), or binding power of road tars; types and patterns of thermometers (Fahrenheit) as used in tar and asphalt work; (2) the road engineer's pocket thermometer; (3) hand thermometers for foremen and others; (4) thermometers for fixing in port-

able tar heaters; (5) tank thermometers; (6) "melting point" and volatilisation test apparatus; (7) flash point and ignition testers (open cup); (8) specific gravity apparatus for tars, liquid asphalts, oils, &c., and also for stone aggregates and other solids; (9) penetrometers; (10) the Crosby consistometer; (11) New York testing laboratory penetrometer; (12) New York Testing Laboratory viscosity float; and (13) the Reliance fly-wheel foot brake, exhibited by Mr. E. S. Sinnott, M.INST.C.E.

HARD YORK NONSLIP STONE COMPANY.

(Stand 9.)

The above-named firm, a branch of Messrs. Brookes, Limited, are showing the well-known "Nonslip" stone. This reconstructed York stone is stated to be used to a large extent now by practically every important town in the United Kingdom, in addition to which large quantities are exported to foreign countries. It is claimed to be absolutely non-slippery. The chippings of Silex hard York stone are pulverised and reduced to their original sand. Since the crushing strain of this rock is 2,200 tons per cubic foot, it may be realised that powerful machinery is essential, and after crushing the patented and secret processes follow closely upon Nature's own lines. The granulated chippings and other ingredients are run into moulds, the enormous pressure of well over 2,000 tons is applied, and almost before the operation can be realised in the mind a solid slab is ready to carry out to the maturing ground. Such, in brief, is the process of manufacture; but before active operations begin an infinity of pains is taken in selecting, testing and preparing the several constituents, and after the slab is pressed and virtually complete, it enters upon its process of weathering. To form an adequate conception of this operation, a space of 14 acres must be pictured, filled with slabs lying edgewise on the ground, and several tiers in depth. The stock of Nonslip stone thus awaiting maturity is never less than 400,000 yds., and none is sent out until it has lain from eight to twelve months in order to become thoroughly matured. Messrs. Brookes, Limited, are also showing specimens of their well-known "Perfecta," "Granolite," "Adamant," "North Wales," and "Thames stone" pavings, produced at their various works, which are so situated as to enable them to supply nearly all parts of the kingdom. A few specimens of this firm's steps and pavings of various kinds, which are much used in conveniences and subways in our principal towns, are also shown. Messrs. Brookes, Limited, are also showing a few specimens of glazed bricks, tiles and faience, as largely adopted for the principal subways and conveniences.

SKANDINAVISKA GRANITAKTIEBOLAGET.

(Stand 12.)

The above are a Gothenburg firm, whose average production annually from their own granite quarries situated on the west coast of Sweden, is as follows: Setts, 425,000 square metres; Durax, 335,000 square metres; kerbstones, 150,000 running metres; building stones, &c., 3,500 cubic metres; coloured granite, 2,000 cubic metres; macadam, 50,000 tons. Messrs. A. & F. Manuelle are the English and Scottish representatives of the company.

BRITISH REINFORCED CONCRETE ENGINEERING COMPANY, LIMITED.

(Stand 13.)

This firm are exhibiting their Clinton steel wire mesh, specially made for the reinforcement of concrete foundations to roads. An ordinary section of road is shown, with concrete foundation 12 in. thick, and an alternative section is shown, with concrete 4 in. thick, reinforced with Clinton mesh. The latter, although much lighter and cheaper, is considerably stronger than the former. The reinforcement carries the road over any soft spots in the ground, and prevents the concrete from cracking. It distributes the weight over a large area, and this also prevents cracking. The feature of this reinforcement is that it is exceptionally easy to handle. It is a steel wire mesh, made in rolls of any length, 200 ft. being the standard length most convenient to handle. The longitudinal wires are crossed at intervals of 6 in. or 12 in. by transverse wires, which are electrically welded to them, and form a perfect connection. The standard rolls are about 6 ft. wide. The material is made in various gauges of wire, and costs from 6d. upwards per square yard. It has recently been used for roads in Manchester and London, and if the results justify the claims of the manufacturers it should be universally used, and create a revolution in road construction, as it provides economy in cost, economy in maintenance, and increased speed of construction. The company also exhibit fencing made from the same material, the features of which are that the connection of longitudinal wires to the vertical wires are simple electrically-welded joints. The wire used is oval in shape, and the material is heavily galvanised after manufacture. This is stated to be the only kind of mesh fencing which can be galvanised after manufacture, and the life of the fence is said to be, for that reason, six or seven times the life of any wire mesh fence.

SOCIETE ANONYME DES MINES DE BITUME ET D'ASPHALTE DU CENTRE.

(Stand 14.)

The Société Anonyme des Mines de Bitume et d'Asphalte du Centre, 33 rue des Archives, Paris, are exhibiting at this stand samples of asphaltic rock for compressed asphalt works, taken from their mine at St. Jean de Maruéjols-Avejan (Gard), cakes of asphalt mastic, mark Seyssel Forens Nord et Avejan, suitable for all fluid (or grouted) asphalt works, and particularly for terraces, roofings, waterproof copings, &c., and square blocks of compressed asphalt made in their works at Pont du Château (Puy-de-Dôme).

ELLIS AND EVERARD.

(Stand 15.)

Messrs. Ellis & Everard are the proprietors of the Markfield granite quarries, near Leicester, Bardon Hill granite quarries, near Leicester, and the Charnwood granite quarries (trading as Charnwood Granite Company), at Charnwood quarries, near Loughborough. The firm's productions include macadam for heavy traffic, macadam for general and light traffic, chippings for carriage drives, fine chippings for footpaths, cement paving, tar spraying, &c., washed chips for cement paving and granolithic work, unbroken granite for hand breaking, rubble for road formation, and granite setts for paving. The granite produced at the company's quarries has been supplied to upwards of twenty-five county councils, fifty cities and boroughs, and 130 urban and rural councils throughout the country.

CEIRIOG GRANITE COMPANY, LIMITED.

(Stand 16.)

The above-named firm are the sole manufacturers of "Granomac" (granite tar-macadam), and among their exhibits will be Welsh granite macadam and chippings, tarred granite macadam and chippings, granite concrete flags, kerb and coping, and a piece of "Granomac," after four years' heavy wear. The grey granite exhibited by this company is claimed to be admirably suited for the manufacture of tar-macadam. It has long been recognised, the firm point out, as one of the best granites obtainable for ordinary macadam roads.

HESKETT STEEL CASTINGS (BRITISH), LIMITED.

(Stand 17.)

This exhibit consists of steel sewer and road work castings, manholes and gulleys, the advantages claimed for these being lightness, strength and durability, freedom from breakages, and moderate cost. The address of the company is 17 Victoria-street, S.W.

PYX GRANITE COMPANY, LIMITED.

(Stand 18.)

The Pyx Granite Company, Limited, whose registered office is Malvern, Worcestershire, will exhibit samples of road material from their quarries, the productions of which are as follow: Breidden Hills quarry, Montgomeryshire—Granite macadam, granite setts, and tarred macadam; Horsehay quarry, near Wellington, Salop—Shropshire Dhu stone (basalt), and macadam and tarred macadam; Doseley quarry—Macadam and tarred macadam; Dawley slag works—All sizes of broken and tarred slag; North Malvern quarry, Worcestershire—Syenitic granite and broken roadstone and tar-macadam in all sizes; Little Malvern quarry, Worcestershire—Syenitic granite and all sizes of broken roadstone and tarred macadam.

SOCIETE DES CARRIERES D'OLLOY SOCIETE ANONYME.

(Stand 19.)

The exhibits of this company at Stand 19 will include ordinary and hewn paving stones, crushed millstone-grit products (bluestone), macadam ballast gravel, grit and fine slack.

ENDERBY AND STONEY STANTON GRANITE COMPANY, LIMITED.

(Stand 20.)

Specimens of granite kerbs and channels, granite setts for tramway work, crossings, and general paving, broken granite for road making, granite chippings and screenings for roads, footpaths, concreting work, &c., tarred macadam and screenings, granite rubble for road foundations, granite dressers' chippings for foundations, sides of roads, &c., granite steps and spurstones, blocks of undressed granite, steel tools for working granite, and photographs of quarry workings and machinery, may be expected to form an interesting display at the stand of the Enderby and Stoney Stanton Granite Company, Limited, Narborough, near Leicester. During the strong as the best classes of granite and similar materials.

A. & F. MANUELLE.

(Stand 23.)

Machine-cut Durax cubes from the firm's quarries in Sweden, Norway and Guernsey are among the exhibits of Messrs. A. & F. Manuelle, 57 Gracechurch-street, London, E.C., and examples of the work carried out on this system can be seen at the Durax Dustless Road Company's stall (Stand 24, Exterior Section). Aberdeen, Guernsey and Norwegian granite setts will also be shown in addition to special dressed flat setts from the company's Aberdeen and Norwegian quarries. The latter setts were introduced into this country by Messrs. Manuelle, and many thousands of tons have been supplied, not only from their "Brinor" (Norwegian) and Swedish quarries, but also from their Aberdeen quarries, to a great number of councils and contractors, including the City of London Corporation, Croydon, Poplar, Southend, Lambeth, Lewisham and Nottingham. A speciality of the firm is granite for building purposes, this being known as dressed "Standard Grey," polished granites and marbles being also supplied by them.

The "Tarmac" Works, Ettingshall, Wolverhampton.

week of the congress and exhibition, we are asked to state, the company will have a temporary office at the Westminster Palace Hotel (Room 7).

TARMAC, LIMITED.

(Stands 21 and 22.)

Samples of materials and numerous photographs will constitute the display of Tarmac, Limited, of Ettingshall, Wolverhampton. We are reminded that "Tarmac" has now been on the market for nearly twelve years, and has, as is well known, been made use of in all parts of the country. It is made of blast-furnace slag, specially selected for the purpose. The company's works are adjacent to the furnaces of Messrs. Alfred Hickman, Limited, and the Denby Iron Company, Limited, respectively. The company have a fully equipped tar-distillation plant at their works, and the tar compound used for coating is distilled and prepared to physical and chemical standards, known to give the best results as regards strength of binding properties, freedom from tendency to affectation by atmospheric variations, and length of life as an effective bind. Examination of the samples of untreated slag will demonstrate that the slag used by the company has an exceptionally rough and uneven surface, which means that it possesses the maximum "holding power" for the mixture used for coating. It is porous enough to retain and hold the mixture perfectly, and is, at the same time, claimed to be as

BRITISH TRUST CORPORATION, LIMITED (PAVING DEPARTMENT).

(Stand 24.)

The productions of this firm, whose address is 85 London-wall, E.C.—include "Cormastik" road covering, "Cormastik" road blocks, the "Cormasticine" road binder, cork asphalt blocks and "Corkite." As a road covering "Cormastik" is claimed to be suitable for all classes of traffic; it is laid *in situ* to any desired thickness. The firm's cork asphalt blocks are intended for laying under cover where a silent and non-slippery paving is required, and is specially suitable for stables and drill halls. A cork asphalt block of a somewhat heavier type is now manufactured for outside work, and is particularly adaptable for bridges and on inclines, on account of its tendency to lessen vibration and deaden sound, and the firm foothold it gives to horses.

VAL DE TRAVERS ASPHALTE PAVING COMPANY, LIMITED.

(Stand 25.)

The Val de Travers Asphalte Paving Company, Limited, Hamilton House, Bishopsgate, London, E.C., will have on view the following: Samples of natural rock asphalte as mined; natural rock asphalte powder; natural rock asphalte slabs, hydraulically compressed, various sizes; natural rock asphalte mastic for paving; natural rock asphalte mastic for paving, granited;

natural rock asphalte mastic, in two layers, for roofs; Val de Travers Asphalte Paving Company's mastic blocks; Pyrimont Seyssel mastic asphalte blocks; acid-resisting mastic paving; natural asphalte matrix, in barrels and sample tins, 2-in. Guernsey granite, granite chippings; refined Trinidad Lake bitumen; Bridport grit; compressed asphalte, cut up from streets after many years' wear; also models of mastic asphalte horizontal dampcourse; mastic asphalte on concrete roof; mastic asphalte on boarded roof, with gritted surface; mastic asphalte as applied for tanking wet basements; mastic asphalte to wood tank, bottom felt, sides metal; mastic asphalte to floor and sides of powder magazine; mastic asphalte as underlay for parquet flooring; mastic asphalte to wood gutter and slope under slates, with tilting fillet, and photographs of mines, depots, and so forth.

GAS LIGHT AND COKE AND SOUTH METROPOLITAN GAS COMPANIES.

(Stand 26.)

The above-named companies exhibit at Stand 26 various grades of tars and pitches, and a number of special preparations for road-construction purposes.

CANADIAN MINERAL RUBBER COMPANY, LIMITED.

(Stand 27.)

The Canadian Mineral Rubber Company, Limited, 37 Victoria-street, S.W., are showing at Stand 27 samples of their high-grade asphalt, together with photographs of roads on which their material was employed since last year. This asphalt, the basic material of which is gilsonite, has been newly introduced into England, and has already given most satisfactory results both in county and municipal work. The special properties claimed for this asphalt are its elasticity and cementitiousness, the result being that a road constructed with "Camarco" as the binding material is more resilient than tar-bound macadam, and, moreover, it is practically impossible to dislodge the stones on account of the extremely tenacious way in which they are held to one another. It is, moreover, waterproof, and therefore, the firm state, withstands winter conditions in a way it is impossible to attain when tar is employed. We had an opportunity of inspecting a "Camarco" road last January. This had been constructed the previous July. It appeared to us to be in a perfect state of preservation, and we understand that its condition now is perfectly satisfactory. The members of the congress will have an opportunity of viewing this section, as it is the intention of the county surveyor, Mr. Hawkins, to drive delegates over certain portions of Berkshire, including the main Bath road, in which this section occurs. Another section of "Camarco" road lately constructed has been at Woolwich, close to the boundary on the Eltham-Sidcup road, Kent, this section being laid in connection with the Road Board trial. This section of road will also be officially inspected during the congress. Several other sections of road throughout the country have been constructed both by the mixing method and the grouting method, using "Camarco," and we understand that this road material will be used in several other counties and boroughs during the present season.

"CAMARCO" ON THE ELTHAM-SIDCUP ROAD AT NEW ELTHAM STATION.

A "TARMAC" ROAD IN BERKSHIRE.

LIMMER ASPHALTE PAVING COMPANY, LIMITED.

(Stand 28.)

Specimens of mineral rock asphalte, as taken from the company's freehold mines, Bassin de Seyssel (Haute Savoie), France; mineral rock mastic asphalte (manufactured from the above mineral rock), and of the rock reduced to powder; refined Trinidad bitumen and Bridport grit; Lithofalt paving blocks in various thicknesses, with plain and grooved surfaces; Lithomac asphalte macadam, suitable for country roads and all carriageways bearing fast motor traffic; Lithofaltum, for binding macadam for dustless road surfaces, and for grouting wood and sett pavings, &c.; compressed asphalte paving is taken from the carriageway of Holborn-viaduct (originally laid 2½ in. thick in 1900); Lithofalt paving blocks originally laid in Northumberland-street, Poplar, 1½ in. thick in

August, 1908, and others originally laid in Bow Common-lane, 2 in. thick, in March, 1910, and Bitmarin bituminous specialities, including paints, varnishes and damp-proofing composition, should provide an interesting display at the stand of the Limmer Asphalte Paving Company, Limited, of Caxton House, S.W. Photographs, illustrative of work done in roofs, flooring and street paving, and showing the company's mines in the Bassin de Seyssel (Haute Savoie), France, will also be exhibited, and visitors should note that a specimen area of Lithofalt paving blocks has been laid in the gangway of the exterior section of the exhibition.

J. & P. HILL.

(Stands 29 and 30.)

Messrs. J. & P. Hill, Ordnance Works, Sheffield, and Caxton House, Westminster, S.W., are exhibiting their well-known motor vacuum dustless road cleansing machine, demonstrations of the working of which have recently been given in different parts of the country. The machine provides a simple and practical method of cleaning roads of rubbish, whether light or heavy, wet or dry; also of collecting and depositing it without dust. It gathers up every kind of road rubbish, garbage, dust, mud, stones, snow, water, &c., without manual labour of any kind. It cleanses the road surface without damaging it. It is also applicable for fixing to tramcars for track and rail work, driven by an electric motor. The firm's "Galloway-Hill" patent furnace and tar-macadam plants for drying road materials will also be shown.

ROADITE, LIMITED.

(Stand 31.)

The exhibit of Roadite, Limited, Broadway-court, Westminster, S.W., will consist of various examples of road surfaced with Ferromac. This, as is now very generally known among municipal engineers in this country, is the name of an especially prepared cementitious powder and two chemical solutions which, to quote the words of the company, "thoroughly binds together all kinds of broken granite, slag, stone or flints, making the whole into a clean, hard, waterproof, non-slippery and durable road, which does not give off dust in dry weather." Ferromac is stated to be quite harmless to animal, fish and plant life, and to be one of the cheapest and most efficient road-binding materials on the market. Ferromac roads are simply and rapidly constructed and cheap to maintain, and may be prepared to take a surfacing of any bituminous material, thus enabling surveyors and engineers to provide roads that will take the heaviest traffic at a minimum cost. Excellent examples can be seen in various streets in Leyton, London, E., on the Great North Road near Grantham, and in many other places.

ROCMAC, LIMITED.

(Stand 34.)

Rocmac, Limited, of 13 Victoria-street, S.W., and Burley Grange Works, Leeds, claim for their extensively used material the following among other advantages: (1) It can be laid in any weather; (2) it affords a good foothold to horses in any weather or on any gradient; (3) it binds granite as well as tar or bituminous binders bind softer or more porous materials. Rocmac is claimed to be unaffected by weather or any climatic changes. The Rocmac binder is a silico-saccharate-carbonate, and is formed by the combination of Rocmac solution with carbonate of lime. The first cost is not excessive; as a general rule Rocmac costs in Great Britain 20 to 40 per cent more than a water-bound macadam road laid with the same aggregate, and is stated at least to double or treble the life of the aggregate bound with it. It can be repaired as easily as a water-bound road, and its cost in maintenance is very low.

ANGLO-MEXICAN PETROLEUM PRODUCTS COMPANY, LIMITED.

(Stand 35.)

The exhibit of the Anglo-Mexican Petroleum Products Company, Limited, of Finsbury-court, London, E.C., is of particular interest in view of its high-grade products for modern road work, and the immense resources for the continuous and abundant supply of these. These materials, refined from Mexican bitumen, are marketed under two registered names which have rapidly become household words among surveyors. Mexphalte for road making is a solid, pure bitumen of the highest quality. It is over 99·5 per cent pure. It possesses high ductility value, which indicates its tenacity and cementing power—an important point in road construction. Extremes of heat and cold leave Mexphalte unaffected; this is claimed to be proved by the fact that it has been largely used in Mexico (tropical climate) on the one hand, and Canada (with frequent severe frosts) on the other. It is equally successful by the grouting or mixing methods, and roads laid in this country and on the Continent have given excellent service under severe traffic conditions. One road at Hornsey successfully stands the daily traffic of 850 motor 'buses in addition to other vehicles, and in some parts is only 16 ft. wide. Fluxphalte for road spraying is a liquid bitumen designed to supersede the use of tar as a road dressing. It contains over 60 per cent of solid pure bitumen, and is entirely free from sand or mineral matter. It is heated and sprayed on the road in a manner similar to tar. Among other good points it contains no poisonous elements, and may be applied to roads that drain into streams without the least danger to plant or fish life. It does not wear off in a few months, but penetrates the road and forms a durable asphalt surface, waterproof, dustless, silent and non-slippery. The 2-mile stretch of road sprayed with Fluxphalte at Epping has been most favourably commented on by competent critics, and at Romford an old broken surface has been rendered practically a new road by treating with Fluxphalte at 4 yds. to the gallon, followed by a liberal coating of ¼-in. granite chippings. The Anglo-Mexican exhibit is, of course, devoted to the above materials, but is further made interesting by various photographs of roads made with Fluxphalte and Mexphalte, and views of the Mexican Eagle Oil Company's extensive refineries. A model of the world's largest oil tanker— the "San Fraterno" —which is one of the fleet of vessels engaged in the distribution of Mexican Oil Products, together with penetration and ductility machines to illustrate the standard tests for determining the quality of bitumen for road work, are also shown. Altogether it is a very attractive exhibit, which is bound to receive more than a passing interest from those visiting the exhibition.

HIGHWAYS CONSTRUCTION, LIMITED.

(Stand 36.)

Highways Construction, Limited, is a new company, recently registered, for the construction, maintenance and repairs of roads under the Praed patents in this country. Its registered offices are at Finsbury-court, London, E.C. Roads constructed by the new organisation are on the asphalt-macadam principle, employing high-grade Mexican bitumen (Mexphalte). The exhibit comprises interesting sectional samples of asphalt-macadam roads, as constructed by the methods known as single coating and double coating work. The double coating method constitutes the standard process for roads built to successfully stand motor 'bus and other heavy traffic. Samples of the various materials used, together with diagrams and photographs of work done are also shown.

AMERICAN WESTRUMITE COMPANY.

(Stand 42.)

The name of Westrumite is a familiar one to English road engineers. Westrumite asphalt pavements are claimed to embody the best features of many types of pavement construction now in use. The material is ordinarily laid 2 in. thick as a wearing surface on either concrete or macadam foundation. Old macadam pavements can be resurfaced at moderate cost. Although this wearing surface hardens on top, it remains sufficiently plastic underneath to form a resilient pavement which has a minimum susceptibility to wear. The granular texture of the surface prevents slipping and skidding, even when completely covered with water. A pavement can be replaced with the greatest ease when it is necessary to cut it open for repairing pipe lines, Westrumite and the proper stone matter, mixed cold, by hand or machine, tamped into place, bonding perfectly to the old section. The London offices of the company are at 104 Victoria-street, S.W.

R. S. CLARE & CO., LIMITED.

(Stand 40.)

Visitors to this stand will find much to interest them in the binder which Messrs. R. S. Clare & Co., Limited, Stanhope-street, Liverpool, have recently introduced for the manufacture of an improved tar-macadam. "Bi-Tarco," as it is called, is stated to have wonderful adhesive and agglomerating power, and to be elastic and never brittle. Stones, when

treated with it, adhere firmly together in one solid, unbreakable mass, and it is said to be especially suited to the treatment of hard granite, such as Syenite. At the firm's stand will be found some very interesting models showing the different stages of construction of Pitchmac roads, and several sections cut from Liverpool roads which have been under traffic from one to over twelve years are also exhibited.

George Gregg & Sons, of Larne, for the Antrim County Council, the contract relating to a stretch of highway between 4 and 5 miles in length.

A. C. WELLS & CO.

(Stand 43.)

Three patterns of Wells' road dryers will be shown at this stand, all being fitted with powerful heating

"TARCO" BEING APPLIED TO MAIN STREET IN COLOMBO.

Princes avenue, Liverpool, was laid with Pitchmac by the city engineer, Mr. J. A. Brodie, in 1901, and no repairs have since been necessary. The road is

burners, easily removable, and burning ordinary petroleum oil. The No. 12 is a powerful plant, with multiple heaters, suitable for drying large flat sur-

SPREADING "TARCO" IN HIGH-STREET, KWALA LUMPUR, FEDERATED MALAY STATES.

still in good condition in spite of the fact that the traffic is as great as 120,000 tons per yard width per annum, on the Road Board basis. The area of Pitchmac laid to date in Liverpool exceeds 400,000 super. yds. There appears to be a very promising future for this material. One recent order is for work that is being undertaken in Ireland by Messrs.

faces, such as road beds, and for warming asphalt surfaces before applying sealing coats. The No. 10A is a single heater plant, more portable, and easily moved about over loose road metal and rough surfaces. The No. 9 is a small plant designed for pothole repairing. One man can wheel this plant and carry the tank which supplies it. It is now

recognised by all road authorities that if pitch grouting is to be successful, the surface of the road and the road metal must be perfectly dry. By the adoption of Wells' road dryers no time need be lost in waiting for the road to dry after a shower of rain. Messrs. Wells' London address is 103 Midland-road, St. Pancras, N.W.

BRISTOWE & CO., LIMITED.

(Stands 45 and 46.)

An interesting feature of the exhibit of Messrs. Bristowe & Co., Limited, 11 Tothill-street, Westminster, S.W., is the "Cantar" hand-spraying machine. It is claimed for this that it is the only hand tar-spraying machine which ensures a continuous supply of hot tar compound within a few minutes of starting. The tar or tar compound is carefully filtered, and the machine is so arranged as to ensure regular working and complete efficiency. Arrangements can be made at the stall to view the actual machine close to the exhibition. A complete working model of the "Whalley" mixer can be seen on the stall. This mixer can be used equally for concrete mixing as for tar-macadam mixing. It is supplied in either portable or stationary form, and has proved itself an economical and reliable machine. Robbins' non-set plastic cement, to which attention is also being directed at the company's stand, is used in the place of ordinary grease and red lead for jointing manhole covers and inspection boxes. It is said to make an absolutely watertight joint, but permits the cover to be easily lifted at any time. It is inodorous, and does not decompose. Various illustrations of reports with regard to "Tarvia" can be inspected at the stall.

TRINIDAD LAKE ASPHALT PAVING COMPANY, LIMITED.

(Stands 47 and 48.)

The above company, of Britannia Wharf, Townmead-road, Fulham, London, S.W., are, as is well known, importers of crude Trinidad Lake asphalt, no less than 160,000 tons being annually received by the firm. Samples of the material as dug from the lake will be shown at the stand, and other samples will show the material in its various forms for road work, electrical purposes, and so forth. Samples will be on view of Trinidad asphalt macadam, showing the composition laid in various thicknesses. The following are the specifications in most frequent use: For Roadways of Light Traffic.—1½ in. to 2 in. Trinidad asphalt macadam is laid upon the existing macadam roadway, being shaped to proper falls and contours as may be required. For Roadways of Medium Traffic.—2½ in. to 3 in. of Trinidad asphalt macadam is laid upon the existing macadam, or if there is not room for the new material without excavating, the surplus material is removed, and after the base has been formed to required levels, and consolidated with a heavy roller, the new pavement

STATION-ROAD, HAMPTON, LAID WITH TARVIA IN 1907.

WEST-SQUARE, R.H.A. BARRACKS, WOOLWICH, LAID WITH TARVIA IN 1912.

is laid to the thickness specified. For Roadways carrying Motor 'Bus and similar Heavy Traffic.—3 in. asphaltic concrete and 1½ in. Trinidad Lake asphalt wearing surface. (This is the specification adopted upon the Victoria Embankment.) The foundation of the roadway is prepared as described for roadways of medium traffic, and the new pavement, consisting of 3 in. of asphaltic concrete and 1½ in. Trinidad Lake asphalt wearing surface is put down in two layers. The plant exhibited by the company will include special machinery for drying, heating, grading and mixing coarse and fine aggregate with bitumen, in road construction work. Photographs will show roads in various parts of the United Kingdom laid with Trinidad Lake asphalt, and samples of mastic asphalt in various forms will also be exhibited.

Tarvia Road in the Curragh Camp, Ireland.

BARBER ASPHALT PAVING COMPANY.

(Stands 47 and 48.)

The above firm, of Philadelphia, are producers of, and exporters from Trinidad, B.W.I., and from Venezuela, of crude asphalt and liquid asphalt for the construction of sheet asphalt pavements, asphaltic concrete, and asphaltic broken stone, or macadam surfaces for highways, and for carpet coats. Among the objects of interest to be seen on their stand will be models showing methods of construction in detail, of asphaltic broken stone roads, by the mixing and penetration methods, and materials entering into the construction of standard sheet asphalt pavements. A panoramic view of the famous pitch lake in the Island of Trinidad will be a particularly noteworthy exhibit.

NEUCHATEL ASPHALTE COMPANY, LIMITED.

(Stands 49 and 65.)

Registered in London in 1872 to take over the sole concession to work asphalte mines in the Val de Travers, Switzerland, this company, whose London offices are at 28 Victoria-street, S.W., have worked these mines continuously ever since. The numbers of the stands in their occupation at the exhibition are given above.

Road at Fisher's Green, Waltham Cross, Laid with Tarvia in 1912.

W. & F. ARCHER.

(Stands 51 and 63.)

Road rollers are exhibited by Messrs. W. & F. Archer at Stands 51 and 63.

IMPROVED WOOD PAVEMENT COMPANY, LIMITED.

(Stand 52.)

The merits of creosoted deal paving will be brought to the notice of visitors at this stand. The company —whose offices are at 46 Queen Victoria-street, E.C. —claim that the introduction of this class of paving, forty years ago, supplied a want that had been felt for a pavement combining the qualities of silence, durability, economy, and at the same time, one that could be easily repaired and would meet the fullest requirements of the most critical sanitary engineer. The minimum period for loans granted by the Local Government Board on creosoted deal paving is ten years, and with concrete foundations twenty years. Both these estimates are extremely conservative, the company contend, in quoting examples of the durability of the pavement. In some important thoroughfares the concrete foundations have already lasted for periods of between thirty and forty years. During the years 1910, 1911, 1912 the company supplied 1,000,000 sq. yds. of creosoted deal paving, and already, in the present year, the orders in hand exceed any previous record. Engineers who are interested in the preparation of the blocks can see the entire process at the company's works at East Greenwich, by appointment.

WEBB LAMP COMPANY, LIMITED.

(Stand 53A.)

The Webb system of sewer ventilation will be explained at Stand 53A, and a standard apparatus will be in operation to enable visitors to test the amount of work done at a given cost. The London office of the company is at 11 Poultry, E.C.

UNION OF GERMAN PAVIORS.

(Stand 54A.)

A pavilion intended for use as a place of rest and refreshment for men engaged in paving operations will be exhibited at Stand 54A by the Verband der Steinsetzer Pflasterer U. Berufsgenoss en Deutschlands. The structure to be shown will be one-third actual size.

GIANTS' CAUSEWAY COLUMNAR BASALT COMPANY.

(Stand 56.)

The above-named firm, of Portrush, Co. Antrim, exhibit samples of basaltic columns which are largely used on the Continent for facing road embankments, dock harbour wall, bridges, and for all classes of masonry. In various towns they have been employed for sea defence work, notably in the promenade front at Blackpool. The experience of engineers is said to be that concrete walls faced with these columns resist the action of the sea and the scour which takes place, far better than any other class of dressed stone. The natural crystallisation of the rock forms joints which can be readily fitted and bedded against each other, without requiring any dressing with chisel or hammer. Columnar basalt macadam and chippings for road metal are another feature of this exhibit. The stone is fine grained in texture, very hard and durable, of a high specific gravity, and, the company assert, capable of withstanding a crushing strain of over 50,000 lb. per square inch.

UNITED STONE FIRMS, LIMITED.

(Stand 59.)

The exhibit of United Stone Firms, Limited, is arranged in the form of a street, laid out to represent various products of the company specially applicable to street work. The paving consists of Bristol pennant stone, the kerbing and channelling of pennant stone and Cornish granite, the roadway itself being constructed of Cornish granite setts. Attention is also given to the productions of the company in the shape of macadam and granite chippings, examples being shown of various gauges of their Porthgain granite macadam, and Porthgain granite chippings, specially screened.

STANDARD TAR COMPANY, LIMITED.

(Stand 60.)

Specimen pieces of road surfaces treated with "Bituflux" and "Solta" road binders and dressers, and samples of both those materials will be exhibited by the Standard Tar Company, Limited, 180 Gray's Inn-road, W.C. The firm's Grade "A" bituminous grouting and binding material is described as a highly concentrated material of special manufacture. It is supplied in blocks and melted on the job, and the resultant mixture is capable of binding the hardest granites procurable, and thus enabling the making of roads for withstanding the heaviest traffic. Grade "B" is a heavy bituminous liquid for use in making tar-macadam. Its employment is claimed to ensure a regular uniformity of quality in the binding mixture. Grade "C" is an improved bituminous tar for surface dressing. It is stated to be of great penetrative power, besides setting well, and being of remarkable tenacity. It is manufactured under special processes, and enriched to a high degree, thus being rendered practically waterproof. The "Solta" soluble bituminous road binder can be used for making up the slurry in wet or dry weather. It is also an excellent cheap compound to mix with water for dust-laying, to be sprinkled by ordinary water carts. The firm's materials have been supplied to numerous councils, including Southend and Bournemouth Corporations, and the Dawlish Urban District Council.

BRITISH GRAETZIN LIGHT, LIMITED.

(Stand 61.)

On this stand will be shown various systems of street lighting by gas. High-pressure plant can be seen working in conjunction with directly-coupled gas engine; the plant can also be either electrically or belt driven. Lamps both high and low pressure from 100 to 4,500 c.p. are exhibited, while various devices of special interest to the engineer are demonstrated. Conversion sets for square street lanterns on the self-intensifying principle are also shown. In addition, midnight lighting and distance control of lamps are shown in operation.

ROADAMANT COMPANY, LIMITED.

(Stand 62.)

"Roadamant" is a specially prepared asphalt intended for laying direct on to macadam roadways, and the exhibit of the Roadamant Company, Limited, 65 London-wall, E.C., is one which may be relied upon to be examined with interest. The material is composed of the finest natural rock asphalt, refined Lake Trinidad bitumen, granite chippings, and a specially prepared compound, the result of many years' study, which has the effect of hardening the asphalt, and giving perfect adhesion and elasticity. "Roadamant," when laid 1 in. thick on a roadway with a good foundation, will, it is asserted, bear the heaviest traffic and remain in excellent condition for years. Other claims are that it is always clean-looking, dustless, and non-slippery, that it is easily laid, consolidates quickly, and is ready for traffic in a very short time. Surveyors and others interested are invited to accompany the company's representatives to some of the roadways laid with "Roadamant" in and around London. Motor cars will be in readiness for this purpose during the exhibition.

ANGLO-AMERICAN OIL COMPANY, LIMITED.

(Stand 64.)

At this stand the Anglo-American Oil Company, Limited, 36-38 Queen Anne's-gate, S.W., are exhibiting their preparations for dressing and binding macadam roads, which they are marketing under the name of "Roadoleum." These are fluxed and pure asphalts, and are supplied in a range of several consistencies, suitable for the various purposes for which they are recommended.

EXTERIOR SECTION: HEAVY MACHINERY.

There are a couple of dozen stands in the exterior section of the exhibition, the firms represented being chiefly those concerned in the manufacture and supply of heavy machinery and plant used in connection with road work.

RANSOME-VERMEHR MACHINERY COMPANY, LIMITED.

(Stand 1.)

A No. 4 size Ransome tar and bitumen macadam mixer is exhibited at this firm's stand. It is mounted

on road wheels, equipped with elevating skip, and arranged for belt drive. This mixer is of special interest, as it illustrates the adaptability of this machine for all classes of work, this particular equipment being arranged to discharge into tip wagons. Special attention is called to the mixing principle, which is stated to ensure perfect gauging of stone with a minimum amount of tar consumption, which is gauged and regulated by a tar-measuring tank fitted to the machine. A Ransome stone dryer is also shown. This machine, as is the case with the mixer just referred to, deals with stone on the batch principle; the dryers being made in varying sizes, either for portable or stationary work, being supplied as required with or without elevating charging skip, road wheels, or direct-coupled power unit. It should be noted that these Ransome dryers can be combined with the Ransome tar-macadam mixers, forming a single drying and mixing unit of an extremely compact and portable nature. The company are also exhibiting some of their Standard hand mixers, these, the firm point out, being equally serviceable for dealing with concrete or tar-macadam in small batches at a time. The machine is extremely compact arranged with elevating charging skip, and in such a way that every batch of mixed material as it is delivered from the mixing drum is discharged direct into standard navvy barrows.

AVELING & PORTER, LIMITED.

(Stand 2.)

This well-known Rochester firm are proposing to exhibit a compound steam road roller of a nominal weight of 10 tons when empty. The roller has high and low pressure cylinders side by side, mounted on steel pressed plate base riveted to the barrel of the boiler, and a firebox of the "Belpaire" type. The total rolling width is 6 ft. 2½ in. A "Morrison" patent road scarifier is attached, and an awning is fitted over the tender of the engine. The firm's tandem type petrol road roller, which it is also proposed to place on view, is driven by a 4-cylinder petrol motor developing 20-25 b.h.p. The total rolling width of the machine is 4 ft. 6 in., and its weight in working order about 7 tons.

CLAYTON & SHUTTLEWORTH, LIMITED.

(Stand 3.)

A "Clayton" 3-ton steam motor wagon will be one of the exhibits of Messrs. Clayton & Shuttleworth, Limited, of Lincoln, and 91 Queen Victoria-street, E.C. All the latest practice is embodied in the construction of this vehicle. The motive power consists of a compound steam engine mounted on a "Belpaire" loco-multitubular boiler built for a working pressure of 200 lb. per square inch. Two travelling speeds of 6 and 12 miles an hour are provided for, both being interchangeable by one lever, thus making it impossible for both gears to be thrown in at the same time. The wagon is fitted with resilient wood wheels of ample strength fitted with rubber tyres. The "Clayton" 8-ton steam road roller should be found both efficient and economical; while it contains many special features, simplicity of working has been maintained. The cylinders are of the compound type, 4½ in. by 7½ in. diameter by 9-in. stroke, and are fitted with an automatic forced-feed lubricator. They are bolted to a specially prepared pressed-steel seating riveted to the boiler, thus ensuring freedom from priming. The fly-wheel is 2 ft. 9 in. diameter by 4½ in. face; the balanced crankshaft is fitted with ring-oiling bearings; the feed pump is gear driven, and the hind rollers have spring scrapers. The boiler is of the "Belpaire" loco-multitubular type, and is constructed for a working pressure of 180 lb. per square inch; an injector is fitted.

CHEMICAL ENGINEERING COMPANY AND WILTON'S PATENT FURNACE COMPANY.

(Stand 4.)

An apparatus for treating tar and making it suitable for road purposes is shown by the above firms, whose works are at Hendon, N.W. The principle underlying the process is the heating of the tar in a confined space and releasing it when the water and light oils evaporate (to be subsequently condensed), leaving the dehydrated tar to flow to the store ready for use. It is stated that the plant can be put in full operation in three-quarters of an hour from lighting up. With this apparatus tars of different viscosity can be quite easily prepared for the various purposes for which they are required by the adjustment of temperature and pressure.

STOTHERT & PITT, LIMITED.

(Stand 5.)

The machine which Messrs. Stothert & Pitt, Limited, of 38 Victoria-street, S.W., are exhibiting is a portable drying and mixing plant, suitable for dealing with tar-macadam and bituminous macadam, and known as the "Smith Hot Mixer." It consists mainly of the well-known "Smith" mixer direct-driven by engine and boiler, the whole being mounted on a portable truck. Special heating apparatus is provided, and a side loading bin is fitted for feeding the materials into the mixer drum. For stationary plants where separate means are provided for drying and heating the materials, an ordinary "Smith" mixer is used for mixing purposes; but the plant exhibited completely fulfils all the requirements of a plant capable of drying wet material, heating it to the required temperature, also heating the matrix and mixing the material ready for being laid hot on the site. The various details of the plant will be fully explained on application at the stand.

YORKSHIRE COMMERCIAL MOTOR COMPANY.

(Stand 6.)

The exhibit of the Yorkshire Commercial Motor Company, of Hunslet, Leeds, will be a 5-ton to 6-ton "Yorkshire" steam wagon, fitted with patent mechanically operated tipping gear. It is specially adapted for carrying road material, and for general municipal purposes.

GOODWIN, BARSBY & CO.

(Stand 7.)

The patent "Acme" stonebreaker, of the class generally known as "portable automatic," with lower and upper screens, elevators, loading hoppers, and rejection returning arrangement, will be shown by this well-known Leicester firm. The stonebreaker is fitted with patent manganese steel jaw faces and side plates, and new-style machined renewable bearings, bedded into bored seatings. The elevator is of the internal type, and has the buckets mounted upon a patent armour-plated belt. The size of mouth of stonebreaker is 12 in. by 8 in., with a capacity of about 6-8 tons per hour, when set for road metal sizes. The whole is self-contained, and mounted upon a specially designed carriage, with extra high and broad travelling wheels. The patent "Acme" stonebreaker has been supplied to H.M. War Office, Crown Agents for the Colonies, as well as to councils and public bodies all over the world. Visitors to Leicester during the Road Congress are invited to call and inspect machinery in course of construction.

W. WEEKS & SON, LIMITED.

(Stand 8.)

Messrs. W. Weeks & Son, Limited, Perseverance Iron Works, Maidstone, have arranged for a display comprising the following: (1) Automatic pressure tar-spraying machine of 230 gallons capacity; (2) horse-drawn tar-painting machine of 230 gallons capacity; (3) hand-power tar-spraying machine of 80 gallons capacity; (4) independent hand tar-spraying machine; (5) direction post with cast-iron arms; (6) lime-washing machine.

H. R. MARSDEN, LIMITED.

(Stand 10.)

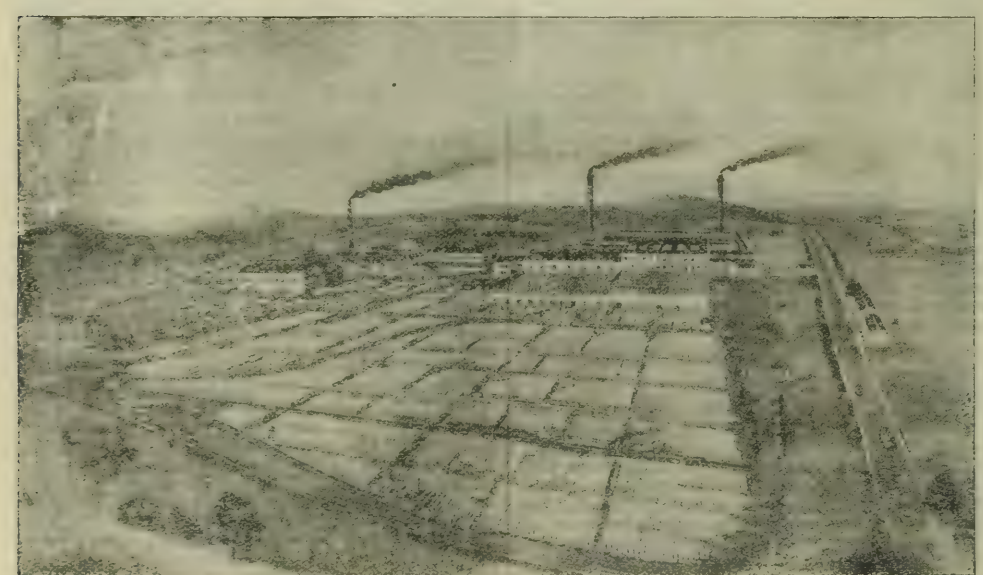
A Blake-Marsden 16 in. by 9 in. "All-Steel" latest improved frictionless lever hammer motion stonebreaker, mounted on wheels and fitted with Marsden's patent combined elevating, screening and loading appliance for discharging into carts and trucks without hand labour, will be shown by Messrs. H. R. Marsden, Limited, Soho Foundry, Leeds. The frame sides are of wrought-steel plate, and the working parts throughout of cast steel, reversible jaws of manganese steel. The machine is capable of breaking from 8 to 12 tons per hour, 14 b.h.p. being required to drive.

MURPHY, STEDMAN & CO., LIMITED.

(Stand 12.)

Tar and bitumen boilers, stone and sand drying apparatus, mixing machines, road-surface dryers, rock and stone crushing machines, elevators and screens, pipe-making machines, concrete mixers, road rollers, and hauling engines, tar-distilling plants and wood block "reforming" machines are some of the numerous appliances for highway work which Messrs. Murphy, Stedman & Co., Limited, 180 Gray's Inn-road, London, W.C., are engaged in supplying. Their "M.S." tar and bitumen boiler, fitted with a stirring device, is specially designed for grouting work, and

can, of course, be used for ordinary tarring. The firm's stone-drying and bituminous-coating machine thoroughly dries the aggregate, heats the binder, and mixes the two together in correct proportions. Regarding the sand-drying apparatus to which reference has been made, it may be mentioned that the firm also supply a special mixing machine for use in treating sand with tar or other liquids. In the "Champion" (jaw type) rock and stone crushing machine, the rock, which is fed at the top of the machine, is broken between two corrugated plates, one of which is stationary, while the other has a reciprocating movement. This means that the rock is broken in cubes the correct shape for road making. The main shaft of the crusher is elliptical in shape, and one revolution of the fly-wheels, which are suspended to either end of this shaft, means two movements of the jaw. It is claimed that the steel side plates on the crusher are absolutely unbreakable by any rock-crushing strain. The firm's concrete pipe-making machines are made in sizes suitable for making pipes from 4 in. to 24 in. in diameter, up to 36 in. in length. At one works, where two of these machines are installed, they have produced, in one year, 52,000 pipes (in different sizes, from 6 in. up to 18 in. diameter) with the labour of three men—one to each machine, and one man mixing the concrete. Messrs. Murphy, Stedman & Co. are directing special attention to their "Monarch" tandem roller, and they point out that many kinds of street work can be done better with this type of machine than with a three-wheeled roller. Squeegees and tar-painting brushes are among the other productions of the firm.



Works of Messrs. Brookes, Limited, Halifax.

MANN'S PATENT STEAM CART AND WAGON COMPANY, LIMITED.

(Stand 13.)

Two steam patching rollers, specially adapted for use on tar-macadam, or for repairing local defects—such as potholes—in the road, are the exhibits of this firm. The machines exhibited are of two sizes, one with a rolling weight of about 7½ to 9 tons and the other from 9½ to 12 tons. Both have the wide roller at the back, with separate steering rollers at the front, in order to reduce the wheel base for repairing work, and to give an even distribution of weight per inch of tread and avoid uneven surfaces on tar-macadam. The larger roller is fitted with Aitken's patent pneumatic high-pressure tar-spraying machine, which is used not only for surface-spraying for existing roads, but also for making tar-macadam *in situ*. The tar or composition is heated by steam coils from the boiler, and is then pumped into a pneumatic receiver under a pressure of 200 lb. to 250 lb. per square inch. It is thence transferred by special atomising spraying nozzles at enormous velocity on to the road surface, actually penetrating the interstices of the crust, and not merely tarring the surface. When used for making a road it enables the road metal to be carted into position before tarring, thus saving heavy railway rates, and enabling it to be carted during the slack season. The material is tarred after being laid on the road, the jets being placed at such an angle that the composition is forcibly projected right through the layers of road metal, and not merely on the surface. These sprayers are supplied either combined with steam wagons or with a patching roller. Specimens of road crusts and photographs will show the method of working, and the results obtained by the Aitken patent process.

JOHNSTON BROTHERS.

(Stand 15.)

Messrs. Johnston Brothers, 79 Mark-lane, London, E.C., have arranged for the exhibition of the following: Johnston's patent double-furnace tar-boiler, with preliminary heater; Waithman's patent reservoir-tarring apparatus, for tar-painting roads by hand; Johnstons' patent hot-air pump, for emptying barrels of Tarvia, Fluxphalte, and other heavy compounds; Archer's patent sweeping brushes, for preparing the road surfaces for tar-painting; Johnston patent road signs, and other road work appliances; Middlesbrough slag, broken and screened to any size; Whirl Hill columnar basalt; Craster (Northumberland) whinstone macadam, and whinstone setts.

THOMAS GREEN & SON, LIMITED.

(Stand 16.)

A 12-ton compound steam road roller, a 7½-ton motor road roller, a patent motor street-sweeping machine with three speeds, and an independent type of road scarifier will comprise the exhibits of Messrs. Thomas Green & Son, Limited, Smithfield Iron Works, Leeds.

BARFORD & PERKINS, LIMITED.

(Stand 17.)

Messrs. Barford & Perkins, of Peterborough, propose to show four of their rollers. One of these is the patent water ballast motor roller, size "E3S," weight, empty, 6¾ tons, full, 8½ tons, for tar-macadam and asphaltic road surfaces. The main roller is 4 ft. wide by 3 ft. 6 in. diameter, and is fitted to hold water ballast. The front roller is 3 ft. in diameter by 4 ft. wide. The roller is fitted with a tank holding 150 gallons of water, and sprinkling attachments are fitted to both front and hind cylinders. This roller can be worked with either petrol or paraffin. Size "J" weighs when empty 10 tons, and when full 11 tons. Their 3-axle motor roller (Crompton & Tapp's patent) is fitted with three rollers, all 4 ft. wide, and is specially designed for working on asphaltic road surfaces. The 3-axle principle has been adopted in order to ensure a perfectly level road surface. The machine is fitted with

an arrangement for increasing or decreasing at will the proportion of weight carried by the centre roller. Size "K" has a weight when empty of 12 tons, and when full of 14 tons, and is adapted for road making of every kind.

BROOKES, LIMITED.

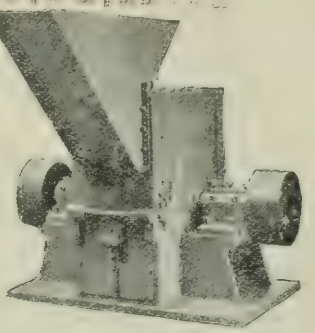
(Stand 18.)

This well-known firm of quarry owners and merchants are exhibiting the many granites produced from their quarries in various parts of the United Kingdom and abroad, also some examples of laid road paving in their specialities—viz., "Nonskid Macrete," "Magna" sett, and "Magna" cubes. "Nonskid Macrete" is a roadway paving material, consisting of picked granite macadam and concrete hydraulically pressed in square blocks for laying on properly rolled surfaces or necessary bed of concrete as the exigencies of the case may require. This form of paving has already found favour with several prominent engineers. The concise pamphlet issued by Brookes, Limited, explains fully the method of manufacture and advantages of this road material. "Magna cube" paving, for secondary roads, is much in vogue.

PATENT LIGHTNING CRUSHER COMPANY, LIMITED.

(Stand 19.)

The Patent Lightning Crusher and Pulveriser is a centrifugal force disintegrator of great simplicity and power, giving a very large output and requiring relatively little horse-power to drive. One of its main features consists of its horizontal swing hammers, which cover the whole width of the crushing chamber, prevent clogging, and reduce friction to the lowest limit. Great range can be obtained in the size of the output, from 1-in. cubes to the finest powder, as required, by increasing or reducing the speed, altering the diameter of the holes or slots in the screens, and regulating the distance of the face of the hammers from the grinding plate. This machine is specially adapted for the crushing of road-making materials such as flint, granite, basalt and other hard stones, as also of pitch, limestone, slag and clinker. It occupies small space and is easily portable. The offices of the company are at 14A Rosebery-avenue, London, E.C.



PATENT LIGHTNING CRUSHER.

J. & E. HALL, LIMITED.

(Stand 20.)

The exhibit of Messrs. J. & E. Hall, 10 St. Swithin's-lane, London, E.C., will consist of a 32-horse power "Hallford" chassis, with four-speed gear box, and chain drive to road wheels, the chains being enclosed in oil-tight dust proof aluminium cases fitted with tipping wagon body, as supplied to the Kent County Council, East Suffolk County Council, and other authorities, for the conveyance of road making materials. The capacity of the body is approximately 4½ cub. yds., and the load is so disposed that the body can be easily tipped by means of the hand-operated screw tipping gear. This is of special interest in connection with the delivery of road-making material, as the latter can be "shot" either in small heaps or while the wagon is travelling

CUTTING BLOCKS FOR ARCHITECTURAL AND ENGINEERING WORK AT ONE OF MESSRS. BROOKES' NORWEGIAN QUARRIES.

SHIPPING GRANITE FROM MESSRS. BROOKES' QUARRIES IN NORWAY.

slowly along the road. All wheels being shod with solid indiarubber tyres, the wear and tear on the road is reduced to a minimum. The vehicle is capable of carrying a load of 4½ tons at about 14 miles per hour on the level. The chassis can be supplied with interchangeable bodies for street watering and refuse collection.

HADFIELD'S STEEL FOUNDRY COMPANY, LIMITED.

(Stand 21.)

One of Hadfield and Jack's solid steel frame jaw breaker, size 16 in. by 9½ in., fitted with "ERA" manganese steel jaw faces and wearing parts, for producing macadam, mounted upon a suitable travelling bogie will be shown in operation at this stand, and another interesting exhibit will be a Symon's patent disc crusher—Hecla design—for making medium fine road dressing material. A set of photographs will illustrate the most modern crushing elevating and screening machinery of various types.

RUSTON, PROCTOR & CO., LIMITED.

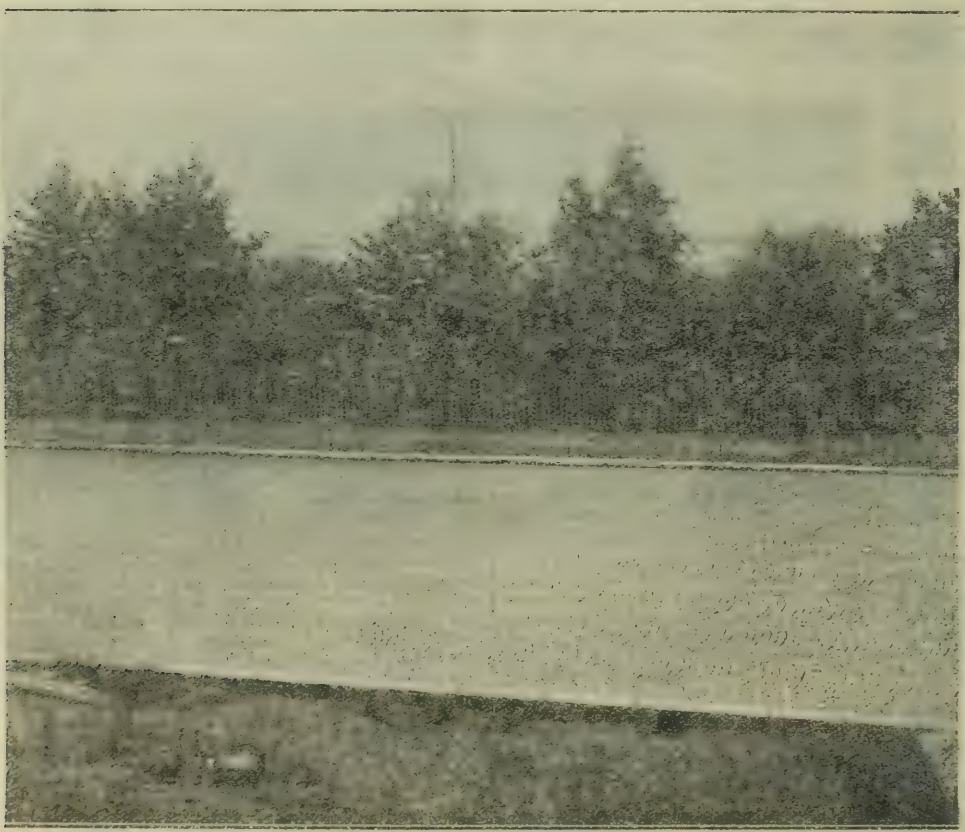
(Stand 22.)

A 12-ton superheated steam road roller will form one of the exhibits of Messrs. Ruston, Proctor & Co., Limited, of Lincoln. The roller is fitted with awning over tender, compensating gear, water lift and suction hose, injector, renewable rims and Ruston Patent 3-tyne scarifier. The boiler is of the loco-multitubular type, fitted with solid drawn-steel tubes, and constructed for a working pressure of 180 lb. per square inch. A Ruston Patent 3-tyne reversible scarifier will be arranged on the right-hand side of the roller. This scarifier will work equally well either backwards or forwards, as by a simple device the centre tyne is always leading in whichever direction the roller may be working. The roller will be exhibited driving a stonebreaker.

PHŒNIX ENGINEERING COMPANY, LIMITED.

(Stand 23.)

This well-known firm of Chard engineers will show their 250-gallon horizontal pattern "Phœnix Rapid" patent continuous heating and working tar-spraying machine, fitted with gib crane for lifting barrels. The machine will also be fitted with the firm's special filling pump for emptying barrels direct into the boiler. This combination is shown so that the customer can either have the machine fitted with crane or filling pump, or both, as desired. These machines are made in the following standard sizes—viz., 80, 160, 250, 320 gallons capacity, or larger, as required. The company's 80-gallon vertical pattern "Phœnix Rapid" patent tar-spraying machine, fitted with specially designed skids for raising barrels for emptying into the top of the machine, are made in the following standard sizes—viz., 25, 50, 80, 100, 150 gallons capacity. The "Phœnix Rapid" patent drag brush tar-spreading machine, another exhibit—is made of either 80, 60 or 250 gallons capacity, and is fitted with a patent trough for distributing the tar to any width within the 5 ft. in front of the drag brushes, which are accurately counterbalanced, so that the pressure on the road can be regulated. A "Phœnix Rapid" horizontal pattern tar, pitch and bitumen boiler, of 160 gallons capacity, the "Farnham" hand road tar-spreading machine, a spring box, the "Phœnix Floodgate" high-capacity lift pump—to be shown working—and the "Phœnix Diaphragm" pump, will be among the other exhibits on this stand, in addition to which a large number of photos of mastic asphalt boilers and other road-making appliances will be on view.



A "Durax" Road.

DURAX DUSTLESS ROADS.

(Stand 24.)

The Durax system of road construction, which will be demonstrated at this stand, is an improved method of laying the well-known Continental system of Kleinplaster (small paving). This class of paving was originally laid in the Stade district, near Hamburg, by Herr Gravenhorst, some twenty-seven years ago, and many hundreds of miles have since been laid with most satisfactory results. Durax paving was introduced into this country some seven years ago, and is now one of the recognised systems of road construction. It consists of machine-cut granite cubes, laid on prepared foundations, in intersecting segmental courses, on a bed of tarred chippings. The cubes are

consolidated by steam rolling, and the joints filled with bituminous mixture. This gives a resilient paving, practically noiseless, and, of course, with a wearing surface of granite. Various depths of cubes are used, according to the demands of the traffic passing over the roadway to be paved, and completed samples of paving will be shown, using cubes of Norwegian, Leicester and Guernsey granites of various sizes. Sections of Durax paving, taken from roadways in various towns, will also be exhibited; also loose cubes from the company's quarries in Norway, Sweden, Leicester, Guernsey, Wales and Ireland. There will be an interesting display of photographs, depicting the production of blocks in the quarries, Durax machine cutting cubes, the cubes being laid, and various views of finished works.

TECHNICAL PUBLICATIONS.

Messrs. Iliffe & Sons, Limited, 20 Tudor-street, London, E.C., the publishers of *The Autocar*, *Motor Traction*, and *Internal Combustion Engineering*, will occupy Stands 4 and 5 in the interior section of the exhibition, and our American contemporary *Good Roads* will be represented at Stand 6, the exhibit including copies of that journal and various books on the maintenance and construction of streets. "The Car" Illustrated, Limited, 62 Pall Mall, S.W., will have a display of their publications at Stand 8.

"The Surveyor" Stand is No. 38. The congress will be reported at length in "The Surveyor," and orders for copies will be received by our representatives at the exhibition.

TESTING OF ROADS AND ROAD MATERIALS.

LABORATORY INVESTIGATIONS AT TEDDINGTON.

A series of systematic tests on model roads in the road-testing machine which has been installed at the National Physical Laboratory, Teddington, has, according to the report of the department for 1912, now been commenced. The experimental track is 34 ft. in diameter, 2 ft. 6 in. wide, and the centre portion of 2 ft. is subjected to the wear of eight cast-iron wheels, 3 in. wide, each independently driven by a 2-horse power motor, and mounted on eight radiating arms. It is estimated that twenty-four hours' continuous running of this machine will represent one year's wear on a typical heavily trafficked road.

For the purpose of the tests referred to the track has been divided into four sections, each section consisting of water-bound macadam, the composition varying as to quality of rock, size of stone, &c. Sets of these four sections will be tested at speeds of 7, 14 and 21 miles per hour. It is intended in the first instance to use the machine for determining the relative durability of various forms of water-bound macadam. The stones of which these model roads are composed will also be tested for attrition, impact, abrasion and cementation qualities, so that if possible some relation may be obtained between these qualities as determined in small testing machines and their behaviour under actual working conditions.

On the conclusion of these experiments, sections of bituminous-bound roads will be tested.

A method of heating the track by means of jets of hot air delivered vertically from pipes radiating from a receiver at the centre of the machine has been designed, the object being to approximate to the various temperature conditions to which roads are subjected.

The equipment of this branch of the laboratory consists of the attrition machine, a Page impact machine, an abrasion machine, a ball mill for grinding up material for cementation tests, a forming machine for making the briquettes, and a repeated blow impact machine for testing the briquettes. The chief part of the testing work carried out for the Road Board during the past year has been a complete set of tests for attrition, impact, abrasion and cementation value of fifty samples of stone supplied by the Devon County Council. A short paper embodying the results of these tests and the conclusions drawn from them has been communicated to the International Congress for reading next week.

ROAD MILEAGE IN RELATION TO POPULATION AND AREA.

(Contributed.)

A committee which was appointed last year by the United States Congress to study the question of Federal participation in road improvement has compiled statistics of population, road mileages, and costs of construction and maintenance in a number of countries. It is clear that population per mile of road is a factor directly influencing the cost of maintenance, but it would be a mistake to push this too far. Coastwise traffic, railway traffic, and the carriage of goods on navigable waters all affect the extent to which the roads are used. Again, the population of a country of fertile soils, with large farms and villages which are to a large extent self-supporting, will not need to use the roads so much as the people who live in scattered fertile spots in a mountainous country. Lastly, some of the most severe forms of traffic are developed rather in proportion to the number of wealthy individuals and large business concerns than in proportion to the average rateable value per head of population. In a country with a large area in proportion to its mileage of roads the average distance traversed per journey is likely to be greater, but the number of journeys taken per head of population per annum is likely to be less than in a country in which the road network is closer. No estimate can be formed as to which is the more important consideration, so this factor must be left alone. Merely to think over the point for a few minutes is sufficient to convince one that the intricacy of the subject, if we go beyond population per mile of road and average wealth per head of population, is such as to render it impossible to compare the costs of roads except within a very limited field. When we consider all classes of roads in a particular country, that part of the cost of maintenance which is due to weathering is far more important than it is when we are studying the principal roads. Weathering becomes more important still when we compare by-roads in one country with roads of a similar class in another country. Comparisons between roads in different countries should therefore be absolute up to a certain point (and an allowance be made for a difference in the effects of the two climates), and beyond that point consideration should be given to the population per mile and the rateable value per head. The mileage of roads per square mile of area may be taken into account if we consider also the occupations and habits of the peoples.

The following lists, taken from a table prepared by the American Committee referred to above, give in order the mileages per square mile and the population per mile of road in fifteen countries:—

MILEAGES PER SQUARE MILE.

The lowest mileage per square mile is found in Norway, and the highest in England and Wales, the order being as follows: –

Norway, 0·161; Spain, 0·174; Sweden, 0·205; New South Wales, 0·223; Hungary, 0·253; Switzerland, 0·465; Austria, 0·641; United States, 0·739; Scotland, 0·745; Italy, 0·834; Denmark, 1·724; Japan, 1·743; France, 1·750; Ireland, 1·755; England and Wales, 2·571.

POPULATION PER MILE OF ROAD.

The following is the order of the fifteen countries, taking population per square mile of road, from the lowest, New South Wales, to the highest, England and Wales (to one place of decimals): New South Wales, 24·6; United States, 41·8; Denmark, 75·5; Ireland, 77·13; France, 108·0; Norway, 115·4; Sweden, 154·5; Japan, 210·0; Scotland, 210; England and Wales, 239; Italy, 371; Austria, 385; Switzerland, 504; Spain, 575·8; Hungary, 655.

It may be noted that in both lists France comes next to Ireland, and if the costs of road maintenance in France are to be compared with those in the United Kingdom, it is fairer to make the comparison with Ireland rather than England. The population per mile is, of course, more important than the mileage per square mile, and on this basis we find that Ireland is to France nearly as 77 to 108, or about 71 per cent (cost of maintenance), while France is to England as 108 to 239, or about 45 per cent. To no inconsiderable extent this proportion, 45 per cent, is a measure of the severity of wear upon the roads of France compared with the wear on English roads.

"MARSHALL" LIGHT ROAD ROLLERS.

In many parts of the country there is an increasing demand for light road rollers readily convertible into steam tractors, and such requirements can be well met by the series of small road rollers, as illustrated,

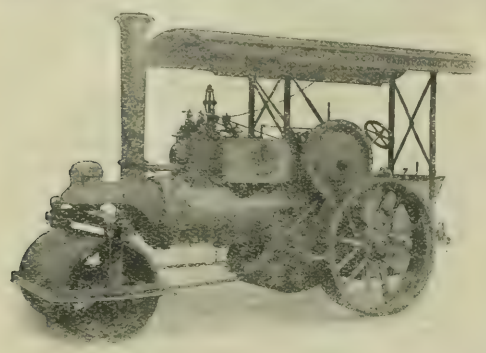


Fig. 1.

which are manufactured by Messrs. Marshall, Sons & Co., Limited, Gainsborough.

We show respectively a small road roller of 6 or 8 tons weight (Fig. 1), a small road roller specially designed for conversion into a steam tractor (Fig. 2), and the same engine as a steam tractor (Fig. 3). These engines are made throughout from entirely new designs and patterns, and are fully in accordance with the most modern practice. Single-cylinder and compound types are supplied, suitable for 180 lb. and 200 lb. per square inch working pressure respectively. In cases where only a small roller is required, as in Fig. 1, no spring mountings, barrel tank and feed-water heater are fitted; but Fig. 2 shows a roller with the equipment usually considered essential for adaptation to a steam tractor, in which case springs are a legal necessity, and the barrel tank and feed-water heater are adjuncts strongly recommended.

The distinctive feature of the roller shown in Fig. 2 is the facility provided for converting it into a steam tractor, or *vice versâ*, a practice which has already found much favour in municipal circles. It will be observed that a flanged bolted joint is provided between the boiler barrel and the smoke box, by which the latter part, together with the fork and rollers, can be readily disconnected and replaced by a tractor smoke box, under-gear and road wheels. The hind or driving rollers are easily substituted by suitable road wheels, and the change is very quickly effected, thus providing an exceptionally serviceable engine which may be equipped at short notice either for road laying or haulage. The multitubular boilers

Fig. 2.

supplied with these engines have a high and rapid evaporative capacity, and the fire boxes incorporate the "Marshall" patent cambered top, by which all roof stays are dispensed with and increased facilities provided for cleaning the boiler. The steam-jacketed cylinders have a planed base, and are erected on a neat planed steel mounting which is riveted to the boiler shell. The transmission gearing is arranged on the three-shaft principle, and the change speed wheels have machine-cut teeth, which are conducive to silent and easy running. All gear wheels and shaft brackets are made of the finest crucible cast steel, which ensures great durability for these parts.

The mechanical details include an oil pump for forced-feed cylinder lubrication, adjustable cross-heads working in circular-bored guides, double "Pop" safety valve, continuous-action geared-down feed pump, and friction brake. Such items as governor, oil bath for main gearing, feed-water heater, water lifter, barrel tank, differential gear of the "Marshall" four-pinioned system, winding drum, &c., are largely optional so far as the roller is concerned, and can be supplied according to requirements. An excellent two-tyne scarifier can also be fitted if so desired.

It is only possible here briefly to state the leading points of merit of these engines; but, in conclusion, it may be mentioned that in all cases where they have been adopted the engines are, we understand, giving the greatest satisfaction to their users, both from the point of economical running and thorough efficiency under the precise working conditions for which they were placed on the market.

The Surveyors' Institution.—The president (Mr. W. Edward Woolley) and the council of the Surveyors' Institution will hold a reception, by arrangement with the council of the Royal Botanic Society, in the gardens of the society on Friday, June 27, from 4 p.m. to 7 p.m.

Steam Cleansing Plant at Yarmouth Fish Wharf.—A new steam power cleansing plant has just been

Fig. 3.

adopted by the Great Yarmouth Port and Haven Commissioners for cleansing the fish wharf and the granite-setted quays and roads in its vicinity. Previously the water supply was drawn from a tank, but the pressure was not sufficient for thorough flushing and cleansing. Some more powerful instrument was therefore required, but it had to be portable, and easily moved from one spot to another. These requirements are met by the new plant, which has been specially designed for the purpose by Messrs. Merryweather & Sons, of Greenwich. It consists of a portable pump of the "Valiant" type, with quick steam-raising boiler, mounted on a four-wheeled carriage with iron wheels and drag handle. The total weight is under half a ton, and it can be hauled about by a couple of men. One man suffices to drive it and look after the machinery. A galvanised-steel tank, placed in the centre of the carriage, holds one hour's supply of fresh water for feeding the boiler, and the front portion consists of a hose and tool locker, and a coal bunker which will hold enough fuel for several hours' work. The pump will lift water from the river at all stages of the tide, and has a delivery capacity of 50 gallons per minute. For ordinary cleansing purposes a working pressure of from 40 lb. to 50 lb. is sufficient, but the pressure can also be increased to 100 lb., when a powerful fire-extinguishing jet is obtained. This plant bids fair to be a great improvement over the former method of cleansing the market and quays, and the fact that the apparatus can be used to tackle a fire outbreak makes it a most desirable appliance to have handy at the wharf, when the distance it is from the fire station is taken into consideration.

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